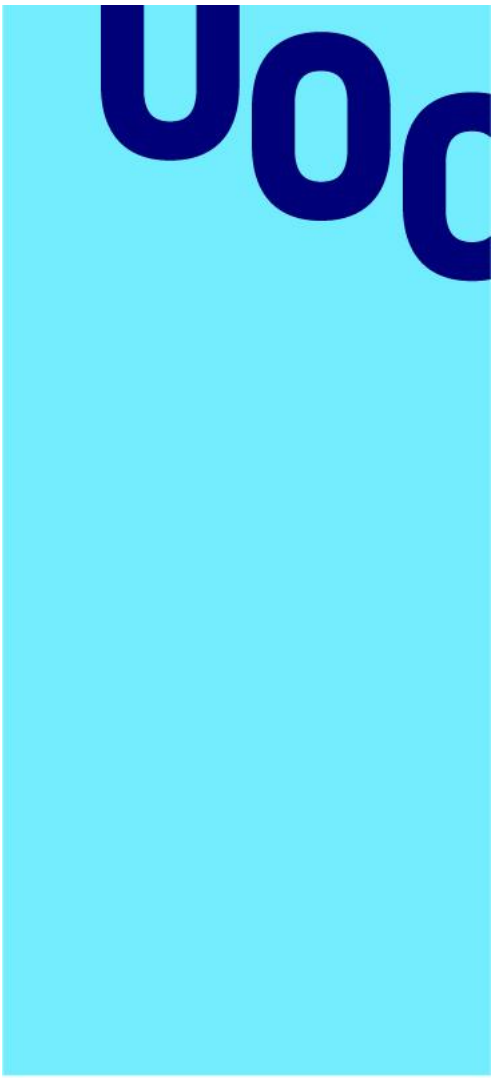
Maria Lucas Gascón - PAC2

Monitoring report

Development of a Web App for Skin Alteration Classification Using Machine Learning



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1. Project identification

Project's title:	*Development of a Web App for Skin Alteration Classification Using Machine Learning*
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Final project's area:	*Statistical Bioinformatics and Machine Learning*
Language:	*English*

This monitoring report has been meticulously formulated and documented on the 22th of December 2023.

In order to maintain conciseness and relevance, this report will specifically delve into the intricacies of the second project phase. It is noteworthy that the first phase, having reached a successful conclusion, was comprehensively documented in the preceding monitoring report.

2. Project's advancements

This section aims to elucidate the advancements made in the project during the period between November 20 and December 22. Specifically, it encompasses the second stage of the project, where development and deployment of a web application that seamlessly integrates the algorithm refined during the initial project stage.

Moreover, this segment will provide insights into the hurdles and challenges faced throughout the project. It will offer a comprehensive exploration of the chosen methodology employed to navigate and overcome these obstacles.

2.1 Achievement of objectives

Main objective: Develop a web-based platform equipped with a machine learning algorithm capable of accurately classifying various skin alterations based on user-submitted images. ✔

The main objective of the project has been successfully achieved with the completion of a web-based platform. This platform is now equipped with a machine learning algorithm that can adeptly classify diverse skin alterations based on user-submitted images. The web application, though subject to potential future enhancements, is currently fully functional and operational following its successful development and deployment. While iterative changes may occur to refine and augment its capabilities, the foundational objective of providing users with a functional and effective tool for skin condition classification has been completed.

Secondary objectives:

1. Implement and evaluate a CNN machine learning model in Python to classify a diverse range of skin alterations. ✔
2. Optimize the model to achieve a minimum precision rate of 85%. ✔
3. Develop an interactive and user-friendly web application, integrating the model for skin alteration classification. ✔

All three secondary objectives of the project have been systematically accomplished. The first two objectives were completed during Phase 1 of development, while the third one was completed during the Phase 2.

The project successfully culminated in the creation and deployment of a dynamic and user-friendly web application. This application not only integrates the optimized model for precise skin alteration classification but also offers an intuitive interface for users to interact seamlessly with the classification tool. Presently operational, the web application stands as a testament to achieving the objective of delivering a practical, user-centric platform.

