

UNIVERSITI TEKNOLOGI MARA

**CNN-BASED FACIAL EMOTION
RECOGNITION FOR MENTAL
HEALTH APPLICATIONS**

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CNN-BASED FACIAL EMOTION RECOGNITION FOR MENTAL HEALTH APPLICATIONS

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This thesis was prepared under the supervision of the project supervisor, Adeline Engkamat. It was submitted to the Faculty of Computer and Mathematical Sciences and was accepted in partial fulfilment of the requirements for degree of Bachelor of Computer Science (Hons.).

Approved by



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ABSTRACT

Facial emotions serve as important diagnostic markers in psychiatric assessment, functioning as objective indicators of a patient's psychological status. Unfortunately, therapists often have trouble remembering patients' emotions during sessions, and conventional methods like questionnaires and clinician-rated scales are subject to subjectivity, limiting diagnosis. On the other hand, many existing FER approaches operate in real-time, providing live classification rather than a persistent record for post-session review. Demographic bias also remains a major challenge in FER systems due to unrepresentative data, causing a representation gap for underrepresented groups. To overcome this, this project proposes a FER System designed to capture and log patient facial expressions via a CNN framework. System execution began by evaluating three prominent deep learning architectures: ResNet50V2, MobileNetV2, and EfficientNet-B0, utilizing the FER2013 dataset. The project then compared three training approaches: FER2013-trained, local dataset-trained, and FER2013-pretrained with local dataset fine-tuning. This localized Malaysian FER dataset was specifically introduced to counteract the heavy Western bias inherent in standard benchmarks like FER2013. Finally, an offline, desktop-based application, MyFERS, was developed to perform interval-based facial emotion analysis, supporting post-session clinical reflection. By generating an Emotional Trajectory Report, this offline approach prevents the cognitive overload that live, real-time FER systems typically impose on therapists. ResNet50V2 was selected as the core architecture, achieving a 69.61% accuracy rate. Furthermore, refining the model pre-trained on FER2013 with local data proved the superior training protocol, yielding an accuracy of 57.14%. This local fine-tuning successfully mitigated a severe domain shift, restoring system accuracy after the base FER2013 model experienced a performance drop to 44.49% when applied to local demographics. From system testing with 18 individuals, MyFERS scored 57% accuracy, 61% precision, 57% recall and 56% F1-score. Despite constraints across dataset parameters, training phases, and evaluation boundaries, this project establishes a foundational benchmark for domain-specific FER architectures.

TABLE OF CONTENTS

CONTENT	PAGE
SUPERVISOR APPROVAL	ii
STUDENT DECLARATION	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	xi
LIST OF TABLES	xiv
LIST OF ABBREVIATIONS	xvi
 CHAPTER ONE : INTRODUCTION	
 1.1 Introduction	1
1.2 Background of Study	1
1.3 Problem Statement	2
1.4 Aim & Objectives	4
1.4.1 Project's Aim	4
1.4.2 Project's Objectives	4
1.5 Scopes	5
1.5.1 Target Users	5
1.5.2 System Function	6
1.5.3 Application Platform	6