BSc (Hons) Computing Course 2024/25

Level 6 Production Project

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Course: BSc (Hons) Computing	**Supervisor's Name:** Saroj Sharma

Final Project Individual Aim & Objectives

Title of my Project: Prediction of Cardiovascular disease using transformer model

Aim of my Project: This project aims to develop an advanced predictive model that uses self-attention mechanisms in transformer architecture to accurately assess the risk of cardiovascular diseases (CVD) based on patient health data.

Objectives of my Project:

- Gain understanding on transformer model and its concepts.
- Develop a self-attention-based transformer model and understand the advantage over other models.
- Pre-process a dataset with features from patient data, such as age, cholesterol levels, and blood pressure.
- Test the model thoroughly against basic models to make sure it is accurate and reliable.
- Develop a website to take the input form the patient and show the prediction.

Specification of my Product:

This project combines research and product development. The system will function as:

- A publicly available cardiovascular disease dataset will be utilized for training and testing the model.
- The system will use web interface where users can input patient health data and receive predictions about CVD.
- A transformer-based model with self-attention mechanisms will be implemented using PyTorch.

- Libraries like Pandas and Scikit-learn will be used for data pre-processing tasks to prepare the input data for model training and prediction.

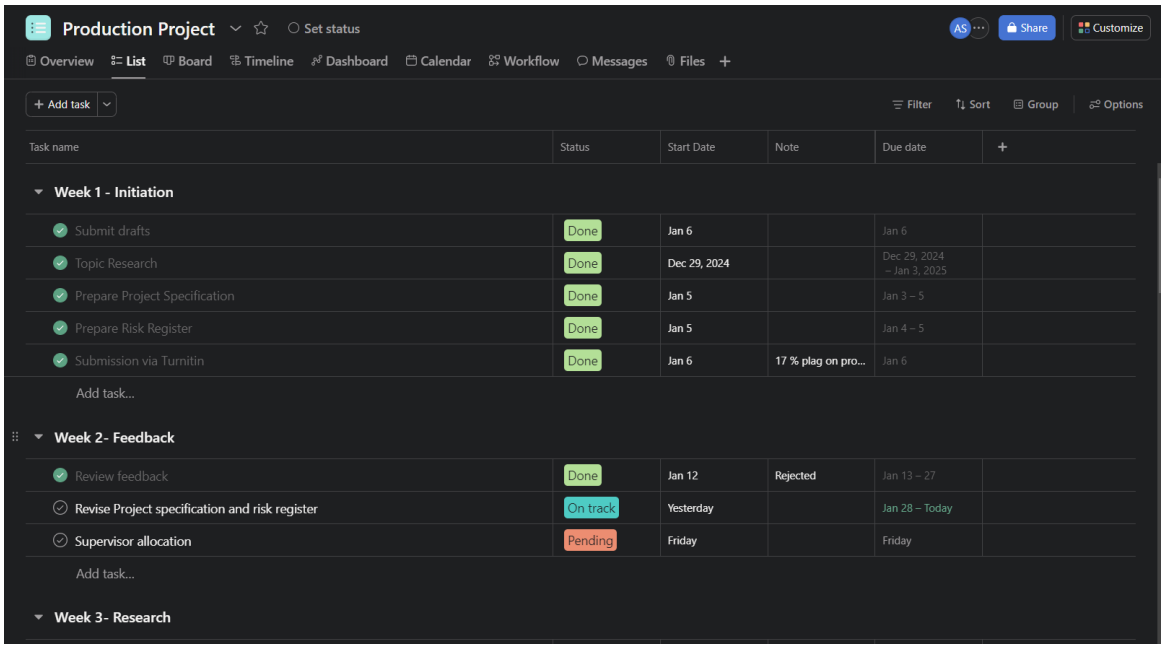
Research:

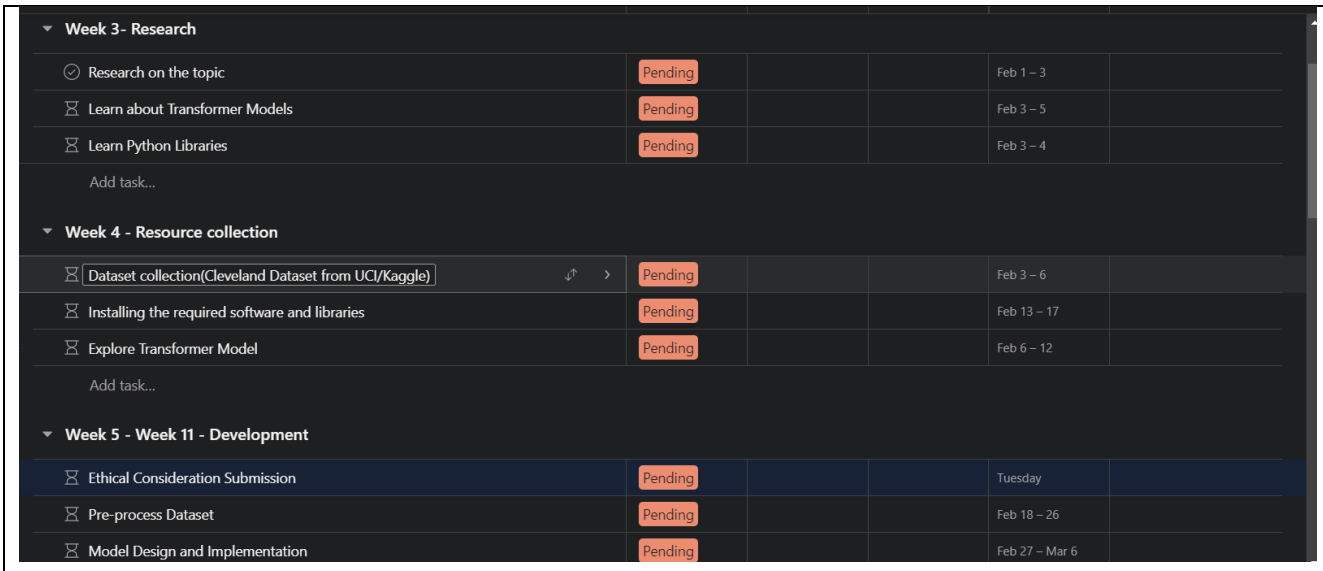
This project focuses on improving heart disease prediction using a self-attention-based transformer model, as proposed by Rahman et al. (2024). Unlike traditional models like CNNs and RNNs, which struggle with sequential data and interpretability, the transformer model leverages multi-head self-attention to capture complex patterns in patient health records, such as age, cholesterol, and blood pressure (Choi et al., 2017; Dutta et al., 2020).

The key difference lies in the model's ability to focus on relevant features and provide interpretable predictions, helping healthcare professionals understand decision-making processes (Rahman et al., 2024). Additionally, its parallelizable architecture ensures faster training compared to sequential models like RNNs (Shah et al., 2020). The project will pre-process the Cleveland dataset, implement the transformer model using PyTorch, and evaluate its performance against baseline models (especially CNN) using metrics like accuracy and F1-score. By addressing the limitations of traditional methods, this project aims to deliver a robust and interpretable solution for early heart disease detection.

Project Planning & Methodology

Project Planning:



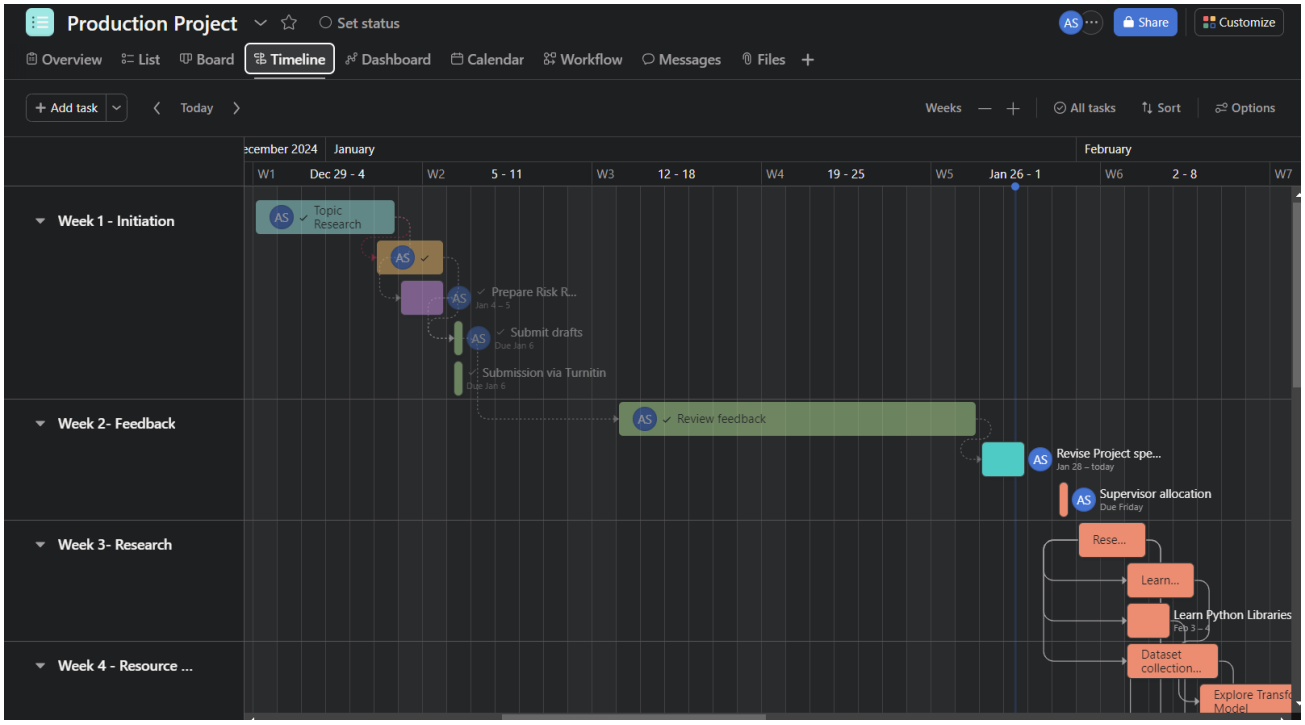


Week 3- Research					
Research on the topic	Pending			Feb 1 – 3	
Learn about Transformer Models	Pending			Feb 3 – 5	
Learn Python Libraries	Pending			Feb 3 – 4	
Add task...					
Week 4 - Resource collection					
Dataset collection(Cleveland Dataset from UCI/Kaggle)	Pending			Feb 3 – 6	
Installing the required software and libraries	Pending			Feb 13 – 17	
Explore Transformer Model	Pending			Feb 6 – 12	
Add task...					
Week 5 - Week 11 - Development					
Ethical Consideration Submission	Pending			Tuesday	
Pre-process Dataset	Pending			Feb 18 – 26	
Model Design and Implementation	Pending			Feb 27 – Mar 6	

Task name	Status	Start Date	Note	Due date	+
Model Design and Implementation	Pending			Feb 27 – Mar 6	
Model Training and Evaluation	Pending			Mar 7 – 14	
Build UI for system interaction	Pending			Mar 17 – 18	
Integrate the system to the UI	Pending			Mar 19 – 21	
Testing and debugging	Pending			Mar 24 – Apr 3	
Make Presentation slides	Pending			Apr 4	
Prepare for the presentation	Pending			Mar 22 – 23	
Add task...					
Week 12- Presentation					
Work in Progress Presentation	Pending			Mar 24	
Gather feedback and make changes to the plan	Pending			Mar 25 – 29	
Add task...					
Week 13- Refine System					
Optimize model and interface	Pending			Mar 31 – Apr 5	