The successful culmination of Phase 2 of the project has been attained well in advance of the stipulated deadline date of December 22, 2023.

2.2 Necessary changes

No relevant deviations from the main plan were needed. One web feature was found to be easier to implement using Javascript, so a small Javascript script was added to the project.

Originally the web was planned to be fully developed using Python within the Django framework for the backend, and HTML and CSS for the frontend. A small javascript section had to be added in order to perform a simple client-side validation and tell the user the status of the submission.

Specifically, the following Javascript code provides basic validation for a file input field. When the button is clicked, it checks if a file has been selected. If no file is selected, it updates the message element to inform the user to select a file. If a file is selected, it updates the message to indicate that the image is being processed.

```
const message = document.getElementById("message");
const button = document.getElementById("submitBtn");
const file = document.getElementById("file");

// if button is clicked, check the file input
button.addEventListener("click", function (event) {
 if (file.files.length === 0) {
   message.innerHTML = "No File selected, Please select a file!";
 } else {
   message.innerHTML = "Processing Image....";
 }
});
```

Client-side validation improves the user experience by providing immediate feedback, while server-side processing, implemented in Python within the Django framework, handles the form submission and any necessary server-side logic, maintaining the separation of concerns between client and server components.

3. Tasks carried out

The subsequent section provides a comprehensive breakdown of the accomplished tasks as well as those that remain pending.

3.1 Programmed tasks

Main tasks:

1. **Definition of the work plan**: Define the project's scope, objectives, methodology and expected outcomes. Create a project charter outlining the project's purpose and goals as well as a calendar with milestones and dates. ✔
2. **Data Collection and Preparation**: Curate a comprehensive and diverse dataset of skin alteration images, ensuring that it represents various skin conditions and ages to train and validate the machine learning model. Split the data into training, validation, and test sets.

Preprocess the images, normalizing pixel values to the range, and augmenting the data if needed. ✔

3. **Algorithm Implementation**: Develop a machine learning algorithm in Python capable of accurately classifying a diverse range of skin alterations. ✔
4. **Web Application Development**: Design and develop a user-friendly web application using the Django framework to enable users to upload skin images for classification. ✔

All key tasks have been successfully completed in accordance with the project plan. This includes defining the project's scope, objectives, methodology, and expected outcomes, resulting in the creation of a comprehensive project charter outlining purposes, goals, and milestones. The Data Collection and Preparation phase involved the careful curation of a diverse skin alteration image dataset, appropriately split into training, validation, and test sets, with thorough preprocessing steps. The subsequent Algorithm Implementation task led to the development of a robust machine learning algorithm in Python capable of accurately classifying a broad spectrum of skin alterations. Finally, the Web Application Development phase brought forth a user-friendly web application using the Django framework, allowing users to upload skin images for classification. The timely and successful completion of these tasks signifies the overall achievement of the project's primary objectives.

Secondary tasks:

1. **Algorithm Evaluation**: Evaluate the performance of the machine learning algorithm by conducting rigorous testing, including metrics such as accuracy, sensitivity, specificity, and precision, to ensure its effectiveness in skin condition classification. ✔
2. **Algorithm Optimization:** Investigate the potential of utilizing a pre-trained model such as VGG16, ResNet50, or MobileNet. Identify the most effective pre-processing technique to enhance the model's performance. ✔
3. **Accessibility and Scalability**: Ensure that the web application is accessible to anyone with an internet connection, and design it to be scalable for potential future enhancements and improvements. ✔
4. **Educational Content Integration**: Incorporate educational content within the web application to provide users with information about various skin conditions, fostering awareness and encouraging proactive skin health practices. ✔
5. **User Experience Testing**: Conduct user experience testing to refine the web application's interface and functionality, ensuring ease of use and accessibility for a wide range of users. ✘

6. **Data Security and Privacy**: Implement robust data security and privacy measures to protect user-submitted images and information, complying with relevant regulations and standards. ✔
7. **Deployment and Maintenance**: Deploy the web application to a reliable hosting environment and establish a plan for ongoing maintenance and updates to ensure continued functionality and accuracy. ✔

Multiple secondary objectives related to the development of the web application have been completed.

