



FIT3162 Project Management Report

Segmentation of Tumour and Extracting Useful Features From Mammography Images

SEMESTER 2 2021

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1 Introduction

Breast Cancer is one of the top types of cancer that is diagnosed in women (Worldwide Cancer Data | World Cancer Research Fund International, 2021). It is common practice for doctors to encourage women of the age 40 above to undergo regular breast cancer screening. As a rule, early detection of breast cancer can help ease the mitigation process and avoid patients from deteriorating to late stage cancer. Correspondingly, breast cancer screening is done by a radiologist manually scrutinizing the mammography images for any signs of tumor. Admittedly, this method leaves room for human error during the screening process. As a result, doctors are turning to better methods of diagnosing breast cancer. One of the new approaches to the problem is by applying the method of Computer-Aided Diagnosis (CAD). This approach can help reduce human error during the breast cancer screening process.

The main objective of our project is to create a breast cancer diagnosing system. The system allows users to choose their dataset of mammography images then apply segmentation and feature extraction onto the dataset. The UI of the system has two main interfaces. The first is the Admin interface, where the user is able to choose different dataset, segmentation and feature extraction to apply. Then users can run the SVM to test the accuracy of the chosen segmentation and feature extraction. Additionally, the User interface allows users to choose a singular image and the system predicts if the mammography image has a tumour or not.

The team consists of 3 members. The member names and their corresponding role is as follows, Daniel Kee is the Technical Lead, Jaclyn Neoh is the Quality Assurance and Tan Sook Mun is the Project Manager. The supervisor for this project is Dr Golnoush. She had greatly helped and guided the team throughout the entire project.

2 Project Management

2.1 Introduction

The project has been implemented throughout the period of Semester 1 2021 to Semester 2 2021. During this period, there was a global pandemic which caused the entirety of the project to be done online. All team members had not met face to face to work on the project for all of our safety. Two team members are based in Kuala Lumpur while another member is based in Penang. Assuredly, a plan was already put in place to work on the project online. All team meetings were conducted online using zoom. Occasionally there will be extra meetings or meetings are pushed onto later days. Every meeting, the members will take turns to write out the meeting minutes. The team also uses Kanban Board to help with keeping track of each other's progress and tasks that had to be accomplished. Another mode of communication between the team members is through Whatsapp. Correspondingly, all documentation and code is done with Google Drive and gitLab.

The meetings with the project supervisor are also done online throughout the entire project. The mode of communication with the supervisor in semester 1 was through emails and weekly Zoom meetings. In semester 2, there were some slight changes where the communication was shifted to Microsoft Teams. However there were still weekly meetings with the project supervisor. Admittedly, this made communication with the project supervisor easier and more accessible. During weekly meetings, we will discuss with the project supervisor our progress and future tasks to undertake. The team also submitted a weekly report to the project supervisor to update her on the team progress.

2.2 Methodology

2.2.1 Explanation of Software Methodology

We decided to use the waterfall methodology for the implementation of the project because the project requires a particular step to finish before another step could start. For example, we need to prepare the dataset before we can start on the segmentation and feature extraction algorithm. It is vital that each stage of the project has to be completed before moving on to the next stage. Furthermore, our group had clearly identified the objective and consulted with our project supervisor and concluded that the requirements are unlikely to change during the project lifecycle. This also gives the reason why the agile methodology is not required for our project. Agile methodology is based on the project requirements and is constantly changing.



The breakdown of the project framework is attached in the appendix below

2.2.2. Execution of Software Methodology

Looking at our project framework that is appended in the appendix below, we need to finish off each phase succession. In the kickoff meeting we clarified the main objective of this project, which is to propose an accurate segmentation algorithm to segment out the tumour and a feature extraction to extract all the useful features of the tumour. This semester we set off to work on the prototype of our project based on the planning stage back in Semester 1.

