

Astronomical Image Classification Web Application

DISSERTATION PROJECT

6200COMP

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Abstract

This project will focus on creating a web-based application that facilitates collaborative annotation and classification of astronomical images that will meet the needs of large-scale scientific projects conducted with instruments such as Euclid and Large Synoptic Survey Telescope (LSST). The goal of my project will be to create a web platform that will allow multiple users such as astronomers and lead scientists to efficiently label and organise astronomical datasets collected by modern telescopes, which could then be used to train machine learning systems that can help with data filtering and classification, helping making discovery easier. Some of the Key features my web application will include will be role-based access, Image annotation tools to classify different images into specific groups, and a progress tracking feature that will enable the Lead Scientists to view how much data belonging to a project has been processed or annotated . The web application will also include a scalable database with supporting image assignment tags which can then be exported to give us extensive astronomical datasets for machine learning processes.

The main outcomes of this project will be to create fully developed web application with a focus on an intuitive and data driven user interface this will allow users to work collaboratively on labelling images whilst allowing supervisors to check the progress of a project and assign people to it. The design of the platform will be modular, to facilitate potential future improvements, such as potential integration with machine learning algorithms for automatic classification of images. This project should become a critical tool for astronomers and scientists in labelling and classifying images whilst maintaining a streamline workflow from beginning to end.

Introduction

The goal of this project is to address a critical gap in the workflow for the categorization of astronomical image data. As large-scale instruments such as Euclid [1] and the Large Synoptic Survey Telescope (LSST) [2] evolve astronomers are collecting huge amounts of image data of galaxies, nebulae, and other cosmic phenomena. The labelling and classification of these image datasets is important because it helps us to identify patterns, study cosmic structures, and conduct data-driven analysis. Modern astronomy now generates such vast quantities of data that it is completely infeasible for human beings to analyse it manually. Therefore, astronomers must rely on more statistical methods and machine learning alternatives to assist in analysing the datasets. However, for these approaches to work effectively, they require well annotated data sets to train these machine learning models, this highlights the need for a system to be able to organise and classify watch volumes of data. The current issue with this is that there is no existing system capable of streamlining the workflow. Therefore, it becomes tedious to manually annotate and classify large datasets and then efficiently organise them.

There is currently no existing technology that supports a collaborative image labelling workflow. Lead scientists are unable to create projects with specific images, assign targets or monitor the status of work within teams. Instead, bespoke tools are often made which are expensive to create and are often only tailored to a specific project making it challenging to maintain as they lack flexibility and modularity resulting in these tools being unsuitable for reuse and limiting their long-term effectiveness. This lack of a centralised system leads to inconsistencies, delays, and misclassifications, ultimately slowing down scientific progress. To solve this, the project aims to provide a system for annotating and classifying astronomical image data. The proposed prototype system will be designed around the need for a lead scientist to create and manage image-labelling projects with an ability to specify the classification labels for each project, assign astronomers to projects and obtain an overview of a project's progress.

Successful completion of this project will yield a web-based software artefact made specifically for collaborative classification and annotation of astronomical datasets. The web application will have a focus on clean yet efficient user interface with the main features being creating projects, adding users to projects, managing projects and classifying projects. The web application will connect to a back-end database responsible for storing image annotations, project classifications, and user login credentials. With the end goal being to allow groups of astronomers to collaboratively label and classify images as well as identifying areas of interest in specific images using a web-based system for efficiency. By creating a structured image classification process, it will streamline the workflow and reduce the time it takes to process these images making it more efficient, this then creates huge data sets that can be used for machine leering purposes and training AI models to automatically recognize these images and the classifications that go alongside them.

Scope

The project will restrict its focus to creating a prototype data organisation and annotation platform using full-stack web technologies with back-end infrastructure to allow for the collaborative annotation and classification of astronomical images. Specifically, it will include the creation of a user-friendly front-end interface allowing users to log in, label and annotate images, and assign tags to images, set confidence levels, and track project progress. It will also include the development of a scalable backend database to store image annotations and classifications, project data and user credentials. This document will also cover the different privilege levels for each type of user and how they will be implemented.

The project will not cover the actual implementation of machine learning algorithms for automatic image classification or predictions, The application architecture will however be designed for future machine learning integration. Additionally, techniques like automatic region detection and segmentation algorithms will also not be covered in this document. With the focus on annotations and classifications being based on user input.

The project is significant as it helps astronomers and scientists organise classify and annotate large sets of data. it also helps in creating workflows for large scale Imaging projects. By providing a collaborative platform, it allows multiple groups of astronomers to collaborate on classifying images therefore increasing the efficiency and accuracy of the labelling process and allowing scientists to maximize the scientific value of the data they collect. The system would be especially useful to see what users annotated what areas along with their confidence scores in their contribution, this is useful as not all astronomers will agree on the same classification labels due to varying levels of experience and knowledge in the field. This information can help in measuring areas agreement and areas of uncertainty within classifications therefore supporting better decision-making and increasing quality control. In summary this project will offer an endpoint for collaborative data driven workflows.

Objective	Description	Success Measure	Timescale/Deadline		
	Database Creation				
1	Create Database Architecture	Develop a database structure that I can use to efficiently and securely store user data, Image data and project data.	5th December 2024		
		Project Creation			
2	Project Creation Functionality	Enable lead scientists to create projects, upload images, and define classification labels and guidelines via a user-friendly web interface.	12th December 2024		
2.1	Develop Image Upload Capability	Allow users to upload astronomical images, linking them directly to the database for further processing.	19th December 2024		
2.2	Implement Randomized Image Display	Implement a mechanism to present images in a randomized order during classification, reducing bias and enhancing accuracy.	26th December 2024		
2.3	Enable Assignment of Image Tags Based on Project Specification	Provide tools for lead scientists to define and assign specific tags and classifications for uploaded images, ensuring uniformity in data tagging.	2nd January 2025		
2.4	Develop Image Classification with Confidence Levels	enable users to classify images using predefined tags and assign confidence levels (1–5) to each classification for better quality control.	9th January 2025		

Aims

2.5	Display Labelling	Display labelling instructions for projects,	16th January 2025
	Instructions in User	ensuring users understand classification	
	Interface	guidelines set out in project creation.	
	U	ser and Access Management	
3	Develop User	Allow users to securely create accounts,	23rd January 2025
	Registration (Sign-Up)	log in, and access features based on their	
	and Login Functionality	roles.	
		Project Management	
4	Create Project	Provide lead scientists with tools to	30th January 2025
	Management	manage project details, monitor and	
	Functionality	overall progress.	
4.1	Create Progress Tracking	Display project progress with a progress	6th February 2025
	Dashboard	bar	
4.2	Fuchic Assignment of	Fuchie load esignitists to pasion	12th Cohment 2025
4.2	Enable Assignment of	Enable lead scientists to assign	13th February 2025
	Team Members to	astronomers to specific projects	
	Projects		
_		Role Based Access	
5	Implement Role-Based	Implement permissions based on user	20th February 2025
	Access Control	roles (e.g., lead scientists creating	
		projects, astronomers labelling images).	
		Extra	
6	Allow user to export a	Provide the lead scientists with the	March 2025
	project once complete	ability to export the collated data once a	
		project has been completed	
6.1	Develop Image	Provide users with tools to annotate	April 2025
	Annotation (Markup)	images by marking regions of interest	
	Tools	and adding detailed labels for enhanced	
		analysis.	
6.2	Enhance Progress	Display more in-depth project progress	April 2025
	Tracking Dashboard	such as the number of labelled images	
		and remaining tasks.	

Table 1. Displays The Projects Aims and Objectives.

Background Research & Domain Analysis

In current classification systems for processing scientific data the general stages include data capture, data cleaning, data storage, data annotation, and data analysis. Each one of these steps will apply to my project as they are the essential processes for transforming the raw telescope images into usable scientific datasets. The focus of the project however will relate to the annotation stage which will allow astronomers to classify the images with tags and confidence levels, once the data has been classified and annotated the data will need to be exported for analysis and used for machine learning.

The Large Synoptic Survey Telescope (LSST) now known as the Vera C. Rubin Observatory is a new ground-based optical telescope that aims aiming to conduct a 10-year survey of the visible sky mapping billions of galaxies to help us answer fundamental questions about the universe. [2] The telescope will provide new insight into dark matter and dark energy through the study of cosmic structures and their evolution over time. It will also allow studies of the Solar System to be used to discover and track millions of objects such as Kuiper Belt Objects and near-Earth asteroids essential in learning about the formation of planets and keeping track of possible impact hazards. It is estimated that the

"LSST will deliver a 500-petabyte set of images and data products that will address some of the most pressing questions about the structure and evolution of the universe and the objects in it" [1]. This huge dataset will include multi-band imaging and time-series data relevant in the study of temporary events such as supernovae and variable stars.

At the core of the Rubin Observatory LSST is a digital camera consisting of about 3.2 gigapixels"[2] and "is designed to provide a 3.5-degree field of view, with its 10 μ m pixels capable of 0.2 arcsecond sampling for optimized pixel sensitivity vs pixel resolution." [2] this allows the camera to shoot a "9.6-square-degree" [3] area of the sky much more quickly than any other camera to date, this would allow us to review the same parts of the sky every few nights. By shooting snapshots of images this way it would help in locating large-scale variability in space events send warnings in real time with the discovery of new asteroids or sudden events.

Because the LSST produces such large datasets sophisticated automation systems are required to process and classify this data some machine learning techniques "including random forests (RFs), stochastic gradient descent (SGD), gradient boosting machines (GBMs), and neural networks (NNs), have been used to classify interstellar objects in simulated LSST data" [4]. Using these algorithms, we can identify patterns and distinguish interstellar objects, integrating these algorithms helps us to improve object identification accuracy and remove false positives and allows the data management system to process the large amounts of data more efficiently. However, despite these advancements human validation is still a crucial part of astronomical data analysis as "ML algorithmic decisions must be paired with human domain expertise" [5]. This is because these learning models can be incorrect when attempting to identify vague or unclear scenarios. By including human expertise when identifying new or unclear data we can pick up and deal with any errors that may occur and help in refining the outputs of machine learning systems ensuing the continuing reliability and accuracy of astronomical classification systems.

The same problems arise in handling data with the Euclid Space Telescope. Whilst LSST is primarily focused on time-domain observations, Euclid is a complementary mission which aims to map galaxy distributions and investigate weak gravitational lensing. The Euclid Space Telescope is one of the flagship missions under the European Space Agency (ESA) cosmic Vision program (the planning cycle for ESA's space science missions [6]) And is aimed at understanding the nature of dark energy and dark matter by precisely mapping galaxy distributions and weak gravitational lensing (the bending of light from a distant object due to the gravitational field of a galaxy). These observations will aid in pinning down the properties of dark energy which is thought to be responsible for the universe's accelerating expansion. The Euclid telescope is designed to "perform an extensive cosmic survey over a 6 years period, from 2020 to 2026" [7] and will be tasked in surveying more than 15,000 square degrees of the galaxy and is forecasted to produce 855 Gigabits of data per day [8].

Euclid will carry two state-of-the-art instruments, the Visible Imaging Channel (VIS), and the Near-Infrared Spectrometer and Photometer (NISP). The Visible Imaging Channel is a "large format imager, with 609 million pixels covering a field of view of 0.57 deg2 (almost 3 times the solid angle of the full Moon) with 0.1 arcsec sampling." [9] this allows the Euclid Telescope to take high-resolution, wide-field images of the universe with exceptional precision making it a huge benefit in mapping galaxy distributions. The other instrument, the Infrared Spectrometer and Photometer is responsible for collecting crucial data in the near-infrared spectrum ("between ~950 and 2020nm." [10]) Unlike the VIS which is responsible for capturing high-resolution images the NISP is directly responsible for capturing the spectral information by using "16 Teledyne "H2RG" detectors, with each 2k-by-2k pixels" [10] this means that the NISP can cover the same area as the VIS, and is being used to determine photometric redshifts (the distance to galaxies based on their colours and brightness in a range of wavelengths).

The large amounts of data being produced by the Euclid Telescope highlights the complex requirements needed to process and analyse the datasets from modern astronomical surveys, these will generate about "855 gigabits of data per day" [8], equating to a few petabytes over their operational lifetime. High-resolution imaging and spectroscopic data will enable us to study the universe at a new level of detail and scale. Together, the VIS and NISP instruments will allow for accurate galaxy catalogues to be compiled, the effects of weak gravitational lensing measured, and photometric redshifts to be calculated across the entire survey area. The challenges with processing and analysing large datasets like these necessitate state-of-the-art computing facilities combined with sophisticated data reduction pipelines. The most recent machine learning techniques will be required for automating tasks such as classifying images, noise reduction, and the detection of objects in situations that are unclear or outside the scope of existing ML models, human validation is still essential for improving and verifying classifications.

While Euclid and LSST manage and categorize their huge data sets primarily by using machine learning techniques, they still emphasize the necessity of human input to verify the correctness of the classifications. New approaches to data handling in general have emerged because of the required interaction between automation and human validation, one of these new approaches include Citizen Science platforms like Galaxy Zoo which use collaborative human effort to support machine learning models, this is done by using volunteers tasked with handling the classification of galaxies with unclear or unusual structures and by using this method it will significantly increase the efficiency and accuracy of data processing pipelines. Galaxy Zoo was first launched in 2007 as part of the Sloan Digital Sky Survey, as one of the first-ever examples of a citizen science project for galaxy morphologies.



Figure 1. Galaxy Zoos landing page.

The Sloan Digital Sky Survey was ("the first facility providing multi-epoch optical & IR spectroscopy across the entire sky" [11]). As one of the first citizen science projects for galaxy classifications Its goal was to use the public to aid in classifying the huge datasets of galaxy's. The result of their first

test was "But it was enough to show that the classifications Galaxy Zoo provides were as good as those from professional astronomers and were of use to many researchers. [12]"

▶	TASK	TUTORIAL
- + C	Is the central galaxy sir rounded, with no sign of	nply smooth and a disk?
	5 Smooth	
	Features	or Disk
	Star, Artit	act, or Bad Zoom
	NEED SOME HELF	WITH THIS TASK?
🛈 🤁 You should sign in!	Done & Talk	Done

Figure 2. Galaxy Zoos Current image classification system.

nput the basic information	about your project, and set up its home page.
Avatar	NAME
Drop an	Untitled project (4/14/2025, 11:21:16 AM)
avatar image	The project name is the first thing people will see about the project, and it will show up in the project URL Try to keep it short and sweet. Your project's URL is
here	/projects/chaz135/untitled-project-4-14-2025-11-21-16-am
	DESCRIPTION
Pick a logo to represent your	A short description of the project
project. To add an image, either	This should be a one-line call to action for your project that displays on your landing page. Some volunteers will decide whether to try your project based on reading
drag and drop or click to open	this, so try to write short text that will make people actively want to join your project. 266 of 300 characters remaining.
our file viewer. For best results,	
han 50 KB	
Background image	A more in-depth introduction to your science
Drop a	
background	
image here	
the loss of will be the	
nis image will be the	
valors round for all of your	
noject pages, meluumg your	

Figure 3. Galaxy Zoo s Build a Project Page.

the success of the platform grew into Zooniverse as it is today, hosting projects across many different scientific disciplines. The information that has been collected from galaxy zoo has informed hundreds of studies, among them galaxy evolution, star formation rates, and what the environment does to the structural properties of galaxies, it has also lead to the discovery of "rapidly growing emission line galaxies, known as 'Green Peas,' first noted by volunteers in the Galaxy Zoo project because of their peculiar bright green colour and small size, unresolved in SDSS imaging." [13] this result is one of many that demonstrates the impact of public participation in progressing astronomical research.

Machine learning (ML) has also become a key part of the functioning of Galaxy Zoo this is because early classifications by volunteers can be used as training data for ML models, such as convolutional neural networks "CNN outperforms other machine learning methods for classifying GZ1 samples into ellipticals and spirals in ref. [45]. Promising classification results were achieved with the implementation of CNNs as shown in ref. [46, 47, 48, 49, 50]" [14] This therefore shows the efficiency of CNNs for image classification tasks and their capability to outperform traditional machine-learning approaches on tasks like galaxy classification. However, ML systems struggle with unfamiliar events which is why human validation is still very necessary. The combination of human expertise with the efficiency of machine learning systems displays the advantages of a hybrid system for big data management. Galaxy Zoo's flexibility has enabled it to be relevant in an era when workflows are ever more automated. As datasets expand, projects like Galaxy Zoo fill the gaps by using the public where human pattern recognition excels.

Apart from galaxy zoo, there are many other data annotation platforms across different fields that provide valuable comparisons and insights that can aid the development of astronomical classification systems. These platforms all share common challenges like managing large data sets collaborating with other users and ensuring data integrity for annotations.

One of these platforms is Labelbox which describes itself as being a "unified platform that combines the best labeling tools and expert labeling services, AI-assisted alignment, and data curation" [15]. The software is a data annotation platform that allows teams to create datasets for use in machine learning projects across many industries such as autonomous vehicles, satellite imagery, and social media. The software offers the ability to annotate visual data using different tool types such as "bounding box, segmentation mask, etc" [16]. The software also allows collaborative labelling via a role-based permissions system and alongside task creation, management, and version control. These features align with the type of system that will be designed for this project particularly the need for a lead scientists to be able to assign work, monitor progress, and ensure consistent data labelling. This platform is a solid example of a well-designed annotation tool that be used for inspiration when designing the system.

Another example comes from the medical field with a platform called MedSeg, this tool that allows for the Segmentation of radiological images for use in "Volumetry, visualization including VR/AR, 3D printing, radiotherapy, (co-)registration, and many other post-processing tools" [17] the site is essentially an annotation tool for medical imaging in CT and MRI scans. The platform was designed to allow clinicians and researchers to correctly identify structures of interest within a medical image while using the standardizes file formats in the medical field (DICOM [18] and NIFTI [19]) and has been adopted well due to its compatibility with existing healthcare workflows. Although the primary use case for this system is for medical and diagnostic environments the fundamental ideas behind the system are highly applicable to other fields that depend on image annotation such as astronomy. Both data sets in these fields are complicated, image-based, and often require manual classification to ensure accuracy. MedSeg illustrates that a web-based tool for domain-specific annotation exists with scalable potential without compromising ease of use or accuracy, The attributes of this system align with the goals of the project to create a web based collaborative image classification platform for astrological data sets displaying an example of how these tools can be created.

For any citizen science/image annotation projects, good user interface design is crucial for ensuring user retention, effective user interface design can also impact the quality of data being collected. By applying usability concepts to these platforms, we can close the gap between the public and complex scientific work whilst also increasing involvement and engagement. User experience (UX) design is one of the most important considerations when designing the system as it will directly influence the user's ability to complete tasks efficiently, If the user experience is to complex or unintuitive then there will be an increased rate of errors and task abandonment.

To provide an effective user interface one method would be to adopt the Human-Centred Design framework [20] This design methodology involves using users of the system to aid in the design of the user experience, By creating an interface this way the design is more likely to reflect actual user needs, behaviours, and expectations therefore producing a system that's intuitive to use leading to a reduction in errors and a higher engagement rate. In addition to this some of the best practices for UX design come from Jakob Nielsen's 10 usability heuristics which dives into the "general principles for interaction design" [21], the Article provides fundamental principles for creating an accessible and easy-to-use interface. The proposed heuristics in the article include key areas such as visibility of system status, alignment with real-world conventions, error prevention, and consistency. Overall, these aspects form a cohesive approach to creating an accessible and usable interface.

Another key principle in user interaction design is Fitts's Law which discusses the relationship between element styles and sizes can directly influences the user's ability to interact with an element and how poor design choices can massively increase human error. The research illustrates how "error rates go down as target sizes increases" [22] and "any target made up of both an icon and a label will be greater than just an icon" [22]. This highlights the importance of correct sizing and positioning when designing the UI and interactive elements of the system, as design elements that are placed ergonomically increase user productivity especially on a systems requiring repetitive actions. Furthermore, to aid in designing an effective UI Cognitive Load Theory should be taken into consideration, The Cognitive Load Theory is defined as "the burden placed on working memory during problem solving and learning" [23], Its used to evaluate how task requirements affect user performance in complicated systems by comparing the intrinsic cognitive load ("demand or the complexity of the material to be learned" [23]) against the extraneous cognitive load ("the added difficulty presented by the method in which the material is presented" [23]). Extraneous cognitive load can be increased in a site's user interface by elements such as ineffective layouts, excess content, and inconsistent navigation, this ultimately then leads to a reduction in user efficiency when completing tasks. Therefore, to prevent overloading the user's limited cognitive resources and maximise effective task completion it is crucial to create UIs that preserve visual and functional consistency and minimise needless complexity.

Another crucial aspect of UI design has to do with the clarity of text and its readability at its an essential channel of communication with the users. research shows that most people do not read through content on the web but instead scan it. According to the studies published by the Nielsen Norman Group: "79% of test users always scanned any new page they came across; only 16% read word-by-word." [24] therefore, its recommended to use a simple font types such as sans-serif, Arial or Roboto as these are easy to read on screens. In addition to this WIX studio also recommends that "Font sizes should be at least 16px for body text" [25] as this makes sure the text is readable across various devices and demographics. In addition to this it is also important that we "Use words and concepts that users (humans) are already familiar with." [26] by using jargon-free language and avoiding technical terms we can make the interface more accessible for end-users of any level of technical knowledge which in turn makes it less confusing and a much smoother experience for the user.