Both accessibility and scalability have been prioritized in the development of the web application. The platform is designed to be accessible to any users with an internet connection, ensuring inclusivity. Moreover, scalability has been considered to accommodate potential future enhancements and improvements, allowing for the seamless evolution of the application.

Educational content integration is a key feature of the web application, enriching the user experience by providing valuable information about various skin conditions. Three separate pages explain in detail various information such as: causes and risks factors, symptoms, treatment and prevention.

In terms of data security and privacy, robust measures have been implemented to safeguard user-submitted images and information. No user data is permanently stored, and all data is deleted after image processing and rendering of the results page.

The deployment of the web application has been successfully executed, placing it in a reliable hosting environment. A private dedicated server running Ubuntu executes Python in a virtual environment. Caddy is used as a reverse proxy to handle SSL automatically. We created a DNS A record of the chosen domain pointing towards the server for ease of public access.

Due to unforeseen delays in the deployment schedule, the task of conducting user experience testing could not be completed as originally planned. The web application was not available for testing within the anticipated timeframe. While this delay is regrettable, it is noteworthy that the web application has been meticulously designed with a focus on user-friendliness. Although user testing would have been beneficial to refine the interface and functionality further, the inherent design principles prioritize ease of use and accessibility for a diverse user base.

While the absence of formal user testing is acknowledged, the comprehensive design approach adopted aims to mitigate potential usability concerns, and future opportunities for user feedback and refinement will be explored as the web application continues to evolve.

3.2 Non-programmed tasks

1. **Integration of menu and webpage refinement:** Addition of a menu with the items "Home," "BCC Info," "Melanoma Info," "Nevus Info," "References," "Specifications," "Privacy," and "About Me." Refinement of the webpage for enhanced visual aesthetics and improved user interface.
2. **Integration of new pages content:** Redaction and addition of informative content for newly created pages within the web application.

The web application underwent an enhancement in its navigational structure with the strategic addition of a menu. This newly incorporated menu encompasses crucial items such as "Home," "BCC Info," "Melanoma Info," "Nevus Info," "References," "Specifications," "Privacy," and "About Me." This addition serves to provide users with seamless access to diverse sections, enhancing the overall user experience. Additionally, refinement of the webpage was conducted to optimize visual aesthetics and ensure a cohesive and user-friendly interface.

In response to the inclusion of new pages within the web application, comprehensive information pertaining to these pages was meticulously curated and seamlessly integrated. The content for each new page was thoughtfully redacted and incorporated, aligning with the project's overarching goal of providing users with informative and educational content related to skin alterations. This integration ensures that users can access detailed information on specific topics of interest, contributing to the educational value of the web application.

The introduction of the Specifications page holds paramount importance in enhancing user understanding and utilization of the web application. This dedicated page serves as a comprehensive guide, enlightening users on the functionalities, features, and limitations of the application. It plays a crucial role in empowering users to navigate and utilize the tool effectively, emphasizing that the web application is not a substitute for professional medical advice.

Equally significant is the incorporation of the References webpage, strategically designed to direct users towards additional and authoritative information on skin health. This dedicated space acts as a valuable resource, guiding users to explore further insights and knowledge beyond the scope of the web application.

By fostering accessibility to reputable references, this webpage contributes to the educational ethos of the project, promoting informed awareness about skin conditions.

4. Calendar revision

Despite gaining a head start in the algorithm development during Phase 1 and initiating Phase 2 four days ahead of the planned schedule, the completion of web application testing encountered unanticipated challenges. The figure below (**Figure 1**) illustrates that the web development phase surpassed the initially allocated time frame by almost twice the intended duration. Originally designated for a 10-day period, this phase extended to 20 days due to unforeseen complications.