We continued applying the Waterfall methodology as it was vital that we complete a specific stage before the other such as preparing the dataset before proceeding with the segmentation of the mammography images and segmenting the mammography images before feeding the features extracted from the segmentation algorithm into the classification model for testing. This enforces that the feature extraction algorithm needs to be completed before we can test our algorithm with the classification model of our choice, which is SVM. After documenting and testing of the results of the SVM, we then proceeded to the User Interface as all the algorithms required are ready to be linked up to the User Interface. After this process, the prototype is completed and is ready for the final testing and documentation.

Furthermore, the team also took extra steps on ensuring that the project can be completed on time with the best quality that the team can produce. Throughout the executing process of this project, we have frequent weekly meetings with our supervisor, Dr Golnoush, not only to report our progress to her, but also receive feedback, guidance and advice from her as well as tasks to be completed by the following week. This helps ensure that the quality of the results that we, as a team, are producing is up to the standard expected from our stakeholders while making sure that the project is on schedule. Not only do we have frequent meetings with our supervisor, we also have frequent group meetings, which are 2-3 times a week. The first meeting of the week, which is the day of the meeting with the supervisor, is reserved to discuss the overall progress of the project, the task to be accomplished by the end of the week and task allocation of the week. The purpose of the last meeting of the week is to monitor the progress of each teammate for the week which ensures that the project is on course. We also take meeting minutes to document how the week went, highlight what was accomplished during that week, and document the task given to the teammates on the last meeting. A useful software resource that was used during both meetings was the Kanban Board, Notion. Notion is an additional software

source that the team took full advantage of to help keep us on track for the week by allowing us to see the current task allocated, allocate new tasks to teammates and check the rate of progress of the project. Another important document that was referred to very frequently is the Gantt Chart as it allows us to track the overall progress of the project. Last but not least, in order to report our progress to our supervisor, the Weekly Progress Report will then be written and sent to the supervisor, Dr Golnouch to report the team progress for the week.

The excerpt of the gantt chart and kanban board is attached at the appendix below

2.3 Project resources

2.3.1 Project Resources

Hardware Requirement

Table 1 - Hardware Specification

Hardware Specification	
Operating System	Windows 10 Home
CPU	Intel i5/equivalent or better
GPU	Nvidia GeForce GT1030
RAM	8GB
Storage	10GB of space

Software Requirement

Table 2 - Software Specification

Software Specification	
MATLAB 2020B	This software is use for running, creating and testing our segmentation and featuring algorithm
Image Processing Toolbox	Image Processing Toolbox provides built-in functions for image processing,algorithm development, visualization and more. This toolbox is required to build our segmentation and feature extraction algorithm.
Matlab Compiler	Matlab Compiler is an add-on app that enables you to package and deploy your Matlab programs into executable files, web applications and more. We will need this to deploy our diagnosis system at the end of the project.
Statistic and Machine Learning	This toolbox provides functions that describe, analyse and model data.

Toolbox	This toolbox will be used to code out our classification model to evaluate our segmentation and feature extraction algorithm for testing.
GitLab	This software is used for version control of our codes. Each member can contribute to writing the code by pushing and pulling the project code base. With this tool we can see each change and version of our codes.
Notion	This software is used for project management. It has a collaborative to-do list, kanban board and a roadmap which features the timeline of the project
Whatsapp	This is used for day to day informal communication
Google Drive	This is used for storing all our project files (assignments, documents, summary and etc)

Software Libraries

The following software libraries are all under MATLAB version R2020b.


- Computer Vision Toolbox 9.3
- Global Optimization Toolbox 4.4
- Image Processing Toolbox 11.2
- Optimization Toolbox 9.2
- Statistics and Machine Learning Toolbox 12.0
- Symbolic Math Toolbox 8.6
- Wavelet Toolbox 5.5

2.3.2 Project Planning, Management and Execution

Below is a table listing the roles and responsibilities of each team member.