Colour also plays a huge role in UI design, as colours can make an interface much more usable because they can affect a user's perception and interaction. "Research indicates that appropriate colour contrast can enhance readability by up to 40%, thereby reducing user error rates and significantly reducing eye strain and enhancing user comfort" [27] therefore by using colours effectively we can increase the efficiency of a website in addition to this the article also states that "Yellow shades of blue, in combination with a non-invasive colour scheme (such as dark mode), can increase the time users spend browsing a webpage." [28] This supports the idea that carefully chosen colours can enhance a digital platform's usefulness while also drawing people in and increasing their duration of stay. A UI designer should create interfaces that are both aesthetically pleasing and

incredibly functional, resulting in a positive user experience and achieving informational or commercial objectives by fusing strategic design components with scientifically grounded colour choices.

Another important aspect in UI design is accessibility, ensuring that platforms adhere to standards like the Web Content Accessibility Guidelines (WCAG) is crucial for inclusivity for people with disabilities, the guidelines discuss making a website "perceivable, operable, understandable, and robust" [29] my designing a web application with these 4 foundations in mind allows the site to accommodate all types of users, examples of this can include providing "text alternatives for any non-text content" [29] and ensuring "all functionality of the content is operable through a keyboard interface" [29] for those who cannot use a mouse. Another important consideration is designing content that "can be presented in different ways without losing information or structure." These practices not only meet diverse needs in terms of accessibility but also improve the general usability and clarity of digital interfaces for everyone. By incorporating these design principles, platforms can build interfaces that will be both functional and inviting to users, letting them execute complicated tasks with assurance and ease.

Web hosting is another critical part of web application development as it provides the infrastructure needed for a web application to be able to run in an online environment. One of the most common tools for hosting is XAMPP which is a "easy to install Apache distribution containing MariaDB, PHP, and Perl." [30] Some of the main advantages of XAMPP are that it is a lightweight "open-source" [30] bundle that assists in creating, testing, and hosting web programs on a local environment. By doing this, XAMPP simplifies web server installation. Making it a good tool for creating prototypes and continuous development.

Because XAMPP provides a pre-configured local server environment it removes the complexity of having to install and set up a web server. One of the main objectives for XAMPP is to "build an easy to install distribution for developers to get into the world of Apache." [31] allowing developers to design and create powerful database driven web applications. Another benefit of using XAMPP is its cross-platform support as there "are currently distributions for Windows, Linux, and OS X." [31] this allows developers to work on a variety of platforms to suit whichever one they need. Included in the XAMPP packages is phpMyAdmin which "offers the ability to run and manage MySQL over the internet With the use of a graphical user interface called phpMyAdmin" [32] this helps to simplify the regular SQL server operations like creating tables, query execution, and exporting a database's contents. This could be a very useful tool for developers creating projects with large databases as it gives them the ability to see how the site would run in a web environment.

One of the current downsides of XAMPP is the lack of default security configurations meaning that " is not meant for production use but only for development environments" [33] this is his is because there are several security flaws that have not been addressed by default making it susceptible to attacks when used in a live environment. One of the examples of this is that "The MySQL administrator (root) has no password" [33] making the database vulnerable to unauthorised access. In addition to this "ProFTPD uses the password 'lampp' for user 'daemon'," [33] and "the default users of Mercury and FileZilla are known." [33] this creates huge vulnerabilities, especially if the web application is accessible to people outside your network. XAMP also recommends running the security console allowing users to address the default password issues however also states that the "web-based tool does not fix any additional security issues" [33] Even with these added security steps XAMPPs default settings prioritize ease of use over security meaning that It would be risky to use in live scenarios. Due to this XAMPP is best utilized in a development environment in which its

ease and adaptability override security weaknesses that could be dangerous in a production environment.

Domain Analysis

The literature review that I conducted helped me gain important knowledge on the problem of dealing with big datasets in astronomy, its current solutions and the tools and techniques used by other domains. I will use the information I have discovered to help shape the design and development of my project. After analysing the workflows and data management practices of LSST and Euclid, it became evident that a system capable of managing big datasets and facilitating collaborative workflows was needed for my project.

One of the key factors shaping the design of my project is the large amounts of data estimated to be produced with LSST specifically anticipated to deliver "a 500-petabyte set of images and data products" over its operational lifetime. This displays the need for a scalable database that can support multiple image annotations and labels, the database will be designed to support multiple different types of tagging methods alongside metadata which could be used later to implement machine learning capabilities. As discussed in the literature review the use of machine learning to classify astronomical data highlights the necessity of human validation to guarantee accuracy in cases that are unclear or ambiguous, this has led to the choice to add confidence levels as part of the classification process by integrating confidence levels it allows us to improve quality control and can be used as training data for machine learning models. I will also aim to design the database to allow for easy implementation of future developments therefore creating a scalable and futureproof database design.

The complexity of big astronomical projects underlines the importance of well-structured workflows and function specific roles. The insights from my literature review have led to the decision to include role-based access control. This decision is based on the LSST and Euclid management systems that help to standardise their workflows to manage their operations. The goal of the role-based access control will allow lead scientists to create projects, upload datasets, and assign tasks while astronomers can focus on annotations and classifications, providing a more streamlined workflow and minimising data management errors. One of the most significant drawbacks of current systems is that citizen science projects like Galaxy Zoo lack the ability to delegate tasks to specific individuals, additionally, as mentioned at the start of my literature review these platforms also often lack the tools necessary for lead researchers to manage and coordinate collaborative workflows. Without these tools, we lack the ability to monitor progress and guarantee the consistency of classifications. To address these issues, I will design my project to focus on clear team assignments and projectspecific management options allowing professional workflows to be integrated with citizen science projects.

Galaxy Zoos success proves that having simple and useful tools for collaboration is important and as such features like clear labelling instructions and easy-to-use annotation interfaces will be added. These elements will simplify the user experience reducing workflows errors resulting in minimal misclassifications. The goal will be to produce a system for classifying and managing astronomical data based upon the processes used in LSST and Euclid and taking inspiration from Galaxy Zoos straightforward design. The research conducted also discusses the best practices for user interface design, I will use this research when designing the interfaces for the project to emphasize accessibility and readability. This will be done using fonts, high contrast colours, and compliance with web content accessibility guidelines (WCAG), this will allow the site to be inclusive and user-friendly and therefore have a higher rate of engagement and task completion rates.

Furthermore, the literature review also guided me in picking the underlying web infrastructure that I will use for my project. Due to the aims of my project, I will be using XAMPP as it is a lightweight but robust web server [34] and database platform for development and testing. In addition to this XAMPP comes with Apache, MariaDB, PHP, and Perl making it relatively easy to connect the web application to a backend database. Because my project needs to be able to deal with image annotations, multiple projects, and user roles the XAMPP phpMyAdmin makes it easy to setup databases capable of sorting big data sets with ease and allows me to focus on developing the key parts of my web application.

Critical Evaluation

The classification and annotation of astronomical images have a critical role in important scientific projects such as LSST and Euclid, however current approaches come with many drawbacks and issues. Additionally, machine learning (ML) techniques have become essential for handling large datasets however still depend on human verification for vague or unique cases. Platforms like galaxy zoo have made great progress in the field, however, lack the ability to facilitate effective professional workflows (as shown in Figure 3). In addition to this galaxy zoos current infrastructure is unsuited for project level planning and delegation resulting in lead Scientists being unable to assign tasks and oversee group projects. This ultimately ends up in projects being inconsistent and having an increased risk of misclassifications. My project aims to address these issues by developing a web application to simplify the workflow process for labelling and classifying these images resulting in high quality data which could be used for future use with machine learning.

One of the limitations associated with current machine learning classification systems that astronomy projects use is their performance when attempting to classify faint, intricate and complex patterns that are lacking in previous examples to learn from, in situations where there is insufficient training data, machine learning processes become ineffective. This highlights the need for large numbers of well annotated datasets with carefully segmented image regions for our algorithms to learn from. When this data is missing In these cases, we still need to rely on manual human verification however no current system exists that can effectively integrate expert verification. In a similar manner, citizen science platforms reply on non-expert volunteers to classify datasets however this can create unreliable results due to inconsistent levels of expertise and the lack of an overarching management framework for ensuring the quality and consistency of the classifications.

In addition to this current platforms do not have a streamlined workflow (as shown in Figure 3) for their classification systems as shown in, Lead scientists currently have no centralized platform to assign users to projects, and monitor progress therefore making it extremely challenging to classify big datasets. Role-based access is also not supported in current platforms, so lead researchers cannot effectively manage their groups or monitor work in an efficient way. While machine learning pipelines are available, they usually either lack the required data to be completely effective or need training on high quality examples of human classified data using a system such as the one being developed. The current datasets often lack a consistent, exportable structure, which makes it difficult to refine and improve computerized classification algorithms.

The project I have proposed will overcome these issues with a role-based, collaboration workflow specifically designed for astronomical classification. The goal will be to create a central web application where lead scientist can create projects, specify classification labels, assign users, and monitor progress. By allowing users to classify and annotate images whilst assigning confidence levels the platform can ensure uncertain classifications can be reviewed again. This allows for the creation of reliable datasets with a consistent structure which could then be used for future

integration with machine learning. My solution is an improvement over current systems combining scalable data management with structured collaboration while allowing for a more efficient yet high quality workflow whilst also laying the groundwork for future machine learning capabilities.

Requirements Analysis & Methodology

My project requirements were gathered through a comprehensive research process which involved secondary research [35] reviewing and evaluating the current approaches to classifying astronomical datasets, discussions with my personal tutor and a critical analysis of the user requirements based of the limitations of existing technologies. The aim was to determine the needs for a web-based classification system that would streamline the workflow for annotating and classifying astronomical images. The research stage helped me to understand issues in current systems allowing me to create clear and structured requirements for my project.

One of the first phases in gathering my project requirements involved conducting a literature review discussing some of the current large-scale astronomy projects including the LSST and Euclid telescope. Both telescopes are estimated to produce huge amounts of astronomical data that will need to be classified and processed. Machine learning technologies play a big role in classifying most of this data automatically however my research underlined the critical need for human annotation / investigation for images or data sets that are seemingly unusual. Current classification pipelines rely almost exclusively on automation however these algorithms can still struggle to classify images that do not appear in their training data, and this emphasizes the need for a system where astronomers can collaboratively review and classify them manually.

Use Case diagram

The use case diagram illustrates how people and the system interact. Lead scientists, astronomers, and system administrators are the three roles. Lead scientists can assign users, upload photos, create projects, and monitor progress. System administrators keep track of the system logs and manage user accounts, whereas astronomers are focused on image classification and annotation.



Figure 4. The Projects Use Case Diagram.

To address this my project will have a confidence level feature which will allow astronomers to verify and validate classifications in a structured manner whilst also building a dataset that could be used in the future.

Furthermore, looking at current tools that are used for classifying astronomical data sets such as galaxy has helped in providing the strengths and weaknesses of current platforms Galaxy Zoo performs well in participatory classification but struggles with providing an efficient workflow system, this is because it lacks the ability to develop projects, assign work, and track progression. The lack of these ability's also highlighted the need for role-based access control as we would only want lead scientist being able to create and manage projects whilst allowing the astronomers to focus on analysing and classifying the data. In addition to this, current systems also lack the ability to track progress across different projects this is a big disadvantage as lead scientist cannot get a high-level overview of a project resulting in ineffective tracking metrics. As a result of this one of the requirements for my project will be to include a feature rich tracking dashboard with real-time tracking and the ability to reassign work.

Discussions with my personal tutor helped me gather additional insights towards the project requirements, specifically regarding the efficiency of the database when given large data sets and the optimization of Workflows. We discussed the system requirements and how it should support structured data management while being able to retrieve and store the data efficiently. From these discussions, it was clear that the project required a scalable database capable of handling multiple annotations and the ability to expand in the future. In addition to this we also talked about the use cases and identifying the key needs of the users, this helped in providing a holistic approach when gathering the requirements needed for the project. A key point that came from this discussion was

having the ability to collate and label data in a way that allows for quick exporting in a format suitable for machine learning algorithms.

By gathering the information and insights from the research and discussions I had with my tutor I have been able to develop a set of requirements focused on effectively being able to collaboratively classify astronomical datasets alongside having an efficient workflow system and project management capabilities. The system being developed aims to give more functionality to users while also addressing the weaknesses in current platforms.

Requ	iirement	Linked Objective	Description	Test Type	Test Description
REQ1 Manag	– Data gement	1	The Database must be able to store User, Project, and Image data efficiently.	Scalability Test	Add large records to the database and see how growth affects performance.
	REQ1.1	1	The web application must be able to handle multiple users.	Performance Test	Test the web application from multiple devices with different logins.
REQ2 & Ima Manag	- Project ge gement	2	Lead Scientists must be able to create and edit projects.	Functional Test	Verify that lead scientists can create, edit, and delete projects.
	REQ2.1	2.1	Lead Scientists need the ability to upload images to a project	Functional Test	Test various image formats and confirm correct database storage.
	REQ2.2	2.3	Lead Scientists need the ability to assign tags to a project	Functional Test	Verify that lead scientists can create tags for a project – and the tags show up in its designated table in the database
	REQ2.3	2.5	Lead Scientists need to be able to display clear predefined labelling guidelines to users.	Functional Test	Verify that lead scientists can create a description for a project – and that it shows up in its designated table in the database
	REQ2.4	4.2	Lead Scientists need to be able to assign astronomers to specific projects.	Functional Test	Verify that the user has been assigned to that specific project.

Functional and Non-Functional Requirements

	REQ2.5	2.2	Images should be displayed in a randomized order for fair distribution across users.	Functional Test	Verify that images displayed are not in the same order.
	REQ2.6	2.4	Allow users to classify images using the given tags and assign confidence levels.	Functional Test	Verify that users can select a confidence level when classifying images. And that the result shows up in its designated table in the database.
	REQ2.7	<u>6</u>	Provide the lead scientists with the ability to export the collated data once a project has been completed	Functional Test	Test that the user can export project data once a project has been completed.
	REQ2.8	2	The UI must be intuitive and require minimal training to understand how to setup and classify a project.	Usability Test	Conduct user testing sessions and collect feedback.
REQ3 Manag & Secu	- User gement urity	3	Support user registration, login, and role-based access control	Functional Test, Security Test	Test authentication, role permissions, and access control.
	REQ3.1	<u>3</u>	Users should be able to Login	Functional Test	Test that users can login
	REQ3.2	<u>3</u>	Users should be able to create an account	Functional Test	Test that users can create an account
	REQ3.3	<u>5</u>	Ensure that users without certain rights are unable to view pages to which they are not authorized.	Security Test	Test that as a user with limited access that you cannot view pages without access.
REQ4 Tracki Dashb	- Project ng & oard	<u>4</u>	A progress-tracking system for users to monitor project completion.	Functional Test	Verify that project progress updates dynamically based on image classifications.
	REQ4.1	<u>4.1</u>	Display a Progress Bar: Show classification progress based on how many images a user has classified compared to how many are in the project	Functional Test	Check that the progress bar updates as users classify images.

REQ4.2	<u>6.2</u>	Provide additional project metrics such as images left in a project – how many images a user has classified	Functional Test	See if a user can view the added information in the progress bar
REQ5 - Image Annotation & Tooling	<u>6.1</u>	Provide tools for users to mark regions of interest on images.	Functional Test	Ensure users can annotate images and the changes added save in the database.

Table 2 Displays the Projects Functional and Non-Functional Requirements.

Project Management Approach

Due to the limited time frame given to complete this project, I will be taking a methodical approach to ensure that the project is completed within the time frame. The goal of this project will be to create a web-based image classification system suitable for handling large data sets and annotating astronomical images. Because of this I will need a methodology capable of defining specific milestones and keeping consistent progress, this will allow the project to stay on target and meet the requirements set out previously.

For this project, I have considered several different project management approaches each with their own advantages and disadvantages, one of these for example is the waterfall model which works by following "a linear, sequential approach" [<u>36</u>].



Figure 5. The waterfall Model [<u>36</u>].

This means that each stage needs to be fully complete before progressing with the next. This provides a clear framework with preset milestones making it simple to track progress and verify each

stage before moving onto the next. The downsides to this approach are that it lacks flexibility so making changes during development could be difficult to implement. Another key methodology I considered was the agile approach which allows a project to be developed "in, an uncertain and turbulent environment" [37].



Figure 6. Agile Approach Methodology [38].

The advantages of this methodology are that the project can be adapted to ever-growing requirements and can be continually improved on until a desired result is met. The downsides of this approach are that feedback from users is required on a constant basis and relies on constant changes, which can result in delays and not being able to meet deadlines. The final methodology I considered was the Spiral model that is based "on managing risk through multiple iterations" [39].



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Figure 7. The Spiral Model [40].

With this methodology a project can be developed in cycles with ongoing planning, risk assessment, and evaluation. The positives of this approach are that it allows for an early identification of the risks involved while additionally allowing for improvements with each iteration. On the other hand, this methodology is time consuming due to the multiple iterations needed and is better suited for large high-risk projects with no previous milestones set out.

Design of Artefact

High-Level Design



Figure 8. High Level Design Diagram.

During the design of the system architecture for the project I will ensure that essential requirements are addressed, ensuring that the system is functional and intuitive. This includes making sure the system has Project & Image Management (REQ2), User Management & Security (REQ3) and the ability to track projects via a dashboard (REQ4). The high-level designs will focus on establishing workflows, user interactions and supporting efficient collaboration. Using a verify of UML diagrams

such as activity diagrams, use cases, package diagrams, and wireframes the systems can be visualised before the implementation phase.

Activity diagrams

The primary workflows for the project are highlighted in the activity diagram. The diagram accurately displays the workflow of the project from a user logging on to completing their assigned image classification tasks. The diagram also shows the workflow for the lead scientist roles allowing them to create and edit projects as well as assigning other users to projects. The workflows mentioned support multiple of the systems requirements that were set out such as REQ2.6 that allows users to tag images with specific tags and confidence levels and REQ4.1 and REQ4.3 that allow users to be able to track the progress of a project. The lead scientist's workflows are satisfied by requirements REQ2.1 to REQ2.5 as these requirements are responsible for being able to create the project and assign the astronomers to it. These workflows are supported by strict access control to align with REQ3 and ensures that only authorised users have access to the functions that are required for their role. By having the workflows in line with the requirements it enables lead scientists to focus on the creation and administration of projects while astronomers can focus purely on their assigned image classification tasks.



Figure 9. The Projects Activity Diagram.

Package diagrams

The package diagram illustrates how the systems components are grouped to visualize their relationships and dependencies It establishes the system by defining functions including user authentication, project management, image storage, and classification workflows. By designing the system with modularity in mind it makes sure that individual components are manageable and scalable, as well as easily created independently. By designing the project this way, it can facilitate future updates and the addition of new features by defining explicit boundaries between the packages.







Cognitive Walkthrough Introduction

Persona: Rick - The Project Scientist About

- Name: Rick Rollington
- Age: 56

- Occupation: Project Scientist
- Education: Ph.D. in Astronomy
- **Experience:** 25+ years in field research and data analysis

Profile:

Rob is a senior project scientist specializing in long-term monitoring. His projects often involve collecting large sets of images to document changes over time. Rob works both in the field and at his office, analysing images and compiling scientific reports for academic publication.

Behavioural Considerations

- **Methodical and Detail-Oriented:** Rob is meticulous in organising research data and wants clear, structured image storage.
- **Technically Proficient but Not a Developer:** He is comfortable with data analysis tools (like R and Python) but prefers intuitive, user-friendly software interfaces.
- **Collaborative Worker:** Rob frequently shares data with colleagues and students, so robust annotation and collaboration features are crucial.
- **Time-Constrained:** Balances fieldwork, data analysis, and report writing, so quick and efficient software is essential.

Frustrations

- **Disorganised Image Libraries:** Manually categorising thousands of images is time-consuming and prone to error.
- Inconsistent Annotations: Lacks a standardised method for annotating images, leading to confusion when collaborating.
- **Difficult Searching:** Finding specific images based on metadata or annotations is currently tedious.
- Lack of Version Control: Updating or editing annotations can result in version conflicts when working with colleagues.

Goals

- **Organise and Manage Images Efficiently:** Create a system that supports categorising, tagging, and archiving images seamlessly.
- **Standardize Annotations:** Develop a consistent and intuitive method for adding metadata and notes to images.
- Improve Collaboration: Enable multiple users to annotate and update image sets without losing version integrity.
- Facilitate Data Retrieval: Implement a robust search and filter function to locate images based on content, annotations, and metadata.

Tasks:

1. Project Creation:

- \circ $\,$ Create a new project by entering a title and description.
- o Create classification instructions for astronomers to follow during classification.
- Create a list of classification tags relevant to the project.
- Upload astronomical images from local directories or telescope archives.
- \circ $\;$ Assign astronomers or other lead scientists to the project using the user selector.
- Submit the project to make it live for the users assigned for classification.

2. Project Editing (If required)

• Edit a project from the edit project dashboard.

- Update the project details such as the instructions to give more information, or the assigned users.
- Add new images to an existing project.
- Add or remove classification tags.
- Save changes to update the project for all assigned users.

3. Image Classification and Tagging

- Select an assigned project from the View Projects dashboard.
- View one image at a time in a randomised order.
- Choose one or more classification tags based on the visual content of the image.
- Assign a confidence level (1–5) for classification accuracy.
- o Submit the Classification and next image will load automatically.
- Continue classifying until all assigned images have been annotated.

4. Team Collaboration and Access Control

- During project setup or editing, assign or unassign users from the user selector.
- Collaborate with other users on projects by contributing annotations independently through the classification interface.

5. Data Exporting

- Navigate to a completed project from the project dashboard.
- Select the "Export" option to download classified data.
- Save the dataset locally to be used for further analysis, reporting, or machine learning.

Task List:

- 1. Initial Setup
 - Enter a title for your project (example: "galaxy cluster observation 2025").
 - Enter classification instructions for users.
 - Create classification tags (e.g. "Galaxy cluster", "Supernova", "Planet transit").
 - Select images from local storage or connected devices (telescopes, databases). Use the user selector to select which astronomers to assign to the project.
 - Select "Submit" to create the project.