The delay is attributable, in part, to the unplanned inclusion of a menu feature and challenges encountered during the CSS coding process. The incorporation of the menu, while enhancing the overall functionality, introduced an additional layer of complexity that extended the development timeline. Moreover, complications arising in the CSS coding presented unforeseen hurdles, necessitating a more meticulous and time-intensive resolution.

It is essential to acknowledge these challenges as contributing factors to the extended web development timeline, ultimately impacting the completion of user testing. Despite these setbacks, efforts were steadfastly directed towards ensuring the quality and functionality of the web application. As the project progresses, measures will be taken to mitigate such unforeseen obstacles and streamline the development process for future enhancements.

Nombre	Fecha de inicio	Fecha de fin
Work development CAA3	20/11/23	22/12/23
~~Result's analysis~~	~~20/11/23~~	~~23/11/23~~
Learning to develop web-app in Django	~~24/11/23~~ **20/11/23**	27/11/23
Designing web map	28/11/23	29/11/23
Delevop app	30/11/23	~~9/12/23~~ **20/12/23**
Write educational content	7/12/23	9/12/23
~~Test web app~~	~~10/12/23~~	~~14/12/23~~
Write CAA3	~~15/12/23~~ **19/12/23**	22/12/23

Figure 1: Phase 2 Calendar. Calendar presented in CAA1 featuring tasks and associated dates. Actual start and finish dates are highlighted in red. Tasks uncompleted during the second phase of the project are crossed out.

Due to unforeseen delays encountered in the second phase of the project, it has become necessary to make strategic adjustments to the project timeline for the final phase. As a result of these delays, additional time has been allocated to the redaction of the final report, which includes the detailed methodology of the webpage and a comprehensive discussion of the entire project (**Figure 2**).

Recognizing the importance of providing a thorough and insightful analysis in the final report, some time originally allocated to presentation preparations has been reallocated to ensure the quality and completeness of the report. This adaptive approach aims to maintain the project's overall integrity and deliver a robust final documentation that encapsulates the methodology employed in webpage development and provides a reflective discussion on the project's evolution and outcomes.

Final report and presentation CAA4	27/12/23		13/1/24	
Optimize report + Finish writing report	27/12/23		~~30/12/23~~	**10/1/23**
Optimize code presentation and documentation	31/12/23		3/1/24	
Making presentation	~~4/1/24~~	**10/1/23**	13/1/24	
Public defense CAA5	14/1/24		1/2/24	

Figure 2: Final Stage Calendar. Calendar presented in CAA1 featuring tasks and associated dates. Actual start and finish dates are highlighted in red. An additional task was added in red.

5. Obtained results

The primary achievement in Phase 2 is the successful development and deployment of the web application. The web application is now fully operational and accessible via the following link: WebTool. Additionally, a webdemo video has been recorded and is available in the event of any issues with web hosting (Web Demonstration).

The project's GitHub repository has been meticulously updated, ensuring that it remains current and reflective of the latest developments. The web application's code has been appropriately added and is available for review on the project's GitHub (Web Code).

Regrettably, it is noted that the main project report has not undergone updates since the last monitoring report. Despite diligent efforts, corrections related to the methodology explanation could not be incorporated and adjusted within the stipulated time frame. While this is acknowledged as an area for future attention, the focus has been prioritized on successfully completing and deploying the functional web application.

During this developmental phase, a critical aspect of the project involved addressing and implementing corrections suggested by the tutor in the previous report. However, due to time constraints, these revisions remain outstanding, particularly in relation to the presentation of information within the project report. It is essential to underscore that rectifying these aspects constitutes a top priority upon the conclusion of this monitoring report.

The impending focus on the project report will ensure the incorporation of recommended changes, enhancing the overall clarity and coherence of the documentation as advised by the tutor.

Presented below is a consolidated list of all results obtained to date in the course of this project:

- GitHub Repository
- Main report: MemoriaMariaLucas
- Full working website: WebTool (https://skinai.bioedu.one/)
- Video demonstration: Web Demonstration