Table 3 - The Team Table

The Team	
ROLES	NAME
Project Manager	Tan Sook Mun
Quality Assurance	Jaclyn Neoh
Technical Lead	Daniel Kee



A Gantt chart was prepared to display the entirety of the project schedule. Its timeline covers the topic selection to the completion of the project. The Gantt chart clearly outlines the corresponding deliverables scheduled in phases.

Furthermore, we had the privilege to add on to our project, more than what was actually planned out, with our supervisor's guidance and approval. This includes extra features to the UI in our project, and the implementation of SVM to ensure our algorithms are working correctly. This is possible because some of our project deliverables were accomplished ahead of schedule.

As mentioned, the excerpt of the gantt chart is attached at the appendix below

2.4 Risk Management

In this section, we will talk about the risk management of our project. Back in FIT3161, we made a risk register to help track and control all the potential risks that could occur during the project. We found out looking back at this risk register that "Risk 1: A lot of open source code can be found online" did in fact exist and we took full advantage of it by using it in our implementation of the algorithm. We also emailed the authors of the research paper for the source codes.

Another risk that was triggered was "Risk 4: Team members may fall sick or receive side effects from taking the Covid vaccination". During the middle of the semester, all the team members had to receive their vaccine shots. Some members encountered side effects which affected their work. This risk is a negative risk and we tried to resolve this risk by assigning that person less work for the week and giving the other teammate more work so that the affected teammate that got the vaccination can rest up while not affecting the progress of the project.

The risk register is attached at the appendix below

2.5 Limitations

This section covers the limitations we have experienced along the course of this project, from a project management point of view.

Code

- It was a challenge and time consuming to obtain code based on the algorithms that we are going to use. This is because we have obtained code from the authors of research papers on algorithms we based ours on. Some of them took a while to reply, some did not reply at all.
- To understand the code that we have obtained was challenging. The codes we have obtained contained parts that we had to do our own research to fully understand, for example, a function built into MATLAB that we do not understand, or a concept within the algorithm the code uses we have never seen before.

External Environment And Conditions

- During the endeavours of this project, it was conducted all online. Internet connection issues were an occasional issue whenever we needed to have meetings. This impacted our efficiency.
- Some of the members of the team had to take a dose of vaccine in this season of Covid. This period of time reduced our productivity as we had lesser hands to handle the project.


2.6 Reflection on Success

Overall, the project management for this project was a success. There were some roadblocks and difficulty encountered, however in the end we as a team managed to pull through. Throughout the project execution we closely monitor the gantt chart that was proposed last semester. The team was a little slow at the beginning but we managed to speed up our process in time to complete it. Every meeting, we also ensured there was proper documentation for each detail of the agenda item. Every team meeting there will be a status report from each member and also a closing statement. During the closing statement, each member has to declare the task they have to accomplish for the week. This ensures all team members are all on the same page and understand the overall project progress. Every assessment task for this unit was completed and submitted in time. As a team we manage to split the work properly and complete it together on time.

However, there are some shortcomings where a team member may not have the skill set to complete their task. What should have been done differently was, the members need to be more open and reach out for help when needed. The team also had not accounted for the delayed response from authors of the research paper when we reached out for more information. The team wasted time waiting for a response when we should have started searching for a different algorithm to compensate. Additionally, waiting for the responses from the researcher was not accounted for in the Gantt chart or during the planning phase.

3 Conclusion

Breast cancer is a prevalent issue among women. Our project aims to use the means of image processing to swiftly identify an abnormality in mammography images and to determine whether the abnormality is cancerous or not. We had researched in depth each section of the steps of image processing: pre-processing, segmentation, feature extraction and post-processing. We want to discover and obtain the most suitable algorithm for each of these parts to properly identify whether there is an abnormality in mammography



images using segmentation, and to obtain features accurate enough for proper diagnosis, using feature extraction.