2. Editing an Existing Project

- Select project to edit
- Update the project title, instructions, or classification tags.
- Add images using the image upload feature
- Remove images by clicking the (-)
- Assign or remove users from the team list.
- Select "Save" to update the project.

3. Image classification

- From the dashboard, select "Classify" on a project that is assigned.
- View the image presented (randomized).
- Choose applicable classifications (multiple selection available).
- Choose confidence level 1-5.
- Select submit and be prompted with the next image.

4. Team collaboration and access control

4.1 assign users to a project

- When creating/editing a project, a user assignment box will allow access to a checklist of users.
- You can select or deselect users to assign them to the project.
- Save the project to confirm assignments.

4.2 work with other users assigned to the same project

- Submitting classifications independently on the project.
- Each user's classifications are stored automatically.

5. Exporting a Project

- Select a project that was previously completed from the dashboard.
- Select "Export Project".
- The project will download to your local device.

Action List:

1. Creating a New Project

Goal: Create an image classification project with instructions, tags, and assign users. Actions:

- 1. Log in as Lead Scientist.
- 2. Click "Create Project".
- 3. Enter a title for the project (e.g. 2025 Galaxy Cluster Observation).
- 4. In the instructions text box, enter classification instructions.
- 5. In the tags input, enter classification tags (e.g. Supernova, Planet Transit).
- 6. Click *Upload Images* and select the image files that will be associated with the project.
- 7. In the user selector, select the users to assign to the project.
- 8. Click Submit.
- 9. Confirmation box will inform you that the project is successfully created.

2. Edit a Project That has Already Been Created

Goal: To edit project instructions and tags or edit assignments as the project progresses Actions:

- 1. From the dashboard, select "View Projects".
- 2. Locate the project and select "Edit".
- 3. To edit project title/instructions, type in the respective fields.
- 4. Add new or remove unwanted classification tags using the editable field.
- 5. To add additional images from your computer, select "Upload Images".
- 6. To delete any images, select the (–) icon next to its preview.
- 7. To edit the projects assignments, check/uncheck the users in the user selector.
- 8. Select "Save" to update the changes made.

3. Image Classification

Goal: Assigns classification tags with confidence ratings to images. Actions:

- 1. From the dashboard, select "View Projects".
- 2. Click the "Start Classifying" Option on the project you want to Classify
- 3. A classification screen will load where one of the assigned images will randomly load.
- 4. Assess the image and choose one or more applicable classification tags.
- 5. Choose a confidence rating, 1-5, from the dropdown menu or slider.
- 6. Hit "Submit" to classify.
- 7. A new image will load automatically.

8. Continue until all images are classified.

4. Teamwork and Assignments

4.1 Add Users to a Project

Goal: To add and remove users to and from a project team.

Actions:

- 1. While creating a new project or during editing, find the section to assign users.
- 2. Check or uncheck the checklist of users to add/remove.
- 3. Review the list to confirm the team for the project.
- 4. Click "Submit" if creating, or "Save" if editing.

4.2 Work on the Same Project Together

Goal: Allow team members to work collaboratively on classifications Actions:

- 1. Once a project is assigned to everyone, each person can log into their account and everyone will see the same project on their assigned projects page.
- 2. Each person can explore the classification interface and classify images in their own time.
- 3. Each classification will be automatically saved.
- 4. There is no need to coordinate image assignment as each image appears in a randomised order.

5. Exporting a Project

Goal: Download the classified project data for reporting, analysis, or machine learning. Actions:

- 1. Choose a completed project from view or archived projects.
- 2. Choose the project of interest and click the "*Export*" button
- 3. A download window will pop up. It may request downloading a .CSV or .XLS file. If so, proceed with these directions.
- 4. The file will automatically download to your computer.

Wireframes

The low fidelity wireframe provides an illustration of the basic layout of the system with a focus on the structure of the site and some of the basic functions. It includes a sidebar for easy navigation, accompanied by a title and logo area, in addition to login and logoff buttons replaced with user information if a user is logged in. While also providing a primary content area which will be the intended workspace for the different capacities in the system such as classifying data crating projects and exporting data once classifications are complete.



Figure 11. The Projects Low Fidelity Wireframe.

The medium fidelity wireframes build on the systems initial wireframe designs and adding the default text sizing, font family and display the interactive functions, the user should be able to do. These wireframes use a grayscale to represent the different UI features the system will offer to demonstrate how the users would interact with various features such as creating projects, classifying images and Viewing Projects. The wireframes created follow the background research conducted by ensuring the system adheres to good usability and accessibility standards. By creating these diagrams, it allows for initial feedback to be given before the official implementation of the user interface.

	Create A Project
Logo & Title	Title Of Project: Project Instructions:
[Login - "Username"]	Project Tags (Comma Separated):
[Signup - Logout]	Choose Files (Files Selected)
[Create Project]	Assign Users:
[Edit Projects]	
[View Projects]	
[Archived Projects]	
[Change Theme]	Upload



	Assigned Projects
Logo & Title	"Project Title" : String "Created At" : Timestamp
[Login - "Username"]	0% - 100% (classified Images: INT) - (Total Images : INT) [Start Classifying - Export Data] (Once progress is 100%) Archive Project
[Signup - Logout]	All Projects
[Create Project]	"Project Title" : String "Created At": Timestamp
[Edit Projects]	0% - 100% (classified Images: INT) - (Total Images : INT)
[View Projects]	[Start Classifying - Export Data] (Once progress is 100%) Archive Project
[Archived Projects]	
[Change Theme]	

Figure 13. The Projects Medium Fidelity Wireframe for Viewing a Project.



Figure 14. The Projects Medium Fidelity Wireframe for Classifying a Project.

Low-Level Design

The Low-level designs will give a detailed illustration of how the system will be implemented with a heavy focus on visualising data structures, system logic and how different classes interact. In addition to this designing the low-level systems as diagrams first it ensures that the system is accurate and can accommodate future updates when needed. The key components of the low-level design are the Entity-Relationship Diagram (ERD), which displays how data is saved and structured in the database, and the Class Diagram, which illustrates how the users can interact with the different components of the system. These diagrams help to provide a firm foundation for work by ensuring effective data handling and clear relationships between components.

Entity-Relationship Diagram

The Entity-Relationship Diagram displays the structure of the database and how the relationships are defined between each table. When designing the Entity-Relationship Diagram I ensured that data best practices were followed, this included normalizing data to reduce redundancy with a specific focus on 3rd normal form to provide maximum query optimization. 3rd normal form focuses on "Removing transitive dependencies, a situation where non-key attributes depend indirectly on the primary key." [41] therefore, doing this will minimizes unnecessary duplication and enhances data consistency across the database. In addition to this the Diagram was structed to provide referential integrity using primary and foreign keys, by doing this the diagram can illustrate the relationships between the data therefore making sure the database is accurate and consistent.



Figure 15. The Projects Entity-Relationship Diagram.

Class Diagram

The class diagram illustrates how the different components in the system interact, the components are placed in classes that outline the attributes behaviours and relationship relationships to one another. The different classes in my system include *User*, *Project*, *ProjectImages*, *ImageTags*, and *Assignments* with each of them providing a specific function. In addition, the diagram uses object-oriented principles such as encapsulation to only expose what data is needed using methods and inheritance enabling roles like Lead Scientist and Astronomer to share common behaviours; by doing this, the class diagram illustrates the structure of the system and how future upgrades could be implemented.



Figure 16. The Projects Class Diagram.

Design Rationale

When working on the designs for the project it was key that both the functional and non-functional requirements of the system where met, this included making the system adhere to the guidelines I had previously set out while also ensuing the system is still scalable efficient and intuitive. For the high-level designs, I made sure to address requirements 2 (Project and image management), 3 (user and security management) and 4 (progress tracking). <u>REQ2</u> was met by creating a modular system design allowing for each site of the project to be swapped out with minimal UI changes from the base system, shown in the package diagram as the different components of the system such as project creation, image uploads, and classification workflows are independent from each other as separate functions/files yet still connected within the larger system allowing for a smooth project workflow and simplistic management for projects. <u>REQ3</u> was met when designing the use case diagram as it illustrates how the different roles will have different access controls such as the lead scientists being able to create and edit projects whilst the astronomers can only classify projects set by the lead scientists. By designing the system this way it ensures that Role-based access control is implemented and prevents unauthorised individuals from conducting tasks beyond their allotted permissions.

When designing the Entity-Relationship Diagram (ERD) for the system I ensured it was in 3rd Normal Form (3NF) to minimize redundancy and enhancing query performance this meets requirements one (Data Management) that had been discussed earlier. By designing the database this way, the system can maintain referential integrity between tables allowing data to be correctly retrieved efficiently and consistency. This system also aligns again with <u>REQ3</u> user and security management as access is enforced through database links, limiting what the different roles in the system can do. The wireframes were designed with the WCAG compliance and <u>REQ2.8</u> (intuitive UI) in mind as so were designed in a way to optimise workflows and gives the user the capability to easily interact with the system, minimizing training requirements needed for being able to start classifying images this was done by Incorporating classification guidelines into each project reducing user error on enhancing

classification accuracy this was further improved on by ensuring users with impairments can still fully interact with the site.

Tools and Technologies

The tools and technologies I plan to use to implement the designs for the astronomical image classification system will include a combination of web-based programming languages to guarantee the systems scalability, efficiency, and ease of use. This technology stack was chosen because of its open-source nature which offers a low-cost solution to facilitate the system while also having extensive community support and simple integration making it an ideal choice for the system creation. The systems designs will be based on the previously supplied UML diagrams, which describe the features and capabilities the system should offer users while upholding the original project requirements. For the frontend the system will utilize HTML to define the layout and structure of each page, CSS for defining the visual presentation to users as illustrated in the wireframes and JavaScript to handle interactive elements of the site such as user authentication, dynamic user interfaces and image annotations as described in both the use case and activity diagrams. These technologies allow the system to transition seamlessly between each programming language to provide a smooth experience for the users relying on it to handle and manage large astronomical datasets. PHP will be utilised in the systems backend for server-side logic, processing user inputs and providing the communication line between the application and database. XAMPP will be used as the local development environment for my system, offering an Apache web server and a MySQL database managed by phpMyAdmin. This will allow for testing and debugging in a sandbox environment to make sure all functionalities and features are properly implemented. The database design will be directly bases of the ERD diagram provided as this structure allows for the database entities and attributes such as user roles, projects, and image classifications to be stored organised and optimized to provide a streamlined transition between the frontend and backend of the web application. The system will then use PHP to handle real-time retrieval, updating, and saving allowing the user to make changes and interact with the system with minimal delays. The use of these tools enables a systematic, scalable, and effective process, which supports the designs goals of providing a smooth experience for the lead scientists and astronomers who will be using the system to manage and annotate massive astronomical datasets whilst providing a streamlines and collaborative workflow.

Development of Artefact / Implementation

Implementation Details

The artefact implementation began by converting the system diagrams into a complete web application capable of handling the requirements that had been set out. This involved the configuration and set up of a sandbox environment and then programming the core features and functionalities specified in the requirements and designs. The system designs were created agnostically to the technology stack used during implementation to ensure the requirements and designs could be met regardless of the tools used, However the technology stack that was ultimately chosen was a web-based stack including HTML, CSS, JavaScript, and PHP as outlined in the tools and technology section of my design phase. This stack was selected as it was best suited for the projects

requirements and needs and further backed up by my initial background research into existing web infrastructures.

Systems like galaxy zoo illustrate the need for a simplistic system that was scalable and lightweight to be able to run on browser-based technology while also being capable of handling the large datasets produced from the LSST and Euclid. While XAMPP was the chosen sandbox and testing environment due to its inclusion of tools such as Apache, PHP, and phpMyAdmin, this allowed the backend of the system to be scalable and facilitate the creation and testing of the system while being able to see the database updates in real time. This decision was further supported by the system designs including class, ERD, and activity diagrams which showcased how the systems architecture and workflows could be translated from their agnostic designs into the completed system utilizing the proposed technology stack.

using this technology stack allowed me to fulfil the primary requirements of the system alongside the systems modular design that facilitated easy modification and maintenance of the code.HTML and CSS were used on the frontend for structure and layout, with JavaScript providing interactivity for some of the core functions such as image annotation, User Assignment and Dynamic project tracking. These functions gave the system an intuitive and straightforward design for maximum ease of use, the designs followed usability guidelines, such as compliance with WCAG guidelines to ensure the system could be used by all users. For the back end of the system PHP was used to directly control User Login, Project workflows and database queries alongside the MySQL database and XAMPP to store User information Project Data and classification results.

The system was developed following a test-driven approach as each part of the system was coded with a clear idea and understanding of what was needed from each stage, the code was then iteratively developed on until the desired result was achieved. By following this approach, it ensured each function was tested thoroughly and met the requirements set out initially in the designs. By developing the system in incremental steps, it allowed for extensive testing during the development allowing any issues that arose during the initial development to be addressed, this method also provided the flexibility to refine or modify components of the system according to how the system performed in initial tests without compromising the integrity of the web application.

Once each function of the system was initially created it was tested live on the application, phpMyAdmin was utilized to ensure the database functioned as required and to validate any information being stored and retrieved was handled properly. By taking this development approach, it allowed the system to maintain integrity across each function this guaranteed the components of the system would work together as the components were treated as a whole system during the development process. By making testing a continuous process, the system was kept stable during the entire development process, this resulted in minimization of significant issues as the components were essentially being built on top of the initially reliable system.

By using this methodology throughout the implementation phase the system is reliable, consistent, and simple to maintain, the process of continuous iteration allowed the application to be developed as a cohesive system where each component was developed on a robust foundation and compatible with the other functionalities of the system.

Standards Compliance

During the implementation of the project best practices and industry standards were followed, critical functionalities were documented using comments explaining how the functions operated. Additionally, classes created in Camel Case "used as a variable naming convention." [42] By doing this
each part of the web application is named functionally making the code self-explanatory, this blends well with the systems modular design allowing for easy future updates. The system also follows WCAG 2.1 guidelines for UI/UX best practises, this ensures the site is accessible using contrast ratios, font sizes, and layout considerations optimised for all users. These decisions were supported by the background research into UX theories alongside the mid-fidelity wireframes and design rationale.

To ensure data integrity throughout the system 3rd Normal Form (3NF) was utilized throughout the database, doing this helped to minimize redundancy while increasing query efficiency aligning with best practices in industry and supporting the scalability of the web application. Furthermore, to ensure user data security and align with projects REQ3 and REQ5 role-based access control was used throughout the system and aligned with the principle of least privilege meaning users "should only have access to the specific data, resources and applications needed to complete a required task." [43] By implementing role-based access control throughout the web application it restricted the permissions given dependent of a user's role in the system. By implementing this control, it reduces the chances of unauthorized access to the system and minimizes the risk of sensitive data being exposed, doing this ultimately created a more streamlined and secure user experience by hiding unnecessary features from users who did not have the necessary permissions while also meeting the initial requirements set out for the project.

Code Samples and Screenshots

The next phase of the project is the formal testing phase where the design will be evaluated against the project's requirements using different testing methods to aid in assessing the system's overall performance reliability and usability. The process will determine how well the system functions and if the artifact achieves the project's initial objectives, the testing phase will include the verification of key functionalities, system performance monitoring and a cognitive walk through to assess the user experience, these assessments will guarantee the system is suitable for purpose.

Therefore, this final section of the implementation process will provide evidence of how each requirement has been met for the project. Each requirement mentioned will include evidence to communicate how the requirement was met by code snippets or functional descriptions to ensure system transparency as to how the artifact was created alongside creating a definitive link between the requirements and implementation. s

<u>REQ1</u> and <u>REQ1.1</u> are met from the database design which supports the ability to store user, image project and tag data. The SQL provided () shows how the database was created to allow for multiple users and scalability.

```
CREATE TABLE Users (
   Username VARCHAR(50) PRIMARY KEY,
   Password VARCHAR(50) NOT NULL,
   Privilege INT DEFAULT NULL,
    Email VARCHAR(50) NOT NULL,
    created at TIMESTAMP DEFAULT CURRENT TIMESTAMP
);
CREATE TABLE Project (
    idproject INT AUTO INCREMENT PRIMARY KEY,
    idcreator VARCHAR(50) NOT NULL,
    projecttitle VARCHAR(50) NOT NULL,
    classified_Images INT NOT NULL DEFAULT 0,
    Total Images INT NOT NULL DEFAULT 0,
    assigned to VARCHAR(50) NOT NULL,
    created at TIMESTAMP DEFAULT CURRENT TIMESTAMP,
    project_instructions TEXT DEFAULT NULL,
```

```
FOREIGN KEY (idcreator) REFERENCES Users(Username)
);
CREATE TABLE ProjectImages (
    idimage INT AUTO INCREMENT PRIMARY KEY,
    idproject INT NOT NULL,
    imageurl VARCHAR(255) NOT NULL,
    imagetitle VARCHAR(50) NOT NULL,
    FOREIGN KEY (idproject) REFERENCES Project(idproject) ON DELETE CASCADE
);
CREATE TABLE ProjectTags (
    idtag INT AUTO INCREMENT PRIMARY KEY,
    idproject INT NOT NULL,
    tag_name VARCHAR(50) NOT NULL,
    FOREIGN KEY (idproject) REFERENCES Project(idproject) ON DELETE CASCADE
);
CREATE TABLE ImageTags (
    idimagetag INT AUTO_INCREMENT PRIMARY KEY,
    idimage INT NOT NULL,
    idtag INT NOT NULL,
    confidence level INT DEFAULT NULL,
    FOREIGN KEY (idimage) REFERENCES ProjectImages(idimage) ON DELETE CASCADE,
    FOREIGN KEY (idtag) REFERENCES ProjectTags(idtag) ON DELETE CASCADE
);
CREATE TABLE ProjectAssignments (
    idassignment INT AUTO INCREMENT PRIMARY KEY,
    idproject INT NOT NULL,
    username VARCHAR(50) NOT NULL,
    assigned at TIMESTAMP DEFAULT CURRENT TIMESTAMP,
    FOREIGN KEY (idproject) REFERENCES Project(idproject) ON DELETE CASCADE,
    FOREIGN KEY (username) REFERENCES Users(Username) ON DELETE CASCADE
);
```

Appendices 1. The Artifacts SQL Database Code.

REQ2.1 to REQ2.4 are met though Create Project.php and the Post Project.php (Appendices <u>8</u> and <u>10</u>) these files contain the functions for creating a project and updating the database with the provided information. The function allows lead scientists to create the projects which the astronomers can then classify. It allows the lead scientists to input images, titles, instructions, tags, and assignments to the project this information is then stored in the database.

REQ2.5 and REQ2.6 Are met through classify_images.php and process_classification.php (Appendices 12 and 13) which allows the astronomer role to view the assigned projects and assign the tags provided to the uploaded images. The images are presented in a randomised order to prevent bias and allows the astronomer to effectively classify the data sets provided by the lead scientist. Once all the images have been assigned tags and confidence levels this data is then sorted in the database and the project can then be exported and archived.

REQ2.7, REQ4.1, and REQ4.2 are met by the view project.PHP file (Appendices <u>11</u>), this file acts as a centralised way for both astronomers and lead scientists too have an overview of projects. The file displays a progress bar which is dynamically updated as projects are classified by astronomers. This page also allows projects to be exported once a project is completed and gives an informative data set which can then be used to support to future machine learning algorithms

REQ2.8 is met through the systems design alongside accessibility options (See <u>Cognitive walkthrough</u> and appendices 20), the site has an overall modular design, allowing the different components to be

inserted into the initial web template, while the theme menu option allows users to increase/decrease tax size change fonts and change colour options allowing the site to be intuitive and accessible.

TO meet REQ3 the system uses role-based access control via the use of permission levels 0 (Astronomer) - 1 (Lead Scientist) From this privilege it determines which parts of the application users can see and do. These permissions are enforced by session cookies, as well as by backend checks, so users are not able to perform operations or access pages outside their defined role.

Appendices 2. Displays role-based control in PHP according to permission levels defined in the database.

REQ3.1 is met from the user login/logout system (Appendices 5, 6, and 7) which verifies user credentials against the database and then directs users to their respective sections. On a successful login, the system determines a user's role, uses the correct interface, and opens access to the required levels. In cases of login failures or incorrect credentials, users are prompted with an error message.

The "Signup" feature (Appendices $\underline{3}$ and $\underline{4}$) covers REQ3.2, allowing new users to sign up by giving their email address and password in Signup.html This data is then stored in the database using php, These functions include input validation to ensure email accuracy and prevent duplicate accounts from being created.

Testing / Evaluation of Artefact

Test Strategy and Plan

The testing strategy for the artifact is designed to ensure that the system aligns with the requirement set out previously, test driven development was used when implementing the project to ensure the basic functions and core features worked as expected. The testing phase will use a combination of functional and non-functional tests to evaluate the system. Functional tests will be conducted to check the different code functions like user login, project creation and image classification worked as required while Non-functional tests like performance tests scalability tests and cognitive walkthroughs help to verify the system could handle multiple users securely while still being easy to use. The testing process will ensure that each test performed is linked to a requirement set out initially so the outcome can be assed against the initial plan.

