

# TABLE OF CONTENTS

## FRONT PAGE

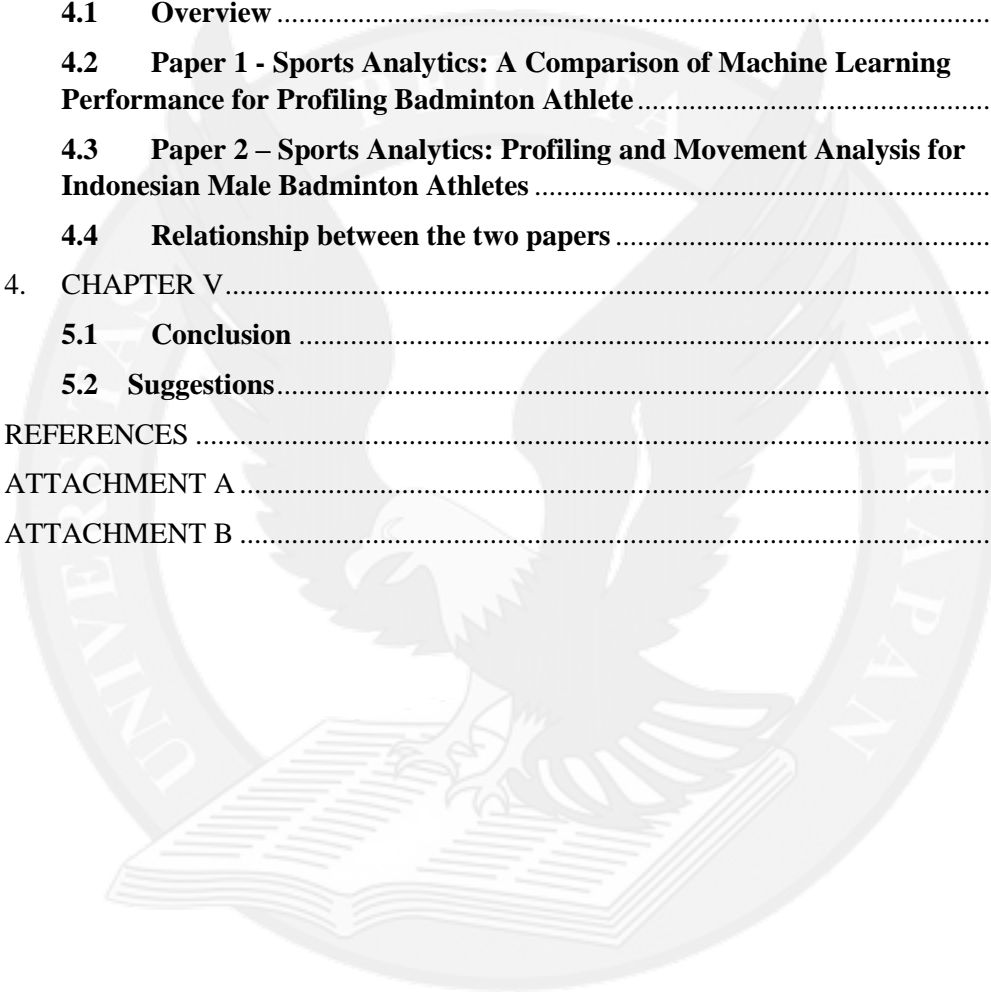
## ORIGINALITY STATEMENT OF THE THESIS

## THESIS SUPERVISOR'S APPROVAL

## THESIS EXAMINATION TEAM'S APPROVAL

ABSTRACT.....	v
OPENING REMARKS.....	vii
TABLE OF CONTENTS.....	ix
TABLE OF FIGURES.....	xi
LIST OF TABLES.....	xii
TABLE OF ATTACHMENTS.....	xiii
1. CHAPTER I.....	1
1.1 Background.....	1
1.2 Problem Identification.....	5
1.3 Problem Boundaries.....	6
1.4 Problem Formulation.....	6
1.5 Research Purpose.....	7
1.6 Thesis Outline.....	7
2. CHAPTER II.....	9
2.1 Badminton.....	9
2.2 Scoring in badminton.....	10
2.3 Sports Analytics.....	10
2.4 Athlete Profiling.....	12
2.5 Support Vector Machine.....	14
2.6 Random Forest.....	17
2.7 K-means clustering.....	18
2.8 Hierarchical clustering.....	19
2.9 Correlation.....	20
2.10 YOLO Object Detection.....	22
2.11 Tracker.....	24
2.12 Evaluation Tools for Classification Models.....	25
2.13 R <sup>2</sup> Score for Regression.....	27
CHAPTER III.....	28
3.1 Overview.....	28

3.2	Score Data Analysis .....	30
3.2.1	Score Data Collection & Preparation.....	32
3.2.2	Model Training & Predictions .....	38
3.3	Video Analysis .....	42
3.3.1	Video Data Collection & YOLO Model Training .....	43
3.3.2	Video Data Analysis.....	46
3.4	Test Cases .....	47
3.	CHAPTER IV .....	50
4.1	Overview .....	50
4.2	Paper 1 - Sports Analytics: A Comparison of Machine Learning Performance for Profiling Badminton Athlete .....	50
4.3	Paper 2 – Sports Analytics: Profiling and Movement Analysis for Indonesian Male Badminton Athletes .....	51
4.4	Relationship between the two papers .....	52
4.	CHAPTER V.....	55
5.1	Conclusion .....	55
5.2	Suggestions.....	56
	REFERENCES .....	57
	ATTACHMENT A .....	1
	ATTACHMENT B .....	1



## TABLE OF FIGURES

Figure 2.1: Example of an elbow method used on a dataset [36] .....	19
Figure 2.2: Example of a hierarchical clustering dendogram [37].....	20
Figure 2.3: Illustration of YOLO’s object detection process [11] .....	24
Figure 2.4: Example of a confusion matrix [50] .....	26
Figure 3.1: Diagram for profiling process of an athlete.....	30
Figure 3.2: Score data analysis process diagram .....	32
Figure 3.3: Example of a game_scores column followed by the X and Y arrays created from the column value for regression.....	34
Figure 3.4: Pseudocode for clustering data preparation.....	36
Figure 3.5: Example of an initial athlete score table for clustering .....	37
Figure 3.6: Example of a clustering data (game 1) for an athlete .....	37
Figure 3.7: Example data for classification (game 1) .....	38
Figure 3.8: Pseudocode for regression models .....	39
Figure 3.9: Pseudocode for clustering functions.....	40
Figure 3.10: Pseudocode for classification models.....	41
Figure 3.11: Diagram for video analysis process.....	42
Figure 3.12: Dataset configuration file for YOLOv5 model training .....	44
Figure 3.13: Code to start training a YOLOv5 model with a custom dataset.....	46
Figure 3.14: Code to resume YOLOv5 model training using the last saved weights .....	46
Figure 3.15: Code to perform video inference using trained YOLOv5 model.....	46

## LIST OF TABLES

Table 3.1: Classes of objects to be labelled for YOLO model training and object detection .....	44
---	----



## TABLE OF ATTACHMENTS

Paper 1

A-1

Paper 2

B-1

