UNIVERSITAS
GADJAH MADA
**FORECASTING SUGARCANE YIELD USING MACHINE LEARNING ALGORITHM**
FAHMI ZUFARIAN, Anny Kartika Sari, S. Si., M.Sc., Ph. D
**Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