Test	Linked Requirement	Test Description	Test Type	Outcome	Outcome Description
1.	REQ1	Add large records to the	Scalability	Fail	Unable to test due to
		database and see how growth affects performance.	Test		time constraints

2.	REQ1.1	Test the web application from multiple devices with	Performance Test	Fail	Unable to test due to time constraints
3.	REQ2	Verify that lead scientists can create and edit projects.	Functional Test	Pass	The Lead scientist role can successfully create and edit projects from the front end, and all changes were updated in the back- end database accordingly.
4.	REQ2.1	Test various image formats and confirm correct database storage.	Functional Test	Pass	Images that were uploaded were verified to be PNG, JPG, JPEG or GIF using JavaScript – This result was also checked to ensure the images were sorted in the correct directory and then linked correctly in the database.
5.	REQ2.2	Verify that lead scientists can create tags for a project – and the tags show up in its designated table in the database	Functional Test	Pass	The tags created for a project were updated correctly to the database and were successfully linked to the correct image/project view during classification.
6.	REQ2.3	Verify that lead scientists can create a description for a project – and that it shows up in its designated table in the database	Functional Test	Pass	During the creation/edit of a project the description could be successfully implemented/change d – this result was reflected in the database.
7.	REQ2.4	Verify that the user has been assigned to that specific project.	Functional Test	Pass	Users can be assigned/unassigned to projects via the create or edit functions and the result is shown in the database.
8.	REQ2.5	Verify that images displayed are not in the same order.	Functional Test	Pass	The Images for a project were successfully displayed

					in a randomised order.
9.	REQ2.6	Verify that users can select a confidence level when classifying images. And that the result shows up in its designated table in the database.	Functional Test	Pass	During classification users can select multiple tags and assign a confidence level to each tag. This result is the updated in the database.
10.	REQ2.7	Test that the user can export project data once a project has been completed.	Functional Test	Pass	Once a project is complete the results collected can be exported as an xls file.
11.	REQ2.8	Tested Via the cognitive walkthrough Below	cognitive walkthrough	N/A	See table Below
12.	REQ3	Test authentication, role permissions, and access control.	Functional Test, Security Test	Pass	Role-based permissions were properly implemented, Only Lead scientists can create and edit projects.
13.	REQ3.1	Test that users can login	Functional Test	Pass	Log in was successful as proper credentials were validated.
14.	REQ3.2	Test that users can create an account	Functional Test	Pass	New users could sign up and their accounts were added to the user table with the correct default role.
15.	REQ3.3	Test that as a user with limited access that you cannot view pages without access.	Security Test	Pass	base users (Astronomers) were properly denied access to certain pages.
16.	REQ4	Verify that project progress updates dynamically based on image classifications.	Functional Test	Pass	Progress metrics updated automatically in real- time as users classified images. Database updates triggered dashboard refreshes correctly.
17.	REQ4.1	Check that the progress bar updates as users classify images.	Functional Test	Pass	The progress bar correctly reflected classification completion percentage as users classified projects.

18.	REQ4.2	See if a user can view the added information in the progress bar	Functional Test	Parshall Pass	Users can see the progress of a project calculated by the number of images – the total images classified
19.	REQ5	Ensure users can annotate images and the changes added save in the database.	Functional Test	Fail	This feature was not implemented due to time constraints and unexpected technical complexity.

Table 3. Functional and Nonfunctional Testing Table.

The system usability and interface will be tested by use of a cognitive walk-through, by analysing how a regular user - in this case <u>Rick</u>, would complete the fundamental actions using the web interface. By conducting a cognitive walk-through, we can gain insight as to how many steps it takes to achieve these actions, whether the system provides appropriate feedback for errors and the overall usability of the interface. This helps identify potential usability issues early by using the system from a user's point of view while additionally testing the systems functionality.

Task		Goal	No. of Clicks Required	Pass/Fail	User Feedback for Invalid Input?
Signup & Login		Allow the User to either Signup or login to the system.	3 minimum		See individual tests below.
	Signup	Create a new Account.	4	Pass	Error! You must complete all fields! Error! Your email address is not in a valid format!
	Login	Access the platform using existing credentials	3	Pass	Incorrect password Username and password are required.
Create Project		Create a project which can then be classified by astronomers.	7 (to create full project)		See individual tests below.
	Enter Title	Input a name for the Project.	2	Pass	Title is required.
	Add Instructions	Write guidance for the project.	3	Pass	Comment is required.
	Add Tags	Define tags for use during classification.	4	Fail	Fail – No User Feedback has been implemented here.
	Upload Images	Upload images to the project.	5	Pass	Please select at least two photos.

	Assign Users	Select users to	6 – minimum	Pass	At least one user
		assign to the			must be assigned to
	Culturait	project.	7	Data	the project.
	Submit	Save and Create	/	Pass	N/A – Redirect to
E alta	t Duciest	the Project.			anotner page.
Ean	tProject	Edit an aiready			See individual tests
	Madify Title /	existing project.	2	[]	Delow.
		Update text fields	3	Fall	NO USER FEEdback
	Instructions	in an existing			nas been
	Add / Domovo Togo	project.	2	[ail	Implemented here.
	Add / Remove Tags	Wanage tags	3	Fall	Fall – NO User
		within an existing			Feedback has been
		project.	2	[ail	
	Add / Remove	Add of remove	3	Fall	Fall – NO User
	inages	nnages nom the			implemented here
-	Lindate Assigned	Change team	2	Fail	Fail – No Usor
	Upuale Assigned	mombor	5	Fall	Fail – NO Osei
	USEIS	assignments			implemented here
	Savo Changos	Undate the project	1	Dass	N/A Redirect to
	Save Changes	to reflect the	4	F 055	another name
		changes made			another page.
Classify Project		Classify the project	5 minimum		See individual tests
Classify Project		to assign tags and	ner image		helow
		confidence levels	per intage		
		to each image.			
	Open an Assigned	Begin classification	2		N/A
	Project	on a project.			,
-	Select Tags	Choose one or	3 – minimum	Pass	Please select item in
	, i i i i i i i i i i i i i i i i i i i	more tags per			the list
		image.			
	Set Confidence	Rate confidence in	4 – minimum	Pass	Please select item in
	Level	the classification			the list
		for each assigned			
		tag.			
	Submit	Save the	5	Pass	Next image appears
	Classification	classification and			with redirect to
		load next image.			another page upon
					completion.
Ехр	ort Project	Export the	1		See individual tests
		completed			below.
		classified datasets			
	Download File	Export project	1		Not applicable –
		classification data			download triggers
		to device			directly

Table 4. Cognitive Walkthrough Testing Table.

Test Results

The results of the testing phase indicated that the core functions of the system were working correctly, the functional tests I conducted for login/logout, creation of projects, image classification, and data exporting passed with the back-end database reflecting the updates made from the webserver. The system was also able to support role-based access control ensuring that users with different permissions levels could only see certain pages based on their level and were unable to access functions outside their intended role. In addition to this the functions responsible for handling image classification specifically including the randomisation of images in the project alongside the image tagging and confidence level assignments also passed their functional tests, allowing the classification workflows to function as specified in the requirements.

Some of the features highlighted in the requirements that were ultimately unable to be completed due to the strict time constraints and technical complexity was the image annotation feature (REQ5), this feature would have let users highlight specific areas of interest on the images during the classification process however was never implemented in the system as it was much more technically complex than anticipated. Similarly, formal of the database including scalability and performance testing (REQ1 and REQ1.1) was not completed due to the time constraints. While empirically the scalability and performance of the system appeared to be good due to the test-driven development approach taken during implementation the results cannot quantified in a meaningful way, this presents a limitation as the system might not perform as expected in real word testing involving substantial amounts of data.

The usability of the system was assessed through the cognitive walkthrough process with a detailed persona (Rick) which tested the typical user journeys such as signing up, creating and editing projects, classifying images, and exporting data. The cognitive walkthrough concluded that all tasks could all be accomplished with a low click rate making the interface generally intuitive for users with only moderate technical experience. The cognitive walkthrough also assessed the use of input validation and error messaging throughout the system, the results from this concluded that it was generally implemented well especially for the login and classification stages however fell short most notably when editing a project as a whole and when assigning tags during the project creation process. While these issues did not stop successful task completion, they highlight areas where the user functionality designs could be improved on by implementing more robust input validation features to prevent incomplete projects from being created and preserve data integrity in the database.

Evaluation of Project / Conclusion

Project Summary

The main goal of my project was to create a web-based image classification system which allowed for the collaborative classification of astronomical data sets to address the gap in the categorization workflows for large-scale scientific projects conducted with instruments such as Euclid and the Large Synoptic Survey Telescope. The artefact created successfully satisfies most of the functional and non-functional requirements that were initially set out these include role-based access control, project creation, project management, classification with tag assignments and confidence levels and progress tracking dashboards.

Despite the limited time for the projects development the core features of the system were successfully implemented and tested successfully. The results of the cognitive walkthrough proved that the systems UI was intuitive and aligned with accessibility principles therefore creating an effective workflow for all roles using the system. While the functional and nonfunctional test proved

the systems essential functions worked as intended and the results were reflected in the database. Although the image annotation tool was not implemented and full system scalability testing was not properly conducted. The architecture of the system was created with future integration in mind allowing the platform to be adaptable and flexible for growing user and data needs.

Reflection

The project yielded overall positive outcome with the creation of a modular user-friendly platform for use in an astronomical image classification setting. One of the most successful aspects of the project was the implementation of a system that allowed users to collaboratively classify projects to improve and enhance scientific workflows. The design of the artifact remained in line with the original projects aims, and included functions like role-based access, progress tracking, and exportable datasets which all worked as intended. Overall, the artifact had a huge focus on usability, accessibility, and allowing for structured workflows between lead scientists and astronomers.

Some of the challenges of this project was the image annotation feature as mentioned earlier which was planned for the projects end development stages was more technically complicated than originally assumed and therefore could not be completed within the deadline. Additionally, the scalability and performance of the database did not go through formal testing due to the time contains, because of this the results of using this project in a live environment would be unknown however due to the test-driven development approach that was taken during implementation phase the database seemed to be able to handle the small test datasets that were created during implementation.

Despite these challenges, the test-driven development approach that was taken guaranteed that steady incremental progress was being made throughout the creation of the artifact. This approach to development accompanied the modular design of the system allowed the artifact to be created in separate components and validated by ensuring tested fields would display in the database. Although feedback from the cognitive walkthrough identified some shortcomings, primarily related to user feedback when editing projects or assigning tags, however the overall system was shown to be intuitive and easy to navigate.

Ultimately, this project has successfully created a functioning prototype that meets many of the essential features laid out in the requirements, this project has provided lots of insights on system design, testing and user interface development. Moving forward the lessons learnt from this project will be applied to refine the system especially in regards to database scalability testing, image annotation features and machine learning opportunities.

Improvements and Future Work

While the system met a lot of initial requirements, there are several opportunities for improvements and future work with regards to functionality and user interaction. One example of this is the image annotation feature which would have allowed users to select regions of interest on an image, while the system does provide a means to classify using tags and confidence levels, annotation would give greater scientific validity to the data produced that could have been used for machine learning. To implement this feature additional time would be needed for implementation as the system would also have to be able to track the annotations made to the images and then store them in the database.

Formal testing for both stability and database performance was minimal due to time constraints, for future projects/work it would be beneficial to deploy the system to a live server to allow for efficient

and thorough testing to gain a real insight into how the system performs at scale. This would help evaluate how the system operates with substantial datasets images and multiple users, identifying any bottlenecks or lags that may not be visible in a localhost setting.

The cognitive walkthrough tests provided some insights related to usability and error validation when completing tasks, the main downfall in relation to these tests came from the edit project function which provided little to no user feedback upon updating fields, reassigning users and form completion. Future improvements could be made here by implementing more informative error prompts and a more clear feedback system. While these changes are minor considerations, implementing them could significantly improve the usability of the system and decrease potential user error.

In addition to this another area for future development could be integrated use with machine learning, whilst it was not added in as part of this project the database and classification structure were developed with potential integration in mind, The exported datasets could be used to train machine learning models which could then be implemented into future versions of the system to support semi-automated classification with human verification, By doing this the system would have a reduced manual workload while maintaining classification accuracy.

By implementing these changes, the system has a strong case to become a strong and scalable system for handling the classification of large-scale astronomical datasets and provides a foundation for new astronomical research tools to support scientific discovery at scale.

References / Appendices

References

[1] European Space Agency, "Euclid," www.esa.int, 2023. <u>https://www.esa.int/Science_Exploration/Space_Science/Euclid</u> (accessed Apr. 15, 2025).

[2] Vera C. Rubin Observatory, "About LSST | the Large Synoptic Survey Telescope," *Lsst.org*, 2019. https://www.lsst.org/about (accessed Apr. 04, 2025).

[3] Vera C. Rubin Observatory, "Instruments | Rubin Observatory," *Rubinobservatory.org*, 2024. https://rubinobservatory.org/for-scientists/rubin-101/instruments (accessed Apr. 04, 2025).

[4] Vera C. Rubin Observatory, "Key numbers | Rubin Observatory," *Rubinobservatory.org*, 2024. <u>https://rubinobservatory.org/for-scientists/rubin-101/key-numbers</u> (accessed Apr. 04, 2025).

[5] R. Cloete, P. Vereš, and A. Loeb, "Machine learning methods for automated interstellar object classification with LSST," *Astronomy & Astrophysics*, vol. 691, p. A338, Nov. 2024, doi: <u>https://doi.org/10.1051/0004-6361/202451118</u>.

[6] J. Wenskovitch and A. Jaodand, "Human Factors for Machine Learning in Astronomy," *AHFE International*, 2023, doi: <u>https://doi.org/10.54941/ahfe1003580</u>.

[7] European Space Agency, "ESA's 'Cosmic Vision," www.esa.int, Feb. 01, 2025. https://www.esa.int/Science Exploration/Space Science/ESA s Cosmic Vision (accessed Apr. 04, 2025).

[8] F. Fornari, "Software Development and Detector Characterization of the EUCLID Near-Infrared Spectro-Photometer," Ph.D. Dissertation, Alma Mater Studiorum – Università di Bologna, 2018. Accessed: Apr. 04, 2025. [Online]. Available: https://amsdottorato.unibo.it/id/eprint/8437/7/fornari_federico_tesi.pdf

[9] Euclid Consortium, "Mission characteristics | Euclid Consortium," *Archive.org*, Jun. 01, 2019. https://web.archive.org/web/20220316132442/https://www.euclid-ec.org/?page_id=2540 (accessed Apr. 04, 2025).

[10] Euclid Consortium, "VIS – Euclid Consortium," *Euclid Consortium - A space mission to map the Dark Universe*, 2025. https://www.euclid-ec.org/public/mission/vis/ (accessed Apr. 04, 2025). [11] Euclid Consortium, "NISP – Euclid Consortium," *Euclid Consortium - A space mission to map the Dark Universe*, 2025. https://www.euclid-ec.org/public/mission/nisp/ (accessed Apr. 04, 2025).

[12] Sloan Digital Sky Survey, "SDSS," Sdss.org, 2019. https://www.sdss.org/ (accessed Apr. 04, 2025).

[13] zooniverse, "Zooniverse," *Zooniverse.org*, 2020. <u>https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/about/results</u> (accessed Apr. 04, 2025).

[14] C. Cardamone *et al.*, "Galaxy Zoo Green Peas: discovery of a class of compact extremely star-forming galaxies," *Monthly Notices of the Royal Astronomical Society*, vol. 399, no. 3, pp. 1191–1205, Nov. 2009, doi: <u>https://doi.org/10.1111/j.1365-2966.2009.15383.x</u>.

[15] labelbox, "Annotate | Labelbox," labelbox.com. https://labelbox.com/product/annotate/ (accessed Apr. 15, 2025).

[16] labelbox, "Features," *Labelbox docs*, 2025. <u>https://docs.labelbox.com/docs/working-with-features</u> (accessed Apr. 15, 2025).

[17] Medseg, "About," *Medicalsegmentation.com*, 2025. <u>https://medicalsegmentation.com/about/</u> (accessed Apr. 15, 2025).

[18] DICOM, "DICOM Standard," Dicomstandard.org, 2019. https://www.dicomstandard.org/ (accessed Apr. 15, 2025).

[19] dfwg, "NIfTI: — Neuroimaging Informatics Technology Initiative," *nifti.nimh.nih.gov*. <u>https://nifti.nimh.nih.gov/</u> (accessed Apr. 15, 2025).

[20] L. Landry, "What is human-centered design?," *Business Insights Blog*, Dec. 15, 2020. <u>https://online.hbs.edu/blog/post/what-is-human-centered-design</u> (accessed Apr. 15, 2025).

[21] J. Nielsen, "10 Heuristics for User Interface Design," *Nielsen Norman Group*, Jan. 30, 2024. https://www.nngroup.com/articles/ten-usability-heuristics/ (accessed Apr. 15, 2025).

[22] R. Budiu, "Fitts's Law and Its Applications in UX," *Nielsen Norman Group*, Jul. 31, 2022. <u>https://www.nngroup.com/articles/fitts-law/</u> (accessed Apr. 15, 2025).

[23] J. Mendel, "TigerPrints TigerPrints The Effect of Interface Consistency and Cognitive Load on User The Effect of Interface Consistency and Cognitive Load on User Performance in an Information Search Task Performance in an Information Search Task," 2010. Accessed: Apr. 15, 2025. [Online]. Available: https://open.clemson.edu/cgi/viewcontent.cgi?article=2052&context=all theses

[24] M. Wei Lee, J. Y. H. Soo, and S. M. H. Sharoni, "Classification of Spiral Galaxies by Spiral Arm Number using Convolutional Neural Network," *Arxiv.org*, 2023. <u>https://arxiv.org/html/2412.11696v1</u> (accessed Apr. 04, 2025).

[25] J. Nielsen, "How Users Read on the Web," *Nielsen Norman Group*, Sep. 30, 1997. https://www.nngroup.com/articles/how-users-read-on-the-web/ (accessed Apr. 04, 2025).

[26] M. J. Fordham, "Font Sizes for Responsive Websites," *Blog*, Jun. 21, 2021. <u>https://www.wix.com/studio/blog/font-size</u> (accessed Apr. 04, 2025).

[27] U. Team, "Avoid design jargon to improve communication - UXATT," UXATT.com, Oct. 28, 2020. <u>https://uxatt.com/avoid-design-jargon-to-improve-communication/</u> (accessed Apr. 04, 2025).

[28] B. Fialkowski and D. Schofield, "Considering Color: Applying Psychology to Improve the Use of Color in Digital Interfaces," *Art and Design Review*, vol. 12, no. 04, pp. 306–329, 2024, doi: <u>https://doi.org/10.4236/adr.2024.124022</u>.

[29] Web Content Accessibility Guidelines, "Web Content Accessibility Guidelines (WCAG) 2.1," *W3.org*, Dec. 12, 2024. https://www.w3.org/TR/2024/REC-WCAG21-20241212/ (accessed Apr. 04, 2025).

[30] Apache Friends, "XAMPP Installers and Downloads for Apache Friends," *www.apachefriends.org*, 2022. <u>https://www.apachefriends.org/</u> (accessed Apr. 04, 2025).

[31] Apache Friends, "About the XAMPP Project," *Apachefriends.org*, 2011. <u>https://www.apachefriends.org/about.html</u> (accessed Apr. 04, 2025).

[32] P. Kumar, "Open Source Web Application Development," 2025. Accessed: Apr. 04, 2025. [Online]. Available: <u>https://ebooks.lpude.in/new-</u> <u>scheme/arts/ma_math/sem_3/DECAP512_OPEN_SOURCE_WEB%20_APPLICATION_DEVELOPMENT.pdf</u>

[33] Apache Friends, "XAMPP FAQs for Windows," *Apachefriends.org*, 2019. https://www.apachefriends.org/faq_windows.html (accessed Apr. 04, 2025).

[34] WikiHow, "How to Set up a Personal Web Server with XAMPP (with Pictures)," *WikiHow*, Dec. 31AD. https://www.wikihow.com/Set-up-a-Personal-Web-Server-with-XAMPP (accessed Apr. 15, 2025).

[35] Qualtrics, "Secondary Research: Definition, Methods, & Examples," *Qualtrics*, 2024. <u>https://www.qualtrics.com/en-gb/experience-management/research/secondary-research/</u> (accessed Apr. 04, 2025).

[36] P. Kirvan, "What is waterfall model? - Definition from WhatIs.com," *SearchSoftwareQuality*, 2022. <u>https://www.techtarget.com/searchsoftwarequality/definition/waterfall-model</u> (accessed Apr. 04, 2025).

[37] Agile Alliance, "What is Agile Software Development?," *Agile Alliance*, Jan. 16, 2019. https://www.agilealliance.org/agile101/ (accessed Apr. 04, 2025).

[38] S. Laoyan, "What is agile methodology? (A beginner's guide)," *Asana*, Feb. 20, 2025. https://asana.com/resources/agile-methodology (accessed Apr. 15, 2025).

[39] S. Kumar Pal, "Software Engineering | Spiral Model," *GeeksforGeeks*, May 28, 2018. https://www.geeksforgeeks.org/software-engineering-spiral-model/ (accessed Apr. 04, 2025).

[40] IONOS, "Spiral model: the risk-driven software development process model," *IONOS Startupguide*, Sep. 12, 2023. https://www.ionos.co.uk/startupguide/productivity/spiral-model/ (accessed Apr. 15, 2025).

[41] M. Fayard, "What is Third Normal Form (3NF)?," *Datacamp.com*, Nov. 18, 2024. https://www.datacamp.com/tutorial/third-normal-form (accessed Apr. 04, 2025).

[42] mozilla, "Camel case - MDN Web Docs Glossary: Definitions of Web-related terms | MDN," *developer.mozilla.org*, Sep. 08, 2023. <u>https://developer.mozilla.org/en-US/docs/Glossary/Camel_case</u> (accessed Apr. 06, 2025).

[43] paloaltonetworks, "What Is the Principle of Least Privilege?," *Palo Alto Networks*, 2025. <u>https://www.paloaltonetworks.co.uk/cyberpedia/what-is-the-principle-of-least-privilege</u> (accessed Apr. 06, 2025).