Using algorithms referenced from conference papers, we came up with 2 segmentation algorithms and 2 feature extraction algorithms. The 2 segmentation algorithms are region growing and an algorithm called Hammouche's algorithm, of which includes an algorithm called genetic algorithm inside. Feature extraction algorithms are GLCM and LESH.

To ensure that our algorithms are working properly, we pass the features extracted from the feature extraction algorithm into SVM, and then we analyse the accuracy of the output and other metrics. User interfaces are created for both Admin and User. The Admin UI is used to test algorithm correctness and combination of segmentation and feature extraction algorithms. The User UI's are for users to input a mammography image, perform segmentation and feature extraction on it, and then output the results to them.

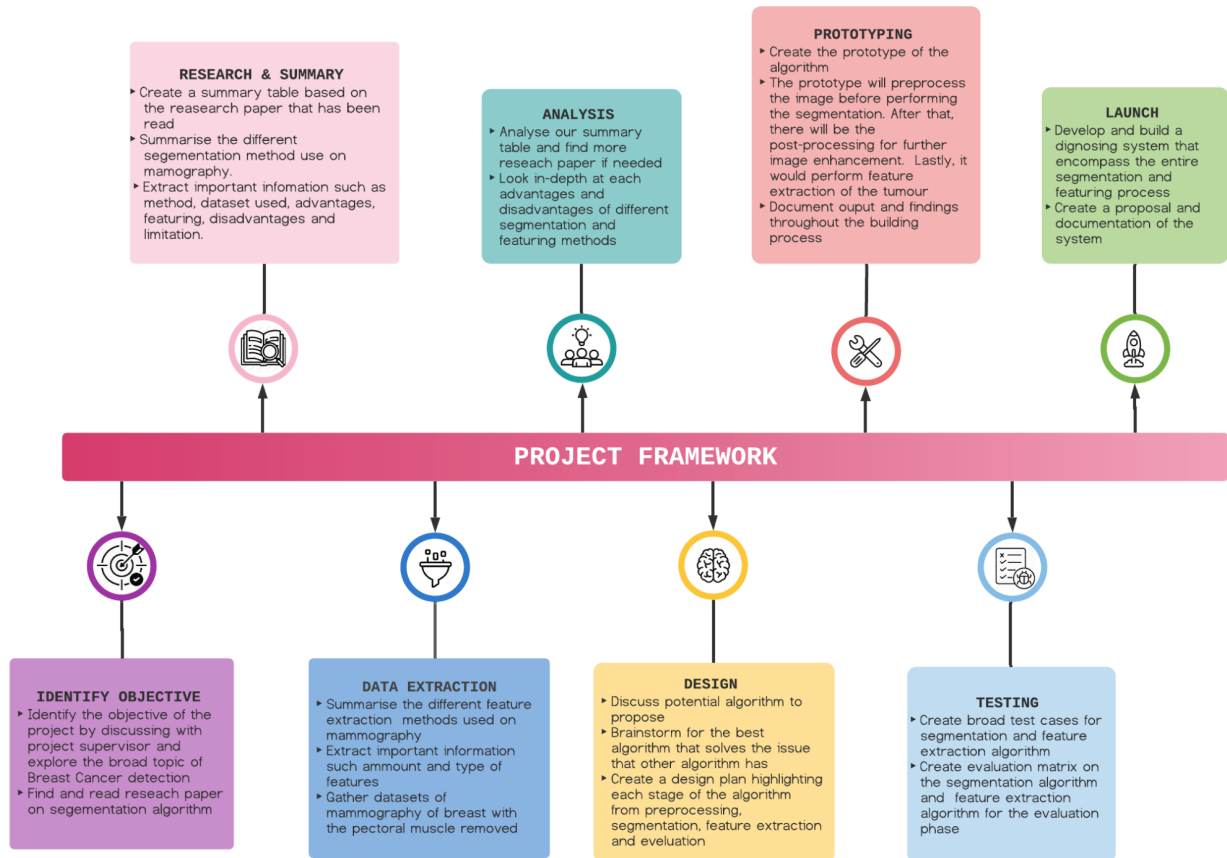
4 References

Worldwide cancer data | World Cancer Research Fund International. (2021, May 25). WCRF International. <https://www.wcrf.org/dietandcancer/worldwide-cancer-data/>

