

# TABLE OF CONTENTS

## ORIGINALITY STATEMENT OF THE THESIS

## THESIS SUPERVISOR'S APPROVAL

## THESIS EXAMINATION COMMITTEE

<b>ABSTRACT</b> .....	v
<b>ACKNOWLEDGEMENTS</b> .....	vii
<b>TABLE OF CONTENTS</b> .....	ix
<b>LIST OF FIGURES</b> .....	xi
<b>LIST OF TABLES</b> .....	xii
<b>1. CHAPTER I : INTRODUCTION</b> .....	1
1.1 Research Background .....	1
1.2 Problem Statements.....	2
1.3 Research Objectives.....	2
1.4 Benefits of the Research .....	3
1.5 Thesis Structure.....	3
<b>2. CHAPTER II : LITERATURE REVIEW</b> .....	5
2.1 Auto-Regressive Integrated Moving Average (ARIMA) .....	5
2.2 Long Short-Term Memory (LSTM) .....	6
2.3 Method Comparison and Related Studies .....	7
2.3.1 Stock price prediction.....	8
2.3.2 Comparison of ARIMA and LSTM in time series forecasting.....	8
2.3.3 Forecast of car sharing user demand .....	9
<b>3. CHAPTER III : MODELLING AND EXPERIMENT</b> .....	10
3.1 Dataset.....	10
3.2 Modelling and Forecasting.....	13
3.4.1 ARIMA Modelling .....	15
3.4.2 LSTM Modelling .....	15
3.4 Performance Metrics .....	15
3.4.1 Model Accuracy .....	16
3.4.2 Run-time Performance .....	16
3.5 Experiments .....	17
3.5.1 Experiment on Short and Long Data Points.....	17

3.5.2	Experiment on Missing Values .....	18
<b>4.</b>	<b>CHAPTER IV : RESULTS AND DISCUSSION .....</b>	<b>19</b>
4.1	Experiment on Short and Long Data Points.....	19
4.1.1	Analysis of Model Accuracy.....	22
4.1.2	Analysis of Run-time Performance.....	23
4.2	Experiment on Missing Values .....	24
4.2.1	Analysis of Model Accuracy.....	26
4.2.2	Analysis of Run-time Performance.....	27
4.3	Publications.....	28
4.3.1	International Conference on Information Technology, Computer and Electrical Engineering .....	28
4.3.2	Bulletin of Electrical Engineering and Informatics .....	33
<b>5.</b>	<b>CHAPTER V : CONCLUSION AND FUTURE WORK .....</b>	<b>51</b>
5.1	Conclusion .....	51
5.2	Future Work.....	51
	<b>BIBLIOGRAPHY .....</b>	<b>52</b>
	<b>BIOGRAPHY .....</b>	<b>57</b>

## LIST OF FIGURES

Figure 2.1 LSTM Cell Structure [21].....	7
Figure 3.1 Indonesia’s Consumer Price Index .....	10
Figure 3.2 Dataset with Different Numbers of Data Points .....	11
Figure 3.3 Dataset with Different Rates of Missing Values .....	13
Figure 3.4 ARIMA and LSTM Modelling Steps .....	14
Figure 4.1 Results of Short and Long Data Points Experiment .....	20
Figure 4.2 Test and Predictions on Numbers of Data Points Experiment 7.....	21
Figure 4.3 Test and Predictions on Missing Values Experiment 8.....	25
Figure 4.4 Accuracy Results of Missing Values Experiment .....	27
Figure 4.5 Run-time Performance Results of Missing Values Experiment 10.....	28

## LIST OF TABLES

Table 3.1 Dataset Comparison .....	12
Table 3.2 Environment Specification.....	17
Table 4.1 Results of the Experiment on Short and Long Data Points .....	19
Table 4.2 Results of the Experiment on Missing Values .....	24