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```
Sign Up.html
 <!DOCTYPE html>
 <html>
 <head>
      <title>Sign Up</title>
      <link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
<link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
      <script src="https://code.jquery.com/jquery-3.6.0.min.js"></script></script></script>
      <script>
          $(document).ready(function () {
               // Hides messages
               $("#E2").hide();
               $("#E4").hide();
               $("#M1").hide();
          });
          function submitQuery() {
               var email = document.getElementById("inputEaddress").value;
               var username = document.getElementsByName("username")[0].value;
               var password = document.getElementsByName("password")[0].value;
               console.log("Email:", email);
               console.log("Username:", username);
console.log("Password:", password);
               if (email.trim() === "" || username.trim() === "" || password.trim() === "") {
                    // If any field is empty
                   $("#E2").show(); // Show error message for incomplete fields
return false; // Prevent form submission
               } else if (!isValidEmail(email)) {
                    // If the email address is not valid
                   $("#E4").show(); // Show error message for invalid email address
return false; // Prevent form submission
               } else {
                   // If all validations pass
                   $("#E2").hide();
                   $("#E4").hide();
                   console.log("Sending AJAX request...");
                    // Send AJAX request to signup.php
                   $.ajax({
                        type: "POST",
                        url: "Sign Up.php",
                        data: { email: email, username: username, password: password },
                        success: function (response) {
                             console.log("Response:", response);
                             // Display response message
                             $("#M1").text(response).show();
                        },
                        error: function (xhr, status, error) {
                             console.error("AJAX Error:", error);
                        }
                   });
                    return false; // Prevent default form submission
               }
          }
          function isValidEmail(email) {
               return /^[^\s@]+@[^\s@]+\.[^\s@]+$/.test(email);
          }
      </script>
```

</head>

```
<body>
   <main>
       <aside class="sidebar" data-sidebar>
          <div class="sidebar-info">
              <figure class="avatar-box">
                  <img src="Logos\Logo.png" width="80">
              </figure>
              <div class="info-content">
                  <h1 class="name">Galaxify</h1>
              </div>
          </div>
          <div class="sidebar-info_more">
              <div class="separator"></div>
              <nav>
                  <a href="login.html">Login</a>
                     <a class="active" href="">Sign Up</a>
                  </nav>
              <div class="separator"></div>
          </div>
       </aside>
       <div class="main-content">
          <article class="about active" data-page="about">
              <header>
                  <h2 class="h2 article-title">Sign Up</h2>
              </header>
              <section class="about-text">
                  <form action="Sign Up.php" method="post" enctype="multipart/form-data"</pre>
                     onsubmit="return submitQuery()">
                     Email:<br><input type="text" name="email" id="inputEaddress">
                     Username:<br><input type="text" name="username">
                     Password:<br><input type="password" name="password">
                     <input type="submit" value="Sign Up" name="submit">
                     <!-- Error message -->
                     Error! You must complete all fields!
                     Error! Your email address is not in a valid format!
                     <!-- Success message -->
```

Already have an account? Login here

</form>

```
</section>
```

```
</article>
```

```
</div>
```

</main>

```
</body>
```

</html>

Appendices 3. The Code for Sign Up.html.

```
Sign Up.php
 <html>
 <head>
 </head>
 <body>
     <?php
     // create new MySQL interface object
     $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
     // try to connect to database.
     if ($mysqli->connect_errno) {
         // if there is an error, output the details
echo "Failed to connect to MySQL: (" . $mysqli->connect_errno . ") " . $mysqli-
 >connect_error;
         exit();
     }
     // Check if the email already exists
     $email = $_POST['email'];
     $query = $mysqli->prepare("SELECT * FROM Users WHERE Email = ?");
     $query->bind_param("s", $email);
     $query->execute();
     $result = $query->get_result();
     if ($result->num_rows > 0) {
         // Email already exists
         echo "Account already exists for this email.";
     } else {
         // Create a query to insert new user
         $username = $_POST['username'];
$password = $_POST['password'];
         $privilege = "user"; // Default privilege, adjust as needed
         $insertQuery = $mysqli->prepare("INSERT INTO Users (Username, Password, Privilege, Email)
 VALUES (?, ?, ?, ?)");
          $insertQuery->bind_param("ssss", $username, $password, $privilege, $email);
         // Execute SQL query. If it is successful, tell the user. If there is an error, print an
 error message.
         if ($insertQuery->execute()) {
             // Account created successfully
              echo "Account created successfully! Login to access your account.";
         } else {
             // Error occurred
              echo "Something went wrong. Please contact your system administrator.";
         }
     }
     // close the database connection
     $mysqli->close();
     25
 </body>
```

</html> Appendices 4. The Code for Sign Up.php.

```
login.html
   <!DOCTYPE html>
   <html>
   <head>
            <title>Login</title>
            <link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
            <link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
            <script src="https://code.jquery.com/jquery-3.6.0.min.js"></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></s
            <script>
                     $(document).ready(function () {
                              var formSubmitting = false;
                              $('form').submit(function (event) {
                                        if (formSubmitting) return false;
                                       formSubmitting = true;
                                       var username = $('input[name="username"]').val();
                                       var password = $('input[name="password"]').val();
                                       if (username.trim() === '' || password.trim() === '') {
                                                 $('#errorMessage').text('Username and password are required.');
                                                 formSubmitting = false;
                                                 return false;
                                       }
                                       return true;
                              });
                              function getErrorMessageFromURL() {
                                        const urlParams = new URLSearchParams(window.location.search);
                                       return urlParams.get('error');
                              }
                              function displayErrorMessage() {
                                       const errorMessage = getErrorMessageFromURL();
                                       if (errorMessage) {
                                                $('#errorMessage').text(decodeURIComponent(errorMessage));
                                       }
                              }
                              displayErrorMessage();
                    });
            </script>
   </head>
   <body>
            <main>
                     <aside class="sidebar" data-sidebar>
                               <div class="sidebar-info">
                                       <figure class="avatar-box">
                                                 <img src="Logos\Logo.png" width="80">
                                        </figure>
                                        <div class="info-content">
                                                <h1 class="name">Galaxify</h1>
                                        </div>
                              </div>
                               <div class="sidebar-info_more">
                                       <div class="separator"></div>
                                       <nav>
                                                 <a class="active" href="">Login</a>
                                                          <a href="Sign Up.html">Sign Up</a>
                                                 </nav>
                                       <div class="separator"></div>
                               </div>
                     </aside>
```

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```
<div class="main-content">
             <article class="about active" data-page="about">
                 <header>
                    <h2 class="h2 article-title">Login</h2>
                </header>
                <section class="about-text">
                    <form action="login.php" method="post" enctype="multipart/form-data">
                        Username:<br><input type="text" name="username">
                        Password:<br><input type="password" name="password"><br>
                        <input type="submit" value="Login" name="submit">
                        <!-- Error message -->
                        Don't have an account yet? <a class="Login-Signup" href="Sign"</p>
 Up.html">Sign Up</a> here
                    </form>
                </section>
             </article>
         </div>
     </main>
 </body>
 </html>
Appendices 5. The Code for login.html.
login.php
 <?php
 session_start();
 // Check if request method is POST
 if ($_SERVER["REQUEST_METHOD"] !== "POST") {
     header("Location: login.html?error=Invalid%20request");
     exit();
 }
 // Validate input exists
 if (empty($_POST['username']) || empty($_POST['password'])) {
     header("Location: login.html?error=Username%20and%20password%20are%20required");
     exit();
 }
 $username = trim($_POST['username']);
 $password = trim($_POST['password']);
 // Connect to database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 // Handle connection error
 if ($mysqli->connect_errno) {
     header("Location: login.html?error=Database%20connection%20error");
     exit();
 }
 // Prepare and execute SQL query
 $stmt = $mysqli->prepare("SELECT username, password, privilege FROM Users WHERE username = ?");
 if (!$stmt) {
     header("Location: login.html?error=Server%20error");
     exit();
 }
 $stmt->bind_param("s", $username);
 $stmt->execute();
 $result = $stmt->get_result();
 // Check if user exists
 if ($result->num rows === 0) {
     header("Location: login.html?error=User%20not%20found");
     exit();
 }
```

```
// Validate password
 $user = $result->fetch_assoc();
 if ($user['password'] !== $password) {
    header("Location: login.html?error=Incorrect%20password");
     exit();
 }
 // Set cookies for 1 hour
 setcookie("User", $user['username'], time() + 3600, "/");
 setcookie("Privilege", $user['privilege'], time() + 3600, "/");
 // Redirect based on privilege (can change if needed later)
 header("Location: View Projects.php");
 exit();
 ?>
Appendices 6. The Code for Login.php.
logout.php
 <html>
 <head>
     <title>Logout</title>
 </head>
 <body>
     <h1>Logout </h1>
     <?php
     if (isset($_COOKIE["User"])) {
    setcookie("User", "", time() - 60); // Set cookie
    header("Location: login.html");
          exit();
     }
     ?>
      <html>
     <head>
          <title>Logout</title>
      </head>
      <body>
          You are logged out.
     </body>
     </html>
 </body>
 </html>
Appendices 7. The Code for Logout.php.
Create Project.php
 <!DOCTYPE html>
 <html>
 <head>
     <title>Create Project</title>
     <link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
     <link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
     <script src="https://code.jquery.com/jquery-3.6.0.min.js"></script>
     <script>
          document.addEventListener("DOMContentLoaded", function () {
               // Fetch usernames from the server
              fetch("fetch_users.php")
                   .then(response => response.json())
                   .then(data => {
```

```
const dropdown = document.getElementById("assigned_users");
                        data.forEach(user => {
                            const option = document.createElement("option");
                            option.value = user;
                            option.textContent = user;
                            dropdown.appendChild(option);
                        });
                        // Enable toggle behavior once users are loaded
                        for (let i = 0; i < dropdown.options.length; i++) {</pre>
                            dropdown.options[i].addEventListener("mousedown", function (event) {
                                 event.preventDefault();
                                 this.selected = !this.selected;
                                 return false;
                            });
                        }
                   })
                   .catch(error => {
                        console.error("Error fetching users:", error);
                   });
              // Form validation
              document.querySelector("form").addEventListener("submit", function (event) {
                   const title = document.querySelector('input[name="projecttitle"]').value;
const files = document.querySelector('input[name="fileToUploads[]"]').files;
                   const comment = document.querySelector('input[name="project_instructions"]').value;
                  const assignedUsers = document.querySelectorAll('#assigned_users option:checked');
let errorMessage = '';
                  if (title.trim() === '') errorMessage += 'Title is required.<br>';
if (files.length === 0) errorMessage += 'Please select at least one photo.<br>';
                   if (files.length < 2) errorMessage += 'Please select at least two photos.<br>';
                   for (let i = 0; i < files.length; i++) {</pre>
                       const ext = files[i].name.split('.').pop().toLowerCase();
if (!['png', 'jpg', 'jpeg', 'gif'].includes(ext)) {
    errorMessage += 'Please select only PNG, JPG, JPEG, or GIF files.<br>';
                            break;
                       }
                   }
                   if (comment.trim() === '') errorMessage += 'Comment is required.<br>';
                   if (assignedUsers.length === 0) errorMessage += 'At least one user must be assigned
to the project.<br>';
                   if (errorMessage !== '') {
                        event.preventDefault();
                       document.getElementById("error-message").innerHTML = errorMessage;
                   }
              });
         });
    </script>
</head>
<body>
     <main>
         <aside class="sidebar" data-sidebar>
              <div class="sidebar-info">
                   <figure class="avatar-box">
                        <img src="Logos\Logo.png" width="80">
                   </figure>
```

```
</div>
```

```
<div class="sidebar-info_more">
               <div class="separator"></div>
               <nav>
                   <1i>
                           <?php if (isset($_COOKIE['User'])): ?>
                               <a href="User Page.php">
                                   <?php echo $ COOKIE['User']; ?>
                               \langle a \rangle
                           <a href="logout.php">Logout</a>
                       <?php else: ?>
                           <a href="login.html">Login</a>
                           <a href="Sign Up.html">Sign Up</a>
                       <?php endif; ?>
                       </nav>
               <div class="separator"></div>
               <nav>
                   <?php if (isset($_COOKIE['User']) && $_COOKIE['Privilege'] == 1): ?>
                           <!-- Check if user is logged in and is an admin -->
                           <a class="active" href="Create Project.php">Create Project</a>
                           <a href="Edit Projects.php">Edit project</a>
                           <!-- Display the "Admin" link only for admin users -->
                       <?php endif; ?>
                       <div class="separator"></div>
                       <a href="#" id="themeToggleBtn">Change Theme V</a>
                           <div id="themeSettingsDropdown" style="display: none; margin-top:</pre>
10px;">
                               <label for="fontSelect" style="font-size: 13px;">Font:</label>
                               <select id="fontSelect">
                                   <option value="'Comic Sans MS', cursive">Comic Sans</option>
                                   <option value="Arial, sans-serif">Arial</option>
                                   <option value="'Courier New', monospace">Courier</option>
                                   <option value="'Times New Roman', serif">Times New
Roman</option>
                               </select>
                               <label for="textSize" style="font-size: 13px;">Text Size:</label><input type="range" id="textSize" min="12" max="24" value="16"</li>
style="width: 100%;">
                               <label for="themeToggleSwitch" style="font-size: 13px;">Light
Mode:</label>
                               <input type="checkbox" id="themeToggleSwitch">
                           </div>
                       </nav>
           </div>
       </aside>
        <div class="main-content">
           <article class="about active" data-page="about">
               <?php if (isset($_COOKIE['User'])): ?>
                   <header>
                       <h2 class="h2 article-title">Create A Project</h2>
                   </header>
```

```
<section class="about-text">
                        <form action="Post Project.php" method="post" enctype="multipart/form-data">
                           Title Of Project:<br><input type="text" name="projecttitle">
                           Project Instructions:<br><input type="text"</p>
name="project_instructions">
                           Project Tags (Tags should be comma separated):<br><input type="text"</p>
name="Project_Tags"><br>
                           <input type="file" name="fileToUploads[]" id="fileToUpload"</p>
multiple>
                           Assign Users:<br>
                                <select id="assigned_users" name="assigned_users[]" multiple>
                                    <!-- Options will be dynamically populated -->
                               </select>
                           \langle n \rangle
                           <input type="submit" value="Upload" name="submit">
                           </form>
                   </section>
                <?php else: ?>
                   <header>
                       <h2 class="h2 article-title">Error</h2>
                       <div class="separator"></div>
                   </header>
                    <section class="about-text">
                       You must be logged in to view this content. Please <a class="Login-</a>
Signup"
                               href="login.html">Login </a> or <a class="Login-Signup" href="Sign</pre>
Up.html">Sign up</a>
                    </section>
                <?php endif; ?>
            </article>
        </div>
    </main>
    <footer>
        <?php
        $cookie_name = "acceptcoookie";
        if (!isset($_COOKIE[$cookie_name])) {
            // If cookie is not set, display the cookie consent banner
           echo '<div id="cook">
            This website uses cookies to ensure you get the best experience on our website.
<button onclick="acceptCookies()">Got it!</button>
       </div>';
       }
        ?>
        <script>
            // JavaScript code to handle cookie consent banner
            function acceptCookies() {
                // Set cookie
               document.cookie = "acceptcoookie=accepted; expires=<?php echo time() + (86400 * 30);</pre>
?>; path=/";
                // Hide the cookie consent banner
               document.getElementById("cook").style.display = "none";
            }
        </script>
       <script src="theme-settings.js"></script></script></script>
    </footer>
</body>
</html>
```

```
Appendices 8. The Code for Create Project.php.
```

```
fetch_users.php
 <?php
 // Connect to the database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 // Check connection
 if ($mysqli->connect_error) {
     die("Connection failed: " . $mysqli->connect_error);
 }
 // Fetch all usernames from the Users table
 $sq1 = "SELECT Username FROM Users";
 $result = $mysqli->query($sql);
 if ($result->num_rows > 0) {
     $users = [];
     while ($row = $result->fetch_assoc()) {
         $users[] = $row['Username'];
     }
     // Return the usernames as a JSON array
     echo json_encode($users);
 } else {
     echo json_encode([]);
 }
 // Close the database connection
 $mysqli->close();
 2>
```

Appendices 9. The Code for fetch_users.php.

```
Post Project.php
 <?php
 // Connect to the database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 // Check connection
 if ($mysqli->connect_error) {
     die("Connection failed: " . $mysqli->connect_error);
 }
 // Check if user cookie is set
 if (isset($_COOKIE['User'])) {
     $username = $_COOKIE['User']; // Creator's username from the cookie
 } else {
     die("Error: User cookie not set.");
 }
 // Handle form submission
 if ($_SERVER["REQUEST_METHOD"] == "POST") {
     // Retrieve form inputs
     $projectTitle = $_POST['projecttitle'];
     $projectInstructions = $_POST['project_instructions'];
     $projectTags = $_POST['Project_Tags'];
     $assignedUsers = $_POST['assigned_users']; // Retrieve assigned users from the form
     $createdAt = date("Y-m-d H:i:s");
     // Validate inputs
     if (empty($projectTitle)) {
         die("Error: Project title is required.");
     }
     if (empty($_FILES['fileToUploads']['name'][0])) {
         die("Error: At least one file must be uploaded.");
     }
     // Count total images uploaded
     $totalImages = count($_FILES['fileToUploads']['name']);
     // Insert project into the `Project` table
     $stmt = $mysqli->prepare("INSERT INTO Project (idcreator, projecttitle, Total_Images,
 classified_Images, created_at) VALUES (?, ?, ?, 0, ?)");
```

```
$stmt->bind_param("ssis", $username, $projectTitle, $totalImages, $createdAt);
    if (!$stmt->execute()) {
        die("Error inserting project: " . $stmt->error);
    }
    // Get the newly created project ID
    $projectId = $stmt->insert_id;
    $stmt->close();
    // Insert project instructions into the Project table
    $stmt = $mysqli->prepare("UPDATE Project SET project_instructions = ? WHERE idproject = ?");
    $stmt->bind_param("si", $projectInstructions, $projectId);
    if (!$stmt->execute()) {
        die("Error inserting project instructions: " . $stmt->error);
    }
    $stmt->close();
    // Handle tags
    if (!empty($projectTags)) {
    $tags = explode(",", $projectTags); // Split tags by commas
        foreach ($tags as $tag) {
            $tag = trim($tag); // Trim whitespace
            if (!empty($tag)) {
                $stmt = $mysqli->prepare("INSERT INTO ProjectTags (idproject, tag_name) VALUES (?,
?)");
                $stmt->bind_param("is", $projectId, $tag);
                if (!$stmt->execute()) {
                     die("Error inserting tag: " . $stmt->error);
                 $stmt->close();
            }
        }
    }
    // Handle user assignments
    if (!empty($assignedUsers)) { // $assignedUsers is an array of selected usernames
        foreach ($assignedUsers as $assignedUser) {
            $assignedUser = trim($assignedUser);
            // Insert assignment into ProjectAssignments
            $stmt = $mysqli->prepare("INSERT INTO ProjectAssignments (idproject, username) VALUES
(?, ?)");
            $stmt->bind_param("is", $projectId, $assignedUser);
            if (!$stmt->execute()) {
                die("Error assigning user: " . $stmt->error);
            3
            $stmt->close();
        }
    }
    // Handle file uploads
    $folderName = $projectTitle . " - " . $username; // Folder name format: {project title} -
{creator}
    $projectFolder = 'projects/' . $folderName;
    if (!file_exists($projectFolder)) {
        mkdir($projectFolder, 0777, true);
    }
    foreach ($_FILES['fileToUploads']['tmp_name'] as $key => $tmp_name) {
        $fileName = $_FILES['fileToUploads']['name'][$key];
$fileTmp = $_FILES['fileToUploads']['tmp_name'][$key];
        $destination = $projectFolder . '/' . $fileName;
        if (!move_uploaded_file($fileTmp, $destination)) {
            die("Error uploading file: " . $fileName);
        }
        // Insert file information into the `ProjectImages` table
        $stmt = $mysqli->prepare("INSERT INTO ProjectImages (idproject, imageurl, imagetitle) VALUES
(?, ?, ?)");
        $stmt->bind_param("iss", $projectId, $destination, $fileName);
```

```
if (!$stmt->execute()) {
             die("Error inserting project image: " . $stmt->error);
         }
         $stmt->close();
     }
     echo "Project created successfully!";
     header("Location: View Projects.php"); // Redirect to the view projects page
     exit();
 }
 // Close database connection
 $mysqli->close();
 ?>
Appendices 10. The Code for Post Project.php.
View Projects.php
 <!DOCTYPE html>
 <html>
 <head>
     <title>View Projects</title>
     <link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
<link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
 </head>
 <body>
     <main>
         <aside class="sidebar" data-sidebar>
             <div class="sidebar-info">
                 <figure class="avatar-box">
                     <img src="Logos\Logo.png" width="80">
                 </figure>
                 <div class="info-content">
                     <h1 class="name">Galaxify</h1>
                 </div>
             </div>
             <div class="sidebar-info_more">
                 <div class="separator"></div>
                 <nav>
                     <1i>
                             <?php if (isset($_COOKIE['User'])): ?>
                                 <a href="User Page.php">
                                     <?php echo $_COOKIE['User']; ?>
                                 </a>
                             <a href="logout.php">Logout</a>
                         <?php else: ?>
                             <a href="login.html">Login</a>
                             <a href="Sign Up.html">Sign Up</a>
                         <?php endif; ?>
                         </nav>
                 <div class="separator"></div>
                 <nav>
                     <?php if (isset($_COOKIE['User']) && $_COOKIE['Privilege'] == 1): ?>
                             <!-- Check if user is logged in and is an admin -->
                             <a href="Create Project.php">Create Project</a>
                             <a href="Edit Projects.php">Edit project</a>
</or>

                         <?php endif; ?>
                         <a class="active" href="View Projects.php">View Projects</a>
```

```
<a href="archive_view.php">Arcived Projects</a>
```