Figure 1:To do task list

Gannt chart



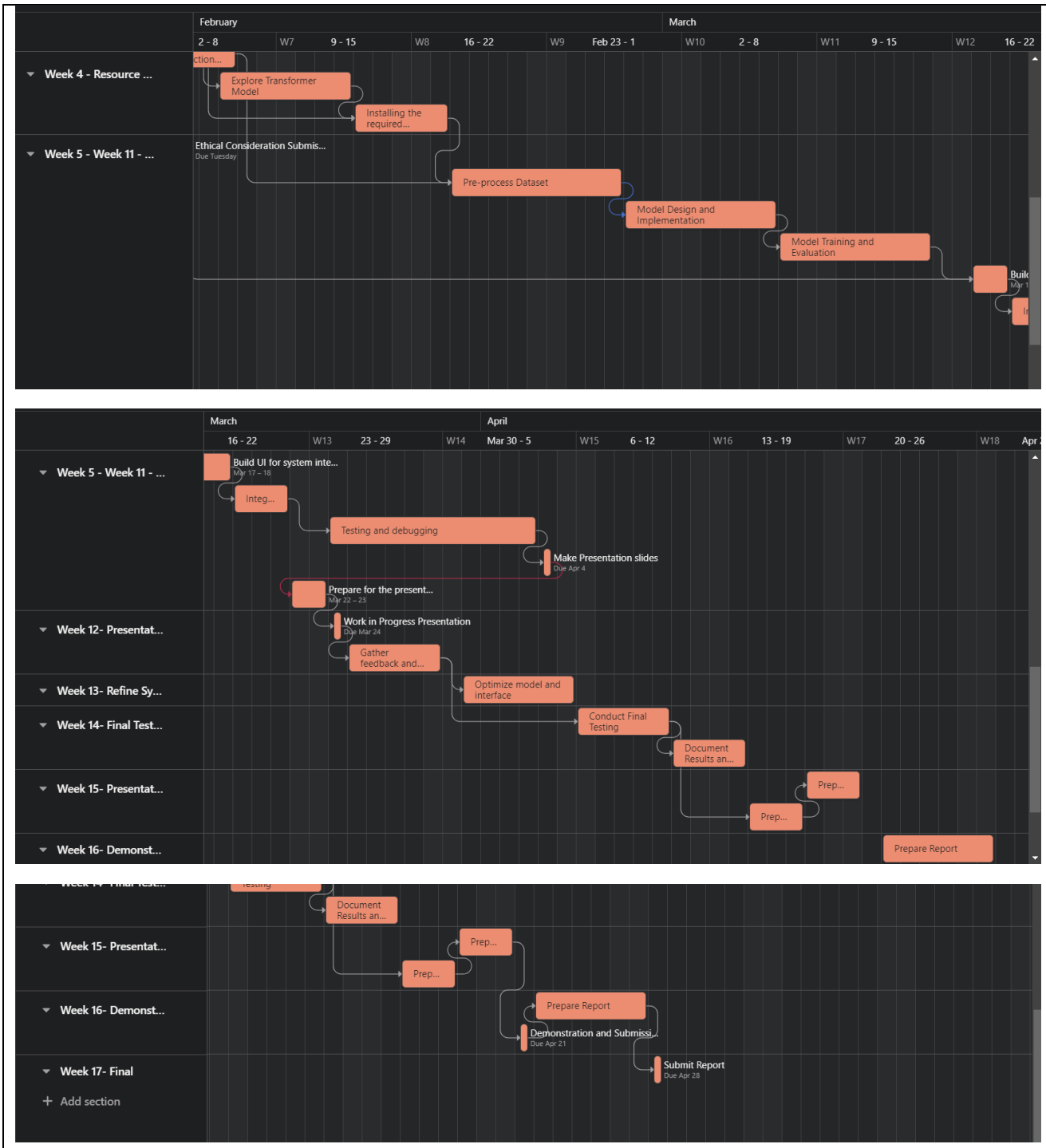


Figure 2: Gannt chart showing the task dependencies.