Špundak, M. (2014). Mixed Agile/Traditional Project Management Methodology – Reality or Illusion? <https://www.sciencedirect.com/science/article/pii/S187704281402196X>

5 Appendix

Appendix A -Project Framework



Appendix B - Gantt Chart

https://docs.google.com/spreadsheets/d/18XIVbkZ1BRfeHr9z_K6lv4vq8SzgIKAHkpoinG7v1Qw/edit?usp=sharing

Appendix C - Kanban Board(Notion)

Backlog 4 To-Do 2 In Progress 4 Completed 6 Archived 0

Final Project Report
Presentation
Final Project Presentation
Team Management Report
+ New

Complete UI (User)
Sook Tan
Complete UI (Admin)
Sook Tan
+ New

Understand how to implement Dragonfly
Sook Tan Daniel Kee
Jaclyn Neoh
High 🚩
Fix SVM
Sook Tan
Create UI for user and login
Sook Tan
Project Management Report
Sook Tan Daniel Kee
Jaclyn Neoh
+ New

Complete LESH
Daniel Kee
meeting minutes
Sook Tan
2.3a,3f
Sook Tan
3b,3d
Jaclyn Neoh
3c,3e,4
Daniel Kee
Weekly Report
Daniel Kee
+ New

Appendix D - Risk Register

No.	Rank	Risk	Description	Category	Triggers	Root Cause	Potential Responses	Risk Owner	Probability	Impact	Status	Score	Legend	Numerical
1		similar open source code found	useful reference of the algorithm can be found on the internet	positive	doing research for own project and stumble across it	Algorithm is famous and commonly used	Use them as reference to see what we can improve upon, citing them in our work too	Technical Lead	8	8	Open	64		
2		Dataset assessability	We may not be able to access the dataset we planned on using if the source's decided not to provide free access to it anymore	Data science	No access to the dataset	Dataset is no longer public	Find another dataset	Quality Assurance	3	10	Open	30	high	7
3		Supervisor may be busy to meet	Our supervisor may not be able to meet with the team when needed	Schedule	Our supervisor writing us an email that suggest that she couldn't make it to the meetings	Due to personal reasons or due to their workload	Reschedule the meeting if the supervisor could not attend the meeting. Another alternative is to communicate to email	Project Manager and Project Supervisor	2	9	Open	18	medium	5
4		Team members may fall sick or received side effects from taking the Covid vaccination	If one of the member is sick, that person has to take time-off to recover. During this period, Malaysia is badly affected by Covid-19 and not only that, we have to take into account of that our members might receive side effects from the Covid-19 vaccination	Schedule	The members informing the rest that they are ill	Illness which includes getting Covid-19, side effects from the Covid-19 vaccination and other illnesses	Assign the task to another teammate	Project Team	3	5	Open	15	low	3
5		Project is delayed due to the change of requirements	Unplanned new work requirement that must be accommodated/change of direction	Schedule	Our supervisor informed the team that there is an update on the scope	Specifications not specific enough in the first, resulting in when it is being implemented many problems come out	Rescheduling of task.	Project team and project supervisor	2	7	Open	14	Very low	1
6		Financial attraction of project to investor	Because this project could helped save lives, we might attract outside investors	Positive	Potential user/investor looking for algorithms on segmentation and feature extraction of mammography images	The success of the project	Go into discussion with potential users/investors, further improve and research on how to improve our application and algorithms	Project Team	1	8	Open	8		

Annex

This section indicates the percentage of contribution made by each team member.

Name of Team Member	Percentage of Contribution
Daniel Kee Li Yung	33.3%
Jaclyn Neoh Si Ying	33.3%
Tan Sook Mun	33.3%