<div class="separator"></div>

```
<1i>>
                            <a href="#" id="themeToggleBtn">Change Theme V</a>
                           <div id="themeSettingsDropdown" style="display: none; margin-top:</pre>
10px;">
                               <label for="fontSelect" style="font-size: 13px;">Font:</label>
                               <select id="fontSelect">
                                   <option value="'Comic Sans MS', cursive">Comic Sans</option>
                                    <option value="Arial, sans-serif">Arial</option>
                                   <option value="'Courier New', monospace">Courier</option>
                                   <option value="'Times New Roman', serif">Times New
Roman</option>
                               </select>
                               <label for="textSize" style="font-size: 13px;">Text Size:</label>
                               <input type="range" id="textSize" min="12" max="24" value="16"
style="width: 100%;">
                               <label for="themeToggleSwitch" style="font-size: 13px;">Light
Mode:</label>
                               <input type="checkbox" id="themeToggleSwitch">
                            </div>
                       </nav>
            </div>
       </aside>
        <div class="main-content">
            <article class="about active" data-page="about">
               <?php if (isset($_COOKIE['User'])): ?>
                   <?php
                   // Connect to the database
                   $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
                   if ($mysqli->connect_errno) {
                       die("Failed to connect to MySQL: " . $mysqli->connect_error);
                   }
                   if (isset($_GET['archived_success'])) {
                       echo " Project archived successfully.";
                   }
                   // Ensure user is logged in
                   if (!isset($_COOKIE['User']) || !isset($_COOKIE['Privilege'])) {
                       echo "You must be logged in to view this content.";
                       exit();
                   }
                   $username = $_COOKIE['User'];
                   $privilege = $_COOKIE['Privilege']; // Assuming 1 = Admin, 0 = Regular User
                   echo "<header><h2 class='h2 article-title'>Assigned Projects</h2></header>";
                   echo "<section class='about-text'>";
                   // Query to get assigned projects (Exclude archived projects)
                   $assigned_query = "
               SELECT DISTINCT p.idproject, p.projecttitle, p.Total_Images, p.classified_Images,
p.created_at, p.is_archived
               FROM Project p
               INNER JOIN ProjectAssignments pa ON p.idproject = pa.idproject
               WHERE pa.username = ? AND p.is_archived = 0";
```

```
$assigned_stmt = $mysqli->prepare($assigned_query);
                     $assigned_stmt->bind_param("s", $username);
                     $assigned_stmt->execute();
                     $assigned_result = $assigned_stmt->get_result();
                     if ($assigned_result->num_rows > 0) {
                         while ($row = $assigned_result->fetch_assoc()) {
                             $progress = ($row['Total_Images'] > 0)
                                 ? min(round(($row['classified Images'] / $row['Total Images']) *
100, 2), 100) // Ensures it never exceeds 100%
                                 : 0;
                             echo "<div class='project'>";
                             echo "<h3>" . htmlspecialchars($row['projecttitle']) . "</h3>";
                             echo "Created on: " htmlspecialchars(date("F j, Y",
strtotime($row['created_at']))) . "";
                             // Progress bar
                             echo "<div class='progress-bar'>";
                             echo "<div class='progress-bar-inner' style='width:</pre>
{$progress}%;'>{$progress}%</div>";
                             echo "</div>";
                             // Buttons for classification, export, and archive
                             echo "<div class='button-container'>";
                             if ($progress < 100) {</pre>
echo "<a href='classify_images.php?project_id=" .
htmlspecialchars($row['idproject']) . "' class='classify-btn'>Start Classifying</a>";
                             } else if ($row['classified_Images'] == $row['Total_Images'] &&
$row['Total Images'] > 0) {
                                 echo "<form action='export_project.php' method='post'</pre>
style='display:inline;'>";
                                 echo "<input type='hidden' name='project_id' value='" .</pre>
htmlspecialchars($row['idproject']) . "'>";
                                 echo "<button type='submit' class='export-btn'>Export
Data</button>";
                                 echo "</form>";
                             }
                             // Show archive button only for admins when project is complete
                             if ($privilege == 1 && $row['is_archived'] == 0 && $progress == 100) {
                                 echo "<form action='archive_project.php' method='post'";</pre>
                                 echo "<input type='hidden' name='project_id' value='" .</pre>
htmlspecialchars($row['idproject']). "'>";
                                 echo "<button type='submit' class='archive-btn'>Archive
Project</button>";
                                 echo "</form>";
                             }
                             echo "</div>"; // End button container
                             echo "</div>";
                             echo "<div class='separator'></div>";
                         }
                    } else {
                         echo "No projects assigned to you.";
                     }
                    echo "</section>";
                     // If the user is an admin, show all projects excluding archived ones
                     if ($privilege == 1) {
                         echo "<header><h2 class='h2 article-title'>All Projects</h2></header>";
                         echo "<section class='about-text'>";
                         $all_projects_query = "
                    SELECT DISTINCT p.idproject, p.projecttitle, p.Total_Images,
p.classified_Images, p.created_at, p.is_archived
                     FROM Project p
                    LEFT JOIN ProjectAssignments pa ON p.idproject = pa.idproject
                     WHERE p.is_archived = 0
                     AND p.idproject NOT IN (
```

```
SELECT idproject FROM ProjectAssignments WHERE username = ?
                    )":
                        $all_stmt = $mysqli->prepare($all_projects_query);
                        $all_stmt->bind_param("s", $username);
                        $all_stmt->execute();
                        $all_result = $all_stmt->get_result();
                        if ($all result->num rows > 0) {
                             while ($row = $all_result->fetch_assoc()) {
                                 $progress = ($row['Total_Images'] > 0)
                                     ? min(round(($row['classified_Images'] / $row['Total_Images']) *
100, 2), 100)
                                     : 0;
                                 echo "<div class='project'>";
                                 echo "<h3>" . htmlspecialchars($row['projecttitle']) . "</h3>";
                                 echo "Created on: " htmlspecialchars(date("F j, Y",
strtotime($row['created_at']))) . "";
                                 // Progress bar
                                 echo "<div class='progress-bar'>";
                                 echo "<div class='progress-bar-inner' style='width:</pre>
{$progress}%;'>{$progress}%</div>";
                                 echo "</div>";
                                 // Buttons for classification, export, and archive
                                 echo "<div class='button-container'>";
                                 if ($progress < 100) {</pre>
                                     echo "<a href='classify images.php?project id=" .</pre>
htmlspecialchars($row['idproject']) . "' class='classify-btn'>Start Classifying</a>";
                                 } else if ($row['classified_Images'] == $row['Total_Images'] &&
$row['Total_Images'] > 0) {
                                     echo "<form action='export_project.php' method='post'</pre>
style='display:inline;'>";
                                     echo "<input type='hidden' name='project id' value='" .</pre>
htmlspecialchars($row['idproject']) . "'>";
                                     echo "<button type='submit' class='export-btn'>Export
Data</button>";
                                     echo "</form>";
                                 }
                                 // Show archive button only for admins when project is complete
                                 if ($privilege == 1 && $row['is_archived'] == 0 && $progress == 100)
{
                                     echo "<form action='archive_project.php' method='post'</pre>
style='display:inline; margin-left:
                                    10px;'>";
                                     echo "<input type='hidden' name='project id' value='" .</pre>
                                     . "'>":
htmlspecialchars($row['idproject'])
                                     echo "<button type='submit' class='archive-btn'>Archive
Project</button>";
                                     echo "</form>";
                                 }
                                 echo "</div>"; // End button container
                                 echo "</div>";
                                 echo "<div class='separator'></div>";
                            }
                        } else {
                            echo "No projects found.";
                        }
                        echo "</section>";
                    }
                    // Close connections
                    $assigned_stmt->close();
                    if ($privilege == 1) {
                        $all_stmt->close();
```

```
}
                      $mysqli->close();
                      ?>
                  <?php else: ?>
                      <header>
                          <h2 class="h2 article-title">Error</h2>
                          <div class="separator"></div>
                      </header>
                      <section class="about-text">
                          You must be logged in to view this content. Please
                              <a class="Login-Signup" href="login.html">Login</a>
                              or
                              <a class="Login-Signup" href="Sign Up.html">Sign up</a>
                          </section>
                  <?php endif; ?>
              </article>
         </div>
     </main>
     <footer>
         <?php
         $cookie_name = "acceptcoookie";
         if (!isset($_COOKIE[$cookie_name])) {
             echo '<div id="cook">
 This website uses cookies to ensure you get the best experience on our website.
<button onclick="acceptCookies()">Got it!</button>
         </div>';
         }
         ?>
         <script>
             function acceptCookies() {
                  document.cookie = "acceptcoookie=accepted; expires=<?php echo time() + (86400 * 30);</pre>
 ?>; path=/";
                  document.getElementById("cook").style.display = "none";
              }
         </script>
         <script src="theme-settings.js"></script></script></script>
     </footer>
 </body>
 </html>
Appendices 11. The Code for View Projects.php.
classify_images.php
 <!DOCTYPE html>
 <html>
 <head>
     <title>Classify Images</title>
     k rel="icon" type="image/x-icon" href="Logos/favicon.ico">
     <link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
     <script>
         document.addEventListener("DOMContentLoaded", function () {
              // Handle tag button clicks
              const tagButtons = document.querySelectorAll(".tag-button");
              const selectedTagInput = document.getElementById("selected_tag");
              tagButtons.forEach(button => {
                  button.addEventListener("click", function () {
                      // Deselect all buttons
                      tagButtons.forEach(btn => btn.classList.remove("active"));
```

```
// Select the clicked button
                   this.classList.add("active");
                   // Update hidden input value
                   selectedTagInput.value = this.dataset.tag;
               });
           });
           // Handle confidence button clicks
           const confidenceButtons = document.querySelectorAll(".confidence-button");
           const selectedConfidenceInput = document.getElementById("selected_confidence");
           confidenceButtons.forEach(button => {
               button.addEventListener("click", function () {
                   // Deselect all buttons
                   confidenceButtons.forEach(btn => btn.classList.remove("active"));
                   // Select the clicked button
                   this.classList.add("active");
                   // Update hidden input value
                   selectedConfidenceInput.value = this.dataset.confidence;
               });
           });
       });
   </script>
</head>
<body>
   <main>
       <aside class="sidebar" data-sidebar>
           <div class="sidebar-info">
               <figure class="avatar-box">
                   <img src="Logos\Logo.png" width="80">
               </figure>
               <div class="info-content">
                   <h1 class="name">Galaxify</h1>
               </div>
           </div>
           <div class="sidebar-info_more">
               <div class="separator"></div>
               <nav>
                   <?php if (isset($_COOKIE['User'])): ?>
                               <a href="User Page.php">
                                  <?php echo $_COOKIE['User']; ?>
                               </a>
                           <a href="logout.php">Logout</a>
                       <?php else: ?>
                           <a href="login.html">Login</a>
                           <a href="Sign Up.html">Sign Up</a>
                       <?php endif; ?>
                       </nav>
```

```
<div class="separator"></div>
<nav>

        <?php if (isset($_COOKIE['User']) && $_COOKIE['Privilege'] == 1): ?>
        <!-- Check if user is logged in and is an admin -->
        <a href="Create Project.php">Create Project</a>
        <a href="Edit Projects.php">Edit project</a>
        <!-- Display the "Admin" link only for admin users -->
        <?php endif; ?>
        <a href="View Projects.php">View Projects</a>
        <a href="archive_view.php">Arcived Projects</a>
```

```
<div class="separator"></div>
```

```
<1i>>
                             <a href="#" id="themeToggleBtn">Change Theme V</a>
                             <div id="themeSettingsDropdown" style="display: none; margin-top:</pre>
10px;">
                                 <label for="fontSelect" style="font-size: 13px;">Font:</label>
                                 <select id="fontSelect">
                                      <option value="'Comic Sans MS', cursive">Comic Sans</option>
                                      <option value="Arial, sans-serif">Arial</option>
                                      <option value="'Courier New', monospace">Courier</option>
                                      <option value="'Times New Roman', serif">Times New
Roman</option>
                                 </select>
                                 <lpre><label for="textSize" style="font-size: 13px;">Text Size:</label>
<input type="range" id="textSize" min="12" max="24" value="16"</pre>
style="width: 100%;">
                                 <label for="themeToggleSwitch" style="font-size: 13px;">Light
Mode:</label>
                                 <input type="checkbox" id="themeToggleSwitch">
                             </div>
                         </nav>
            </div>
        </aside>
        <div class="main-content">
            <article class="about active" data-page="about">
                 <?php if (isset($_COOKIE['User'])): ?>
                     <?php
                     // Fetch username from cookie
                     $username = $_COOKIE['User'];
                     // Check if project ID is passed
                     if (!isset($_GET['project_id'])) {
                         echo "<h2 class='h2 article-title'>Error</h2>";
                         echo "Project not found. Please go back to the <a href='View
Projects.php'>View Projects</a> page.";
                         exit();
                     }
                     // Connect to the database
                     $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
                     if ($mysqli->connect_errno) {
                         die("Failed to connect to MySQL: " . $mysqli->connect_error);
                     }
                     // Get project information
                     $projectId = $_GET['project_id'];
                     $projectQuery = "SELECT projecttitle FROM Project WHERE idproject = ?";
                    $stmt = $mysqli->prepare($projectQuery);
                     $stmt->bind_param("i", $projectId);
                     $stmt->execute();
                     $projectResult = $stmt->get_result();
                     if ($projectResult->num_rows === 0) {
                         echo "<h2 class='h2 article-title'>Error</h2>";
                         echo "Project not found. Please go back to the <a href='View</pre>
Projects.php'>View Projects</a> page.";
                         exit();
                     }
                     $project = $projectResult->fetch_assoc();
                     $projectTitle = $project['projecttitle'];
```

```
?>
                    <header>
                       <h2 class="h2 article-title"><?php echo htmlspecialchars($projectTitle);
?></h2>
                    </header>
                    <section class="about-text">
                       <?php
                        // Fetch a random image for classification
                       $imageQuery = "
SELECT idimage, imageurl FROM ProjectImages
WHERE idproject = ?
AND idimage NOT IN (SELECT DISTINCT idimage FROM ImageTags)
ORDER BY RAND()
LIMIT 1";
                       $stmt = $mysqli->prepare($imageQuery);
                       $stmt->bind_param("i", $projectId);
                       $stmt->execute();
                       $imageResult = $stmt->get_result();
                       if ($imageResult->num_rows === 0) {
                            echo "✓ All images in this project have been classified!";
                       } else {
                            $image = $imageResult->fetch_assoc();
                            ?>
                            <div class="classify-image">
                                <img src="<?php echo htmlspecialchars($image['imageurl']); ?>"
alt="Image to classify"
                                   class="classify-image-img">
                                <form action="process_classification.php" method="post">
                                    <input type="hidden" name="idimage"</pre>
                                       value="<?php echo htmlspecialchars($image['idimage']); ?>">
                                    <input type="hidden" name="idproject" value="<?php echo</pre>
htmlspecialchars($projectId); ?>">
                                    <!-- Tags & Confidence Levels Selection -->
                                    <label for="tags">Select Tags & Confidence Levels:</label>
                                    <div id="tag-selection-container">
                                        <div class="tag-selection">
                                           <?php
                                               // Fetch available tags for the project
                                               $tagsQuery = "SELECT idtag, tag_name FROM
ProjectTags WHERE idproject = ?";
                                               $stmt = $mysqli->prepare($tagsQuery);
                                               $stmt->bind_param("i", $projectId);
                                               $stmt->execute();
                                               $tagsResult = $stmt->get_result();
                                               if ($tagsResult->num rows > 0) {
                                                   while ($tagRow = $tagsResult->fetch_assoc()) {
                                                       $tagId = htmlspecialchars($tagRow['idtag']);
                                                       $tagName =
htmlspecialchars($tagRow['tag_name']);
                                                       echo "<option
value='$tagId'>$tagName</option>";
                                                   }
                                               }
                                                ?>
                                           </select>
                                           <select name="confidence_levels[]" required>
                                                <option value="">Confidence Level</option>
                                                <?php for ($i = 1; $i <= 5; $i++): ?>
                                                   <option value="<?php echo $i; ?>"><?php echo $i;</pre>
?></option>
                                                <?php endfor; ?>
                                           </select>
```

```
<button type="button" class="remove-tag-</pre>
btn">Remove</button>
                                      </div>
                                  </div>
                                  <!-- Button to add more tag-confidence pairs -->
                                  <button type="button" id="add-tag-btn">+ Add More</button>
                                  <button type="submit" class="submit-classification">Submit
Classification</button>
                              </form>
                          </div>
                          <script>
                              document.addEventListener('DOMContentLoaded', function () {
                                  let tagContainer = document.getElementById('tag-selection-
container');
                                  let addTagBtn = document.getElementById('add-tag-btn');
                                  function updateTagOptions() {
                                      let selectedTags =
Array.from(document.querySelectorAll('.tag-dropdown')).map(select => select.value);
                                      document.guerySelectorAll('.tag-dropdown').forEach(select =>
{
                                          Array.from(select.options).forEach(option => {
                                              if (selectedTags.includes(option.value) &&
option.value !== select.value && option.value !== "") {
                                                 option.disabled = true;
                                              } else {
                                                 option.disabled = false;
                                              }
                                         });
                                      });
                                  }
                                  addTagBtn.addEventListener('click', function () {
                                      let newSelection = document.createElement('div');
                                      newSelection.classList.add('tag-selection');
                                      newSelection.innerHTML =
               <?php
                   $tagsQuery = "SELECT idtag, tag_name FROM ProjectTags WHERE idproject = ?";
                   $stmt = $mysqli->prepare($tagsQuery);
                   $stmt->bind_param("i", $projectId);
                   $stmt->execute();
                   $tagsResult = $stmt->get_result();
                   if ($tagsResult->num_rows > 0) {
                       while ($tagRow = $tagsResult->fetch_assoc()) {
                          $tagId = htmlspecialchars($tagRow['idtag']);
                          $tagName = htmlspecialchars($tagRow['tag_name']);
                          echo "<option value='$tagId'>$tagName</option>";
                       }
                   }
                   ?>
               </select>
               <select name="confidence_levels[]" required>
                   <option value="">Confidence Level</option>
                   <?php endfor; ?>
               </select>
               <button type="button" class="remove-tag-btn">Remove</button>
           ٠,
                                      newSelection.querySelector('.remove-tag-
btn').addEventListener('click', function () {
                                          newSelection.remove();
                                          updateTagOptions();
                                      });
                                      newSelection.querySelector('.tag-
dropdown').addEventListener('change', updateTagOptions);
```

```
tagContainer.appendChild(newSelection);
                                          updateTagOptions();
                                      });
                                      document.querySelectorAll('.remove-tag-btn').forEach(button => {
    button.addEventListener('click', function () {
                                               this.parentElement.remove();
                                              updateTagOptions();
                                          });
                                      });
                                      document.addEventListener('change', function (event) {
                                          if (event.target.classList.contains('tag-dropdown')) {
                                              updateTagOptions();
                                          }
                                      });
                                      updateTagOptions();
                                  });
                              </script>
                              <?php
                         }
                         $stmt->close();
                         $mysqli->close();
                         ?>
                     </section>
                 <?php else: ?>
                     <header>
                         <h2 class="h2 article-title">Error</h2>
                         <div class="separator"></div>
                     </header>
                     <section class="about-text">
                         You must be logged in to view this content. Please <a class="Login-</a>
Signup"
                                  href="login.html">Login</a> or <a class="Login-Signup" href="Sign</pre>
Up.html">Sign up</a>
                     </section>
                 <?php endif; ?>
             </article>
        </div>
    </main>
    <footer>
        <?php
        $cookie_name = "acceptcoookie";
        if (!isset($_COOKIE[$cookie_name])) {
            echo '<div id="cook">
            This website uses cookies to ensure you get the best experience on our website.
<button onclick="acceptCookies()">Got it!</button>
        </div>';
        }
        ?>
        <script>
            function acceptCookies() {
                 document.cookie = "acceptcoookie=accepted; expires=<?php echo time() + (86400 * 30);</pre>
?>; path=/";
                 document.getElementById("cook").style.display = "none";
            }
        </script>
        <script src="theme-settings.js"></script>
    </footer>
</body>
</html>
```