Timeline

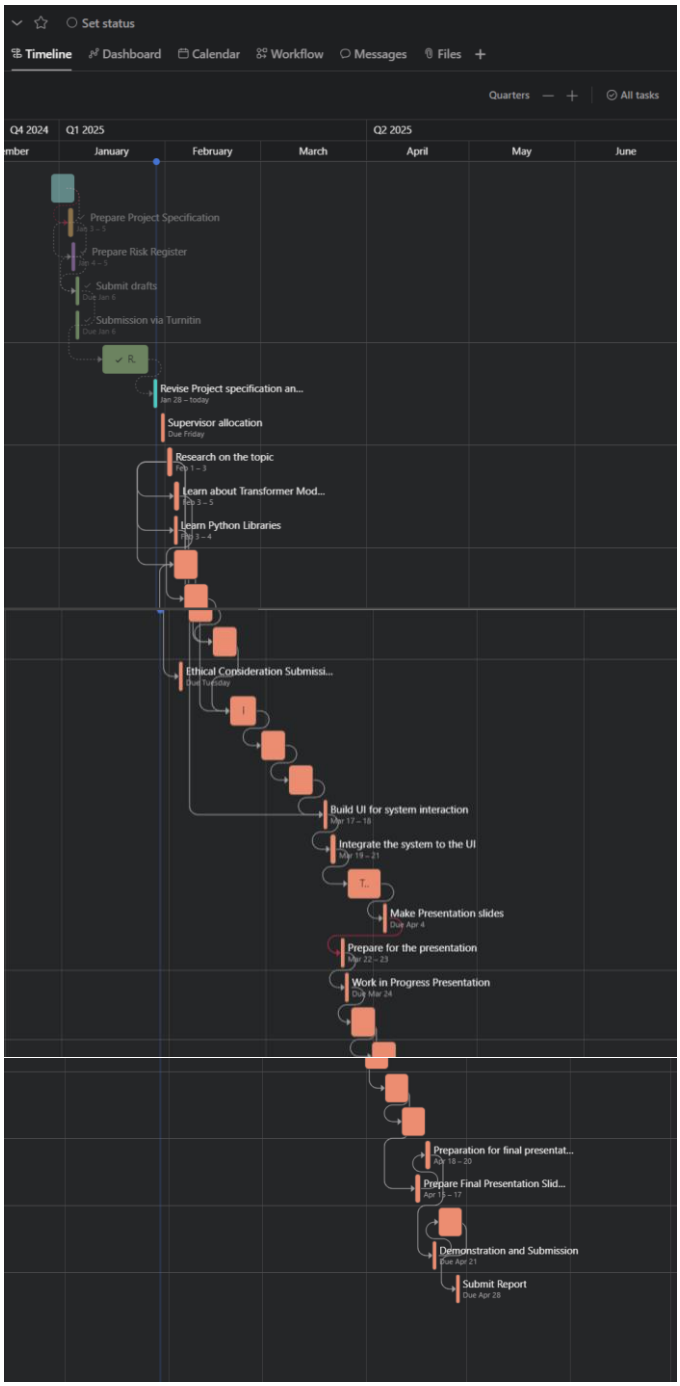


Figure 3: Timeline of the project.

Methodology:

The methodology focuses on achieving accurate predictions of cardiovascular disease risk using transformer model. This approach combines quality research and quantitative analysis to validate results ultimately bringing product to the table. The methodology includes:

Finding the gap in existing method and understanding the role of transformer model.

Gather datasets publicly available (Kaggle, Cleveland Heart Disease dataset).

Implement the self-attention-based transformer model and evaluate model.

Design a website and test functionality.

Documentation and Reporting.

Evaluation:

The evaluation of this project aims to gain the performance and effectiveness of the proposed model which shall be measured using quantitative metrics such as accuracy, recall, AUC-ROC and F1-score. An analysis comparing the self-attention-based transformer model benefit over traditional dataset will be highlighted.

Product Specification:

Divided the product specification into functional and non-functional requirements by using MoSCow approach.

Functional Requirements	MoSCoW
Implement the self-attention-based transformer model	M
Dataset integration and pre-processing	M
Heart disease risk prediction	M
Model evaluation and performance metrics	M
User-friendly interface for input/output	S
Comparative analysis with baseline models	S
Real-time prediction capability	S
Advanced visualization of results	C
Integration with healthcare systems	W

Non- Functional Requirements	MoSCow
Developed using non-paid software tools	M
Rigorous testing and validation	M
Easy to use by the user	S
Fast response time for prediction	C
Compatibility across another platform	W

Resources

The hardware and software I require to complete my Project successfully:

Hardware

- Dell vostro 5502
- Kaggle Server

Software

- Ms Word
- Ms Excel
- Chrome, Ms Edge
- Visual studio code
- Python – TensorFlow, NumPy, Pandas, PyTorch, Scikit-learn, Keras
- Flask
- Laravel, php
- Bootstrap
- MYSQL / MongoDB
- OpenCV
- GitHub
- Jupyter Notebook
- Asana
- Canva

Human Resource

Name	Role
Saroj Sharma	Supervisor
Avishek Sah	Researcher/Programmer

I am working on my Project with the following people

Name: Avishek Sah	**Role:**
	Module Leader: Rohit Raj Pandey Supervisor: Saroj Sharma

Initial Bibliography

Bibliography

Rahman, A.U. *et al.* (2024) *Enhancing heart disease prediction using a self-attention-based transformer model*. https://www.nature.com/articles/s41598-024-51184-7#citeas (Accessed: January 28, 2025).

Choi, E. *et al.* (2017) *Using recurrent neural network models for early detection of heart failure onset*. https://academic.oup.com/jamia/article/24/2/361/2631499 (Accessed: January 28, 2025).

Dutta, A. *et al.* (2020) 'An efficient convolutional neural network for coronary heart disease prediction,' *Expert Systems With Applications*, 159. https://www.sciencedirect.com/science/article/abs/pii/S0957417420302323?via%3Dihub.

Shah, D., Patel, S. and Bharti, S.K. (2020) 'Heart Disease Prediction using Machine Learning Techniques,' *SN Computer Science*, 1(6). https://doi.org/10.1007/s42979-020-00365-y.

Effective heart disease prediction using hybrid machine learning techniques (2019). https://ieeexplore.ieee.org/document/8740989 (Accessed: January 28, 2025).