## UNIVERSITI TEKNOLOGI MARA CAWANGAN PULAU PINANG

# DEVELOPMENT OF CLASSIFICATION MODEL BASED ON TRAINING TIME IN HYPERPARAMETER FOR ACUTE MYELOID LEUKEMIA (AML)

### NURZULAIKHA BINTI ZAIDI @ EDDIE

## BACHELOR OF ENGINEERING (HONS) ELECTRICAL AND ELECTRONIC ENGINEERING

February 2025

### **AUTHOR'S DECLARATION**

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my work unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

| Name of Student      | ; | Nurzulaikha Binti Zaidi @ Eddie                   |
|----------------------|---|---|
| Student I.D. No.     | : | 20229   |
| Programme            | : | Bachelor of Engineering (Hons.) Electrical and    |
|                      |   | Electronics Engineering (CEEE200)                 |
| Faculty              | : | Electrical Engineering Studies                    |
| Thesis               | : | Development of Classification Model Based on      |
|                      |   | Training Time in Hyperparameter for Acute Myeloid |
|                      |   | Leukemia (AML)                                    |
|                      |   |   |
| Signature of Student | 5 |   |

|      | -              |  |
|------|----------------|--|
| Data | Echrupry 2025  |  |
| Date | redituary 2023 |  |

### ABSTRACT

The classification of Acute Myeloid Leukemia (AML) using machine learning models has demonstrated significant potential in advancing diagnostic accuracy and efficiency, offering critical support in clinical decision-making. This study focuses on strategies to enhance AML classification by optimizing hyperparameters and learning rate schedulers, aiming to reduce training time while maintaining high performance. Several learning rate schedulers, including constant, linear, step, and time-based approaches, were evaluated for their effectiveness. The results reveal that step and time-based schedulers consistently outperformed others, achieving superior accuracy, specificity, and computational efficiency, while significantly reducing training time. In addition to exploring learning rate schedulers, hyperparameter optimization techniques were applied to Convolutional Neural Networks (CNNs) such as AlexNet and ResNet-18. These techniques yielded substantial improvements in model accuracy and efficiency by fine-tuning critical parameters like learning rates and momentum. Furthermore, the study developed strategies for handling variable learning rates and momentum adjustments, with SGDM (Stochastic Gradient Descent with Momentum) showcasing excellent adaptability and convergence. This research emphasizes the importance of hyperparameter tuning and advanced optimization strategies in achieving precise and early AML diagnoses. The insights gained contribute to the development of reliable machine learning models that support personalized and effective treatment regimens, paving the way for improved clinical outcomes.

#### ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude to Dr. Zuraidi Saad, my supervisor, for his unwavering guidance, insightful advice, and constant encouragement throughout the course of this research project. His expertise, patience, and constructive feedback have been invaluable in shaping the direction and success of this study. I am truly grateful for his dedication and mentorship, which have inspired me to strive for excellence in my work.

I would also like to extend my heartfelt thanks to the College of Engineering, Universiti Teknologi MARA (UiTM) Permatang Pauh, for providing the necessary facilities, resources, and a supportive academic environment that made this research possible. The access to state-of-the-art tools and collaborative opportunities greatly contributed to the development and completion of this project.

My sincere appreciation goes to my colleagues and peers who have shared their thoughts, constructive criticism, and encouragement throughout this journey. Their valuable insights and willingness to collaborate have played a significant role in enhancing the quality of this research.

Furthermore, I am profoundly thankful to my family and friends for their unwavering support, patience, and understanding. Their belief in me has been a constant source of strength, motivation, and inspiration during the challenges and milestones of this research.

Lastly, I wish to acknowledge all individuals, directly or indirectly, who have contributed to the completion of this project. Your support, kindness, and belief in my work have been truly instrumental. To all, thank you for making this journey a rewarding and memorable experience.

### **TABLE OF CONTENTS**

| AUT                                 | HOR'S               | DECLARATION                   | i    |
|-------------------------------------|---------------------|-------------------------------|------|
| ABS                                 | ГRACT               |                               | ii   |
| ACKNOWLEDGEMENT                     |                     | iii                           |      |
| TABLE OF CONTENTS<br>LIST OF TABLES |                     |                               | iv   |
|                                     |                     |                               | vii  |
| LIST                                | OF FIG              | GURES                         | viii |
| LIST                                | OF AB               | BBREVIATIONS                  | x    |
|                                     |                     |                               |      |
| СНА                                 | PTER                | I INTRODUCTION                | 1    |
| 1.1                                 | RESEARCH BACKGROUND |                               | 1    |
| 1.2                                 | PROBLEM STATEMENT   |                               | 3    |
| 1.3                                 | OBJECTIVES          |                               | 5    |
| 1.4                                 | SCOP                | PE OF STUDY                   | 6    |
|                                     |                     |                               |      |
| CHAPTER 2 LITERATURE REVIEW         |                     | 7                             |      |
| 2.1                                 | INTRODUCTION        |                               | 7    |
| 2.2                                 | INTR                | ODUCTION TO LEUKEMIA DISEASE  | 8    |
|                                     | 2.2.1               | Types of Leukemia             | 8    |
|                                     | 2.2.2               | Pathophysiology               | 9    |
|                                     | 2.2.3               | Symptoms of Leukemia          | 9    |
|                                     | 2.2.4               | Diagnosis of Leukemia         | 10   |
| 2.3                                 | DATA                | ASET                          | 11   |
| 2.4                                 | MAC                 | HINE LEARNING                 | 12   |
|                                     | 2.4.1               | Conventional Machine Learning | 12   |
|                                     | 2.4.2               | Deep Machine Learning         | 14   |
| 2.5                                 | SUM                 | MARY                          | 15   |
|                                     |                     |                               |      |
| СПА                                 | DTED 2              | 2 δέδελος η μετησροί ος ν     | 16   |

| CHAPTER 3 RESEARCH METHODOLOGY |              |    | 10 |
|--------------------------------|--------------|----|----|
| 3.1                            | INTRODUCTION |    | 16 |
|                                |              | iv |    |