Appendices 12. The Code for classify_images.php.

```
process_classification.php
 <?php
 // Start session and connect to the database
 session_start();
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 // Check connection
 if ($mysqli->connect_errno) {
    die("Connection failed: " . $mysqli->connect_error);
 }
 // Ensure user is logged in
 if (!isset($_COOKIE['User'])) {
     die("Error: You must be logged in to classify images.");
 // Check if the form was submitted
 if ($_SERVER["REQUEST_METHOD"] == "POST") {
     $idimage = intval($_POST['idimage']);
     $idproject = intval($_POST['idproject']);
     $tags = $_POST['tags']; // Array of selected tag IDs
     $confidence_levels = $_POST['confidence_levels']; // Array of confidence levels
     // Ensure tags and confidence levels are arrays and have the same length
     if (empty($tags) || empty($confidence_levels) || count($tags) !== count($confidence_levels)) {
         die("Error: Invalid submission. Ensure each tag has a confidence level.");
     }
     // Insert each tag-confidence pair into ImageTags table
     foreach ($tags as $index => $idtag) {
         $confidence_level = intval($confidence_levels[$index]);
         // Validate inputs
         if ($confidence_level < 1 || $confidence_level > 5) {
              die("Error: Invalid confidence level.");
         }
         // Insert classification into ImageTags table
         $query = "INSERT INTO ImageTags (idimage, idtag, confidence_level) VALUES (?, ?, ?)";
         $stmt = $mysqli->prepare($query);
         $stmt->bind_param("iii", $idimage, $idtag, $confidence_level);
if (!$stmt->execute()) {
             die("Error inserting classification: " . $stmt->error);
         $stmt->close();
     }
     // Update the classified Images count in the Project table
     $updateProjectQuery = "UPDATE Project SET classified_Images = classified_Images + 1 WHERE
 idproject = ?";
     $stmt = $mysqli->prepare($updateProjectQuery);
     $stmt->bind_param("i", $idproject);
     if (!$stmt->execute()) {
         die("Error updating project classification count: " . $stmt->error);
     $stmt->close();
     // Redirect back to classification page for another image
     header("Location: classify_images.php?project_id=" . $idproject);
     exit();
 }
 // Close the database connection
 $mysqli->close();
 ?>
```

```
Appendices 13. The Code for process_classification.php.
```

```
export_project.php
 <?php
 // Connect to the database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 if ($mysqli->connect_errno) {
     die("Failed to connect to MySQL: " . $mysqli->connect_error);
 }
 // Ensure project ID is provided
 if (!isset($_POST['project_id']) || empty($_POST['project_id'])) {
     die("Error: Project ID is missing.");
 $project_id = intval($_POST['project_id']);
 // Fetch project details
 $projectQuery = "SELECT projecttitle FROM Project WHERE idproject = ?";
 $stmt = $mysqli->prepare($projectQuery);
 $stmt->bind_param("i", $project_id);
 $stmt->execute();
 $projectResult = $stmt->get_result();
 $project = $projectResult->fetch_assoc();
 if (!$project) {
     die("Error: Project not found.");
 }
 $projectTitle = str_replace(" ", "_", $project['projecttitle']); // Ensure safe filename
 // Fetch image classifications for this project
 $imageQuery =
 SELECT pi.imageurl, pt.tag_name, it.confidence_level
 FROM ProjectImages pi
 LEFT JOIN ImageTags it ON pi.idimage = it.idimage
 LEFT JOIN ProjectTags pt ON it.idtag = pt.idtag
 WHERE pi.idproject = ?";
 $stmt = $mysqli->prepare($imageQuery);
 $stmt->bind_param("i", $project_id);
 $stmt->execute();
 $imageResult = $stmt->get_result();
 // Set headers for CSV download
 header('Content-Type: text/csv; charset=utf-8');
 header("Content-Disposition: attachment; filename={$projectTitle}_Export.csv");
 // Open output stream
 $output = fopen('php://output', 'w');
 // Set column headers
 fputcsv($output, ['Image URL', 'Tag', 'Confidence Level']);
 // Write data rows
 while ($data = $imageResult->fetch assoc()) {
     fputcsv($output, [$data['imageurl'], $data['tag_name'], $data['confidence_level']]);
 }
 // Close database connection
 fclose($output);
 $stmt->close();
 $mysqli->close();
 exit();
 ?>
Appendices 14. The Code for export_project.php.
```

```
<link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
    k rel="stylesheet" href="style.css" type="text/css" media="screen, projection" />
</head>
<body>
    <main>
       <aside class="sidebar" data-sidebar>
            <div class="sidebar-info">
                <figure class="avatar-box">
                   <img src="Logos\Logo.png" width="80">
                </figure>
                <div class="info-content">
                   <h1 class="name">Galaxify</h1>
                </div>
            </div>
            <div class="sidebar-info more">
                <div class="separator"></div>
                <nav>
                   <?php if (isset($_COOKIE['User'])): ?>
                                <a href="User Page.php">
                                   <?php echo $_COOKIE['User']; ?>
                               </a>
                            <a href="logout.php">Logout</a>
                       <?php else: ?>
                           <a href="login.html">Login</a>
                           <a href="Sign Up.html">Sign Up</a>
                        <?php endif; ?>
                       </nav>
                <div class="separator"></div>
                <nav>
                   <?php if (isset($_COOKIE['User']) && $_COOKIE['Privilege'] == 1): ?>
                           <!-- Check if user is logged in and is an admin -->
                           <a href="Create Project.php">Create Project</a>
                           <a class="active" href="Edit Projects.php">Edit project</a>
                           <!-- Display the "Admin" link only for admin users -->
                       <?php endif; ?>
                       <a href="View Projects.php">View Projects</a>
                       <a href="archive_view.php">Arcived Projects</a>
                       <div class="separator"></div>
                       <a href="#" id="themeToggleBtn">Change Theme V</a>
                           <div id="themeSettingsDropdown" style="display: none; margin-top:</pre>
10px;">
                                <label for="fontSelect" style="font-size: 13px;">Font:</label>
                                <select id="fontSelect">
                                    <option value="'Comic Sans MS', cursive">Comic Sans</option>
                                    <option value="Arial, sans-serif">Arial</option>
                                    <option value="'Courier New', monospace">Courier</option>
                                    <option value="'Times New Roman', serif">Times New
Roman</option>
                                </select>
                               <lpre><label for="textSize" style="font-size: 13px;">Text Size:</label>
<input type="range" id="textSize" min="12" max="24" value="16"</pre>
style="width: 100%;">
                               <label for="themeToggleSwitch" style="font-size: 13px;">Light
Mode:</label>
                                <input type="checkbox" id="themeToggleSwitch">
                           </div>
```
</div>

```
</aside>
        <div class="main-content">
            <article class="about active" data-page="about">
                <?php if (isset($_COOKIE['User'])): ?>
                    <?php
                    // Connect to the database
                    $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
                    if ($mysqli->connect_errno) {
                        die("Failed to connect to MySQL: " . $mysqli->connect_error);
                    }
                    // Ensure the user is logged in and is an admin
                    if (!isset($_COOKIE['User']) || !isset($_COOKIE['Privilege']) ||
$_COOKIE['Privilege'] != 1) {
                        die("Access Denied: Admins only.");
                    }
                    // Query to fetch all active projects (not archived)
                    $projects_query = "SELECT idproject, projecttitle, project_instructions FROM
Project WHERE is_archived = 0";
                    $projects_result = $mysqli->query($projects_query);
                    // Check if the query executed properly
                    if (!$projects_result) {
                        die("Error fetching projects: " . $mysqli->error);
                    }
                    2>
                    <header>
                        <h2 class="h2 article-title">Edit Projects</h2>
                    </header>
                    <section class="about-text">
                        <?php while ($row = $projects_result->fetch_assoc()): ?>
                            <div class='project'>
                                <h3><?php echo htmlspecialchars($row['projecttitle']); ?></h3>
                                Instructions: <?php echo
htmlspecialchars($row['project_instructions']); ?>
                                <a href='Edit Project Form.php?project_id=<?php echo</pre>
htmlspecialchars($row['idproject']); ?>'
                                    class='edit-btn'>Edit Project</a>
                            </div>
                            <div class='separator'></div>
                        <?php endwhile; ?>
                    <?php else: ?>
```

```
<header>
<header>
<header>
<header>
<header>
<header>
<header>
<header>
<header>
<section class="separator"></div>
</header>
<section class="about-text">
You must be logged in to view this content. Please
<a class="Login-Signup" href="login.html">Login</a>
or
<a class="Login-Signup" href="login.html">Sign up</a>

</section>
```

```
<?php endif; ?>
              </article>
          </div>
     </main>
     <footer>
          <?php
          $cookie name = "acceptcoookie";
          if (!isset($_COOKIE[$cookie_name])) {
              echo '<div id="cook">
              This website uses cookies to ensure you get the best experience on our website.
 <button onclick="acceptCookies()">Got it!</button>
          </div>';
          }
          ?>
          <script>
              function acceptCookies() {
                  document.cookie = "acceptcoookie=accepted; expires=<?php echo time() + (86400 * 30);</pre>
 ?>; path=/";
                  document.getElementById("cook").style.display = "none";
              }
          </script>
          <script src="theme-settings.js"></script>
      </footer>
 </body>
 </html>
Appendices 15. The Code for Edit Projects.php.
Edit Project Form.php
 <!DOCTYPE html>
 <html>
 <head>
      <title>Editing Project</title>
     <link rel="icon" type="image/x-icon" href="Logos/favicon.ico">
<link rel="stylesheet" href="style.css" type="text/css" media="screen,projection" />
     <script>
          document.addEventListener("DOMContentLoaded", function () {
              const removedImagesInput = document.getElementById("removed_images");
              document.querySelectorAll(".remove-image-btn").forEach(button => {
                  button.addEventListener("click", function () {
                       const imageId = this.getAttribute("data-id");
                       const imageRow = document.getElementById("image-" + imageId);
                       if (imageRow) {
                           imageRow.remove(); // Remove image from the page
                           // Track removed images in hidden input
                           let removedImages = removedImagesInput.value ?
 removedImagesInput.value.split(",") : [];
                           removedImages.push(imageId);
                           removedImagesInput.value = removedImages.join(",");
                       }
                  });
             });
         });
     </script>
      <script>
          document.addEventListener("DOMContentLoaded", function () {
    var selectBox = document.getElementById("assigned_users");
              if (selectBox) {
                  for (let i = 0; i < selectBox.options.length; i++) {</pre>
                       selectBox.options[i].addEventListener("mousedown", function (event) {
```

```
event.preventDefault(); // Prevent default selection behavior
                      this.selected = !this.selected; // Toggle selection
                      return false;
                  });
              }
           }
       });
   </script>
</head>
<body>
    <main>
       <aside class="sidebar" data-sidebar>
           <div class="sidebar-info">
               <figure class="avatar-box">
                   <img src="Logos\Logo.png" width="80">
               </figure>
               <div class="info-content">
                   <h1 class="name">Galaxify</h1>
               </div>
           </div>
           <div class="sidebar-info_more">
               <div class="separator"></div>
               <nav>
                   <?php if (isset($_COOKIE['User'])): ?>
                              <a href="User Page.php">
                                 <?php echo $_COOKIE['User']; ?>
                              </a>
                          <a href="logout.php">Logout</a>
                      <?php else: ?>
                          <a href="login.html">Login</a>
                          <a href="Sign Up.html">Sign Up</a>
                      <?php endif; ?>
                      </nav>
               <div class="separator"></div>
               <nav>
                   <?php if (isset($ COOKIE['User']) && $ COOKIE['Privilege'] == 1): ?>
                          <!-- Check if user is logged in and is an admin -->
                          <a href="Create Project.php">Create Project</a>
                          <a class="active" href="Edit Projects.php">Edit project</a>
                          <!-- Display the "Admin" link only for admin users -->
                      <?php endif; ?>
                      <a href="View Projects.php">View Projects</a>
                      <a href="archive_view.php">Arcived Projects</a>
                      <div class="separator"></div>
                      <1i>>
                          <a href="#" id="themeToggleBtn">Change Theme \</a>
                          <div id="themeSettingsDropdown" style="display: none; margin-top:</pre>
10px;">
                              <label for="fontSelect" style="font-size: 13px;">Font:</label>
                              <select id="fontSelect">
                                  <option value="'Comic Sans MS', cursive">Comic Sans</option>
                                  <option value="Arial, sans-serif">Arial</option>
                                  <option value="'Courier New', monospace">Courier</option>
                                  <option value="'Times New Roman', serif">Times New
Roman</option>
                              </select>
```

```
75
```

```
<label for="textSize" style="font-size: 13px;">Text Size:</label>
                                 <input type="range" id="textSize" min="12" max="24" value="16"</pre>
style="width: 100%;">
                                 <label for="themeToggleSwitch" style="font-size: 13px;">Light
Mode:</label>
                                 <input type="checkbox" id="themeToggleSwitch">
                             </div>
                        </nav>
            </div>
        </aside>
        <div class="main-content">
            <article class="about active" data-page="about">
                <?php if (isset($_COOKIE['User'])): ?>
                    <?php
                    // Connect to the database
                    $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
                    if ($mysqli->connect_errno) {
                        die("Failed to connect to MySQL: " . $mysqli->connect_error);
                    }
                    // Ensure the user is logged in and is an admin
                    if (!isset($_COOKIE['User']) || !isset($_COOKIE['Privilege']) ||
$_COOKIE['Privilege'] != 1) {
                        die("Access Denied: Admins only.");
                    }
                    // Ensure project ID is provided and valid
                    if (!isset($_GET['project_id']) || !is_numeric($_GET['project_id'])) {
                        die("Error: Project ID is missing or invalid.");
                    $project_id = intval($_GET['project_id']);
                    // Fetch project details
                    $project_query = "SELECT projecttitle, project_instructions FROM Project WHERE
idproject = ?";
                    $stmt = $mysqli->prepare($project_query);
                    $stmt->bind_param("i", $project_id);
                    $stmt->execute();
                    $project_result = $stmt->get_result();
$project = $project_result->fetch_assoc();
                    if (!$project) {
                        die("Error: Project not found.");
                    }
                    // Fetch assigned users
                    $assigned_users_query = "SELECT username FROM ProjectAssignments WHERE idproject
= ?";
                    $stmt = $mysqli->prepare($assigned_users_query);
                    $stmt->bind_param("i", $project_id);
                    $stmt->execute();
                    $assigned_users_result = $stmt->get_result();
                    $assigned_users = [];
                    while ($row = $assigned_users_result->fetch_assoc()) {
                        $assigned_users[] = $row['username'];
                    $stmt->close();
                    ?>
                    <header>
                        <h2 class="h2 article-title">Edit Project</h2>
```

<th>ider></th>	ider>	
<sect< th=""><th>ion class="about-text"> form action="update_project.php" method="post" enctype="multipart/form-</th></sect<>	ion class="about-text"> form action="update_project.php" method="post" enctype="multipart/form-	
data">	<input name="project_id" type="hidden" value="<?php echo \$project_id;</th></tr><tr><td>?>"/> <td>Title: input type="text" name="projecttitle" value="<?php echo htmlspecialchars(\$project['projecttitle']);</p></td>	Title: input type="text" name="projecttitle" value=" php echo htmlspecialchars(\$project['projecttitle']);</p
?>">	<pre> input type="text" name="project_instructions"</pre>	
htmlspecialchars(\$project	<pre>value="<?php echo :['project_instructions']); ?>"> </pre>	
28.	Tags (comma separated): input type="text" name="Project_Tags" value=" php \$tags_query = "SELECT tag_name FROM ProjectTags WHERE idproject = </p	
ſ;	<pre>\$stmt = \$mysqli->prepare(\$tags_query); \$stmt->bind_param("i", \$project_id); \$stmt->execute();</pre>	
	<pre>\$tags_result = \$stmt->get_result(); \$tags = []; while (\$tag = \$tags_result->fetch_assoc()) { \$tags[] = \$tag['tag_name']; }</pre>	
	<pre>} echo implode(", ", \$tags); ?>"> </pre>	
	Existing Images: <div id="image-container"> <?php \$images query = "SELECT idimage, imageurl FROM ProjectImages WHERE"</td></div>	
<pre>idproject = ?";</pre>	<pre>\$stmt = \$mysqli->prepare(\$images_query); \$stmt->bind_param("i", \$project_id); \$stmt->execute(); \$images_result = \$stmt->get_result(); while (\$image = \$images_result->fetch_assoc()): ?></pre>	
?>">	<pre><div class="image-row" id="image-<?php echo \$image['idimage'];</td></tr><tr><td><pre>?>" width="100"></div></pre>	<pre><button <="" class="remove-image-btn" td="" type="button"></button></pre>
	Hidden input to track removed images <input id="removed_images" name="removed_images" type="hidden" value=""/>	
	Add New Images: input type="file" name="fileToUploads[]" multiple>	
	Assign/Unassign Users: <select id="assigned_users" multiple="" name="assigned_users[]"></select>	
	<pre><?php // Fetch all users \$users_query = "SELECT Username FROM Users"; \$users_result = \$mysqli->query(\$users_query);</pre>	
	<pre>// Fetch assigned users again to ensure correct highlighting \$assigned_users_query = "SELECT username FROM ProjectAssignments</pre>	
WHERE IUPROJECT = ?";	<pre>\$stmt = \$mysqli->prepare(\$assigned_users_query); \$stmt->bind_param("i", \$project_id);</pre>	

```
$stmt->execute();
                                    $assigned_users_result = $stmt->get_result();
                                    $assigned_users = [];
                                    while ($row = $assigned_users_result->fetch_assoc()) {
                                        $assigned_users[] = $row['username'];
                                    }
                                    $stmt->close();
                                    while ($user = $users_result->fetch_assoc()):
                                        ?>
                                        <option value="<?php echo $user['Username']; ?>" <?php echo</pre>
(in_array($user['Username'], $assigned_users)) ? 'selected' : ''; ?>>
                                            <?php echo $user['Username']; ?>
                                        </option>
                                    <?php endwhile; ?>
                                </select>
                            <input type="submit" value="Update Project">
                        </form>
                    </section>
                    <?php
                    $mysqli->close();
                    ?>
                </article>
            </div>
        </main>
        <footer>
            <?php
            $cookie_name = "acceptcoookie";
            if (!isset($_COOKIE[$cookie_name])) {
                echo '<div id="cook">
            This website uses cookies to ensure you get the best experience on our website.
<button onclick="acceptCookies()">Got it!</button>
        </div>';
            }
            ?>
        <?php else: ?>
            <header>
                <h2 class="h2 article-title">Error</h2>
                <div class="separator"></div>
            </header>
            <section class="about-text">
                You must be logged in to view this content. Please
                    <a class="Login-Signup" href="login.html">Login</a>
                    or
                    <a class="Login-Signup" href="Sign Up.html">Sign up</a>
                </section>
        <?php endif; ?>
        <script>
            function acceptCookies() {
                document.cookie = "acceptcoookie=accepted; expires=<?php echo time() + (86400 * 30);</pre>
?>; path=/";
                document.getElementById("cook").style.display = "none";
            }
        </script>
<script src="theme-settings.js"></script>
    </footer>
```

```
</body>
```

</html>

Appendices 16. The Code for Edit Project Form.php.

```
update project.php
 <?php
 // Connect to the database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 if ($mysqli->connect_errno) {
     die("Failed to connect to MySQL: " . $mysqli->connect_error);
 3
 // Ensure request is POST
 if ($_SERVER["REQUEST_METHOD"] != "POST") {
     die("Invalid request.");
 // Get project ID
 if (!isset($_POST['project_id']) || !is_numeric($_POST['project_id'])) {
     die("Error: Project ID is missing or invalid.");
 $project_id = intval($_POST['project_id']);
 // Fetch current classified images count
 $get_project_data_query = "SELECT classified_Images, Total_Images FROM Project WHERE idproject = ?";
 $stmt = $mysqli->prepare($get_project_data_query);
 $stmt->bind_param("i", $project_id);
 $stmt->execute();
 $stmt->bind_result($classified_count, $total_images);
 $stmt->fetch();
 $stmt->close();
 // Track how many images were removed
 $removed_images_count = 0;
 $new_images_added = false; // Track if new images were added
 // Handle removed images
 if (!empty(_POST['removed_images'])) {
    $removed_images = explode(',', $_POST['removed_images']);
    foreach ($removed_images as $image_id) {
          if (is_numeric($image_id)) {
              // Get image path before deletion
              $get_image_query = "SELECT imageurl FROM ProjectImages WHERE idimage = ?";
              $stmt = $mysqli->prepare($get_image_query);
              $stmt->bind_param("i", $image_id);
              $stmt->execute();
              $stmt->bind_result($image_path);
              $stmt->fetch();
              $stmt->close();
              // Delete the image file from storage
              if (!empty($image_path) && file_exists($image_path)) {
                  unlink($image_path);
              }
              // Delete from database
              $delete_image_query = "DELETE FROM ProjectImages WHERE idimage = ? AND idproject = ?";
              $stmt = $mysqli->prepare($delete_image_query);
              $stmt->bind_param("ii", $image_id, $project_id);
              $stmt->execute();
              $stmt->close();
         }
     }
 }
 // Handle new image uploads
 $added images count = 0;
 if (lempty($_FILES['fileToUploads']['name'][0])) {
     $target_dir = "projects/{$project_id}/"; // Store images in a project-specific folder
     // Create the project folder if it doesn't exist
```

```
if (!file_exists($target_dir)) {
        mkdir($target_dir, 0777, true);
    }
    foreach ($_FILES["fileToUploads"]["tmp_name"] as $key => $tmp_name) {
        $file_name = basename($_FILES["fileToUploads"]["name"][$key]);
        $file_tmp = $_FILES["fileToUploads"]["tmp_name"][$key];
$file_size = $_FILES["fileToUploads"]["size"][$key];
        $file_type = strtolower(pathinfo($file_name, PATHINFO_EXTENSION));
        // Validate file type (PNG, JPG, JPEG, GIF)
        $allowed_types = array("jpg", "jpeg", "png", "gif");
        if (!in_array($file_type, $allowed_types)) {
            continue; // Skip invalid files
        }
        // Generate a unique file name
        $new_file_name = unique ide name;
$target_file = $target_dir . $new_file_name;
        // Move file to the project folder
        if (move_uploaded_file($file_tmp, $target_file)) {
            // Insert image into database
            $insert image query = "INSERT INTO ProjectImages (idproject, imageurl) VALUES (?, ?)";
            $stmt = $mysqli->prepare($insert_image_query);
            $stmt->bind_param("is", $project_id, $target_file);
            if (!$stmt->execute()) {
                echo "Error inserting image: " . $stmt->error; // Debugging output
            }
            $stmt->close();
            $new_images_added = true; // Flag that new images were added
            $added_images_count++;
        } else {
            echo "Error: Failed to upload file - $file name"; // Debugging output
        }
    }
// Determine new classified count:
if ($new_images_added) {
    // If new images were added, reset classified_Images to (Total Images - Unclassified Images)
    $new_classified_count = max(0, $classified_count - $removed_images_count);
} else {
    // Otherwise, keep classified_Images adjusted
    $new_classified_count = max(0, min($classified_count, $total_images - $removed_images_count));
// Update classified_Images and Total_Images in Project table
$update_classified_count_query =
    UPDATE Project
    SET classified_Images = ?,
        Total_Images = (SELECT COUNT(*) FROM ProjectImages WHERE idproject = ?)
    WHERE idproject = ?";
$stmt = $mysqli->prepare($update_classified_count_query);
$stmt->bind_param("iii", $new_classified_count, $project_id, $project_id);
$stmt->execute();
$stmt->close();
// Handle Assigning & Unassigning Users
if (isset($_POST['assigned_users'])) {
    $new_assigned_users = $_POST['assigned_users'];
    // Get current assigned users
    $existing_users = [];
    $get_existing_users_query = "SELECT username FROM ProjectAssignments WHERE idproject = ?";
    $stmt = $mysqli->prepare($get_existing_users_query);
    $stmt->bind_param("i", $project_id);
    $stmt->execute();
    $result = $stmt->get_result();
    while ($row = $result->fetch_assoc()) {
        $existing_users[] = $row['username'];
    }
```

}

}

```
$stmt->close();
    // Remove unselected users
    foreach ($existing_users as $user) {
        if (!in_array($user, $new_assigned_users)) {
            $delete_user_query = "DELETE FROM ProjectAssignments WHERE idproject = ? AND username =
?";
            $stmt = $mysqli->prepare($delete_user_query);
            $stmt->bind_param("is", $project_id, $user);
            $stmt->execute();
            $stmt->close();
        }
    }
    // Add newly assigned users
    foreach ($new_assigned_users as $user) {
        if (!in_array($user, $existing_users)) {
            $insert_user_query = "INSERT INTO ProjectAssignments (idproject, username) VALUES (?,
?)";
            $stmt = $mysqli->prepare($insert_user_query);
            $stmt->bind_param("is", $project_id, $user);
            $stmt->execute();
            $stmt->close();
        }
    }
} else {
    \ensuremath{/\!/} If no users are selected, remove all assignments
    $delete_all_users_query = "DELETE FROM ProjectAssignments WHERE idproject = ?";
    $stmt = $mysqli->prepare($delete_all_users_query);
    $stmt->bind_param("i", $project_id);
    $stmt->execute();
    $stmt->close();
}
// Update project title and instructions
if (isset($_POST['projecttitle']) && isset($_POST['project_instructions'])) {
    $title = $_POST['projecttitle'];
    $instructions = $_POST['project_instructions'];
    $stmt = $mysqli->prepare("UPDATE Project SET projecttitle = ?, project_instructions = ? WHERE
idproject = ?");
    $stmt->bind_param("ssi", $title, $instructions, $project_id);
    $stmt->execute();
    $stmt->close();
}
// Update tags
if (isset($_POST['Project_Tags'])) {
    // First, clear old tags
    $stmt = $mysqli->prepare("DELETE FROM ProjectTags WHERE idproject = ?");
    $stmt->bind_param("i", $project_id);
    $stmt->execute();
    $stmt->close();
    // Insert new tags
$tags = explode(",", $_POST['Project_Tags']);
    foreach ($tags as $tag) {
        $tag = trim($tag);
        if (!empty($tag)) {
            $stmt = $mysqli->prepare("INSERT INTO ProjectTags (idproject, tag_name) VALUES (?, ?)");
            $stmt->bind_param("is", $project_id, $tag);
            $stmt->execute();
            $stmt->close();
        }
   }
}
// Redirect back to View Projects
header("Location: View Projects.php?success=1");
exit();
$mysqli->close();
?>
```

Appendices 17. The Code for update_project.php.

```
archive_project.php
 <?php
 // Connect to the database
 $mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
 // Check connection
 if ($mysqli->connect_errno) {
     die("Failed to connect to MySQL: " . $mysqli->connect_error);
 }
 // Only allow POST requests and check for valid project ID
 if ($_SERVER['REQUEST_METHOD'] === 'POST' && isset($_POST['project_id']) &&
 is_numeric($_POST['project_id'])) {
     $project_id = intval($_POST['project_id']);
     // Ensure user is admin
     if (!isset($_COOKIE['Privilege']) || $_COOKIE['Privilege'] != 1) {
         die("Access denied. Admins only.");
     }
     // Archive the project by setting is_archived to 1
     $stmt = $mysqli->prepare("UPDATE Project SET is_archived = 1 WHERE idproject = ?");
     $stmt->bind_param("i", $project_id);
     if ($stmt->execute()) {
         $stmt->close();
         $mysqli->close();
         header("Location: View Projects.php?archived_success=1");
         exit();
     } else {
         echo "Failed to archive project: " . $stmt->error;
         $stmt->close();
     }
 } else {
     echo "Invalid request.";
 }
 $mysqli->close();
 ?>
```

Appendices 18. The Code for archive_project.php.

```
archive_view.php
<?php
// Connect to the database
$mysqli = new mysqli("localhost", "root", "", "artifactdatabase");
// Check connection
if ($mysqli->connect_errno) {
    die("Failed to connect to MySQL: " . $mysqli->connect_error);
}
// Only allow POST requests and check for valid project ID
if ($_SERVER['REQUEST_METHOD'] === 'POST' && isset($_POST['project_id']) &&
is_numeric($_POST['project_id'])) {
    $project_id = intval($_POST['project_id']);
}
```

```
// Ensure user is admin
     if (!isset($_COOKIE['Privilege']) || $_COOKIE['Privilege'] != 1) {
         die("Access denied. Admins only.");
     }
     // Archive the project by setting is_archived to 1
     $stmt = $mysqli->prepare("UPDATE Project SET is_archived = 1 WHERE idproject = ?");
     $stmt->bind_param("i", $project_id);
     if ($stmt->execute()) {
         $stmt->close();
         $mysqli->close();
         header("Location: View Projects.php?archived_success=1");
         exit();
     } else {
         echo "Failed to archive project: " . $stmt->error;
         $stmt->close();
     }
 } else {
     echo "Invalid request.";
 }
 $mysqli->close();
 ?>
Appendices 19. The Code for archive_view.php.
theme-settings.js
 document.addEventListener("DOMContentLoaded", function () {
    const themeBtn = document.getElementById("themeToggleBtn");
     const dropdown = document.getElementById("themeSettingsDropdown");
     const fontSelect = document.getElementById("fontSelect");
     const textSize = document.getElementById("textSize");
     const themeToggleSwitch = document.getElementById("themeToggleSwitch");
     if (localStorage.getItem("lightMode") === "true") {
       enableLightMode();
       if (themeToggleSwitch) themeToggleSwitch.checked = true;
     }
     if (themeBtn && dropdown) {
       themeBtn.addEventListener("click", function (e) {
         e.preventDefault();
         dropdown.style.display = dropdown.style.display === "none" ? "block" : "none";
    a
});
}
```

```
if (fontSelect) {
    fontSelect.addEventListener("change", function () {
      document.body.style.fontFamily = this.value;
    });
  }
  if (textSize) {
    textSize.addEventListener("input", function () {
      document.body.style.fontSize = this.value + "px";
    });
  }
  if (themeToggleSwitch) {
    themeToggleSwitch.addEventListener("change", function () {
      if (this.checked) {
         enableLightMode();
         localStorage.setItem("lightMode", "true");
      } else {
         localStorage.setItem("lightMode", "false");
         location.reload();
      }
    });
  }
  function enableLightMode() {
    document.body.style.background = "#ededed";
    document.body.style.color = "black";
document.querySelectorAll(".sidebar, article, nav a, #cook, .about form").forEach((el) => {
      el.style.background = "#e0e0e1";
      el.style.color = "black";
el.style.border = "1px solid #c1c1c1";
    });
  }
});
```

```
Appendices 20. The Code for theme-settings.js.
```

```
style.css
 /* General Styles */
 body {
   background: hsl(0, 0%, 7%);
   /* Smoky black */
   color: white;
   /* Set text color to white */
   font-family: Comic Sans MS, cursive;
 }
 /* Sidebar and Article Styles */
 .sidebar {
   background: hsl(240, 2%, 12%);
   /* Eerie black 2 */
   border: 1px solid hsl(0, 0%, 22%);
   /* Jet */
   border-radius: 20px;
   padding: 20px;
   /* Adjusted fixed padding */
   box-shadow: var(--shadow-1);
   z-index: 1;
   width: 250px;
   height: 20%;
 }
 article {
```

```
background: hsl(240, 2%, 12%);
/* Eerie black 2 */
border: 1px solid hsl(0, 0%, 22%);
/* Jet */
```

```
border-radius: 20px;
  padding: 0.2% 2% 3% 2%;
  /* Adjusted padding */
  box-shadow: var(--shadow-1);
  z-index: 1;
 display: flex;
flex-direction: column;
}
/* Separator Styles */
.separator {
  width: 100%;
  height: 1px;
  background: hsl(0, 0%, 22%);
  /* Jet */
  margin-bottom: 16px;
}
/* Navigation Styles */
nav {
 margin-top: 16px;
}
nav a {
 color: white;
  /* Set link color */
  text-decoration: none;
  /* Remove underline */
  padding: 8px 16px;
  /* Add padding for better spacing */
border-radius: 8px;
  /* Add border radius for rounded corners */
  background-color: hsl(240, 1%, 17%);
  /* Set background color */
  transition: background-color 0.3s ease;
  /* Add transition for smooth hover effect */
}
nav a:hover {
  background-color: hsl(240, 1%, 25%);
  /* Darken background color on hover */
}
nav a.active {
 background-color: #593d8d;
}
nav ul.contacts-list li {
  margin-bottom: 15%;
  /* Adjust the margin as needed */
}
/* Main Content Styles */
main {
  max-width: 1200px;
  margin: 0 auto;
  display: flex;
  justify-content: center;
  align-items: stretch;
  gap: 25px;
}
.main-content {
  width: 75%;
  height: auto;
}
/* Logo Styles */
.avatar-box {
  display: flex;
  justify-content: center;
  align-items: center;
  margin-bottom: 20px;
  /* Adjust margin as needed */
```

```
}
.avatar-box img {
 width: 160px;
  /* Adjust the width of the logo */
 height: auto;
 /* Maintain aspect ratio */
}
/* Form Styles */
.about form {
 background-color: hsl(240, 1%, 17%);
  padding: 2%;
  border-radius: 10px;
 z-index: 1;
}
.about form label {
 font-weight: bold;
  /*
 display: block;
 margin-bottom: 8px;
  */
}
input {
 width: 70%;
  padding: 10px;
 margin-top: 4px;
  border: 1px solid hsl(0, 0%, 22%);
  border-radius: 4px;
 box-sizing: border-box;
 color: rgb(0, 0, 0);
}
.about form input[type="submit"] {
 width: 20%;
  padding: 12px;
  background-color: #744CBC;
  color: white;
 border: none;
 border-radius: 4px;
 cursor: pointer;
 display: inline-block;
}
.about form input[type="submit"]:hover {
 background-color: #593d8d;
}
.Login-Signup {
 color: #744CBC
}
/* Delete button styling */
#deleteButton {
 width: 20%;
  padding: 12px;
  background-color: #ff3333;
  color: white;
  border: none;
  border-radius: 4px;
  cursor: pointer;
  display: inline-block;
 text-align: center;
}
#deleteButton :hover {
 background-color: #b82626;
```

```
}
```

```
/* Error message styles */
#E1,
#E2,
#E3,
#E4,
.error-message {
 color: #ff0000;
 font-size: 14px;
}
/* Album Styling */
.small-text {
 font-size: 14px;
}
/* Album Styling */
.album {
 margin-bottom: 20px;
 position: relative;
}
/* Styling for album images */
.image-container {
 position: relative;
  display: inline-block;
 max-width: 100%;
 text-align: center;
}
.image-container img {
 max-width: 100%;
  max-height: 300px;
 height: auto;
 display: block;
  margin: 0 auto;
}
/* Styling for navigation buttons */
.prev-btn,
.next-btn {
 position: absolute;
  top: 50%;
 transform: translateY(-50%);
 background-color: #c4c4cfb0;
 color: white;
 border: none;
  cursor: pointer;
 border-radius: 20px;
 z-index: 1;
}
.prev-btn {
 left: 0;
}
.next-btn {
 right: 0;
}
.prev-btn:hover,
.next-btn:hover {
 background-color: #88888fb0;
}
.button-container {
 display: inline-block;
  margin-bottom: 10px;
}
.button-container form {
 display: inline;
```

```
margin-right: 10px;
  /* Adjust as needed */
}
/* Styling for edit button */
.edit-btn {
  width: auto;
  padding: 5px;
  background-color: #744CBC;
  border-radius: 10px;
  cursor: pointer;
  border: none;
  margin-bottom: 1%;
  color: white;
}
.edit-btn:hover {
 background-color: #593d8d;
}
.Delete-btn {
  width: auto;
  padding: 5px;
  background-color: #ff3333;
  border-radius: 10px;
  cursor: pointer;
  border: none;
  margin-bottom: 1%;
  color: white;
}
.Delete-btn:hover {
  background-color: #b82626;
}
/* Edi Album style*/
.gallery-item {
  display: inline-block;
  margin: 10px;
  position: relative;
 width: 20%;
/* Specify fixed width */
  height: auto;
}
.gallery-item img {
  width: 100%;
  /* Make images fill their container */
  height: auto;
  /* Maintain aspect ratio */
  display: block;
}
.remove-btn {
  position: absolute;
  top: 5px;
  right: 5px;
  padding: 5px 10px;
  background-color: red;
  color: white;
  border: none;
  border-radius: 5px;
  cursor: pointer;
}
#add-photo-input {
  border: none;
}
```

```
#add-photo-label {
  display: inline-block;
  margin-top: 10px;
  padding: 10px 15px;
  background-color: #744CBC;
  color: white;
  border: none;
  border-radius: 5px;
 cursor: pointer;
}
#comment {
  width: 100%;
  padding: 10px;
  margin-top: 10px;
 box-sizing: border-box;
}
/* Cookie Styling */
#cook {
  background: hsl(240, 2%, 12%);
  border: 1px solid hsl(0, 0%, 22%);
  border-radius: 20px;
  padding: 0.2% 2% 0.2% 2%;
  width: auto;
 margin: 20px auto;
  position: fixed;
  top: 85%;
  left: 50%;
 transform: translateX(-50%);
  z-index: 9;
}
#cook p {
 margin-bottom: 10px;
}
#cook button {
 display: inline-block;
  vertical-align: middle;
}
footer button {
 padding: 8px 16px;
background-color: #744CBC;
  color: white;
  border: none;
 border-radius: 8px;
  cursor: pointer;
}
footer button:hover {
 background-color: #593d8d;
}
.project {
 background-color: hsl(240, 1%, 17%);
  border-radius: 5px;
  padding: 15px;
  margin-bottom: 15px;
  box-shadow: 0px 4px 8px rgba(0, 0, 0, 0.2);
 color: white;
}
.project h3 {
 margin: 0;
  font-size: 1.5rem;
 color: #ffffff;
}
.project p {
 margin: 10px 0;
  font-size: 1rem;
```

```
color: #ccc;
}
.project a {
  display: inline-block;
  background-color: #744CBC;
  color: white;
  text-decoration: none;
  padding: 8px 12px;
  border-radius: 4px;
  transition: background-color 0.3s ease;
}
.project a:hover {
 background-color: #593d8d;
}
#assigned_users {
  width: 100%;
  height: auto;
  font-size: 14px;
  padding: 5px;
  border: 1px solid #ccc;
  border-radius: 5px;
}
/* Progress Bar Styles */
.progress-bar {
  background-color: #ccc; /* Light gray for the background */
  border-radius: 5px;
  overflow: hidden;
  width: 100%;
  height: 20px;
  margin: 10px 0;
}
.progress-bar-inner {
  background-color: #4caf50; /* Green for the progress */
  height: 100%;
  color: white;
  text-align: center;
  line-height: 20px; /* Match the height for vertical centering */
  white-space: nowrap; /* Prevent text wrapping */
overflow: hidden; /* Ensure no overflow */
  border-radius: 5px; /* Rounded corners */
}
.classify-image-img {
  display: block; /* Ensures the image behaves like a block-level element */
  max-width: 100%; /* Scales the width dynamically within its container */
height: 80vh; /* Sets the height to 80% of the viewport height */
  object-fit: contain; /* Maintains the aspect ratio while fitting the specified dimensions */
  margin: 0 auto; /* Centers the image horizontally */
}
.tags-container, .confidence-container {
  display: flex;
  flex-wrap: wrap;
  gap: 10px;
  margin: 10px 0;
}
.tag-button, .confidence-button {
  background-color: #4caf50;
  color: white;
  border: none;
  border-radius: 5px;
  padding: 10px 15px;
  cursor: pointer;
  font-size: 1rem;
  transition: background-color 0.3s ease;
}
```

```
.tag-button:hover, .confidence-button:hover {
 background-color: #45a049;
}
.tag-button.active, .confidence-button.active {
 background-color: #1e7e34; /* Darker green for active state */
}
.submit-classification {
  background-color: #744CBC;
  color: white;
  border: none;
  border-radius: 5px;
  padding: 10px 20px;
  cursor: pointer;
  font-size: 1rem;
  margin-top: 20px;
  transition: background-color 0.3s ease;
}
.submit-classification:hover {
 background-color: #0056b3;
}
/* Improve multi-select dropdown */
#assigned_users {
  width: 100%;
  height: auto;
  padding: 10px;
  font-size: 16px;
  border: 1px solid #ccc;
  border-radius: 5px;
 background: #fff;
}
/* Highlight selected options */
#assigned_users option:checked {
 background-color: #744CBC !important; /* Blue background */
  color: #fff !important; /* White text */
  font-weight: bold;
}
/* Make options easier to read */
#assigned_users option {
  padding: 5px;
  cursor: pointer;
}
/* Improve focus */
#assigned_users:focus {
  border-color: #744CBC;
  outline: none;
  box-shadow: 0 0 5px #744CBC;
}
#themeSettingsDropdown {
  background-color: #3f3f4083;
  color: rgb(255, 255, 255);
  border-radius: 8px;
  padding: 10px;
  margin-top: 20px;
 font-size: 14px;
}
#themeSettingsDropdown label {
  display: block;
  margin-top: 8px;
  font-weight: bold;
}
#themeSettingsDropdown select,
#themeSettingsDropdown input[type="range"],
#themeSettingsDropdown input[type="checkbox"] {
```

```
width: 100%;
  margin-top: 4px;
 margin-bottom: 10px;
}
#fontSelect {
 background-color: #e0e0e1;
  color: black;
  padding: 8px;
  border: 1px solid #c1c1c1;
  border-radius: 6px;
  font-size: 14px;
 width: 100%;
  margin-top: 6px;
  margin-bottom: 10px;
 cursor: pointer;
 appearance: none; /* Remove default arrow styling */
}
#fontSelect:focus {
 outline: none;
border-color: #744CBC;
 box-shadow: 0 0 4px #744CBC;
}
#textSize {
 accent-color: #744CBC;
}
.export-btn {
  background-color: #744CBC;
  color: white;
  padding: 10px 16px;
  border: none;
  border-radius: 6px;
  font-size: 14px;
  font-weight: bold;
  cursor: pointer;
 transition: background-color 0.3s ease;
}
.export-btn:hover {
 background-color: #593d8d;
}
/* Container styling */
#tag-selection-container {
 background-color: #1e1e1f;
  padding: 12px;
  border-radius: 10px;
 margin-top: 10px;
  display: flex;
 flex-direction: column;
  gap: 10px;
}
/* Each tag + confidence pair */
.tag-selection {
 display: flex;
  align-items: center;
 gap: 10px;
 flex-wrap: wrap;
}
/* Dropdowns */
.tag-selection select {
 padding: 8px;
  border: 1px solid #c1c1c1;
 border-radius: 6px;
  font-size: 14px;
 background-color: #e0e0e1;
  color: black;
}
```

```
/* Remove button */
.remove-tag-btn {
  padding: 8px 12px;
  background-color: #ff3333;
  color: white;
  border: none;
  border-radius: 6px;
  cursor: pointer;
 transition: background-color 0.3s ease;
}
.remove-tag-btn:hover {
 background-color: #b82626;
}
/* Add more button */
#add-tag-btn {
 margin-top: 10px;
  padding: 8px 14px;
  background-color: #744CBC;
 color: white;
  border: none;
  border-radius: 6px;
  font-weight: bold;
  cursor: pointer;
}
#add-tag-btn:hover {
 background-color: #593d8d;
}
/* Submit button */
.submit-classification {
  margin-top: 10px;
  padding: 10px 20px;
  background-color: #744CBC;
  color: white;
  border: none;
 border-radius: 6px;
  font-weight: bold;
  cursor: pointer;
  transition: background-color 0.3s ease;
}
.submit-classification:hover {
 background-color: #593d8d;
}
/* Label above the group */
label[for="tags"] {
  font-weight: bold;
  font-size: 16px;
 display: block;
  margin-bottom: 6px;
}
.archive-btn {
  padding: 10px 18px;
  background-color: #744CBC;
  color: white;
  border: none;
  border-radius: 6px;
  font-size: 14px;
  font-weight: bold;
  cursor: pointer;
  transition: background-color 0.3s ease;
 margin-top: 10px;
}
.archive-btn:hover {
 background-color: #593d8d;
}
```

Appendices 21. The Code for style.css.



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	·Q: Galewity		•			
	- anter - Lagari - Constitution			-		
	 Baltyngeri Wee Projecti Anned Projecti 					
	• Clarge Teams •					
		Print Tage & Co Sheeling				

Appendices 22. Video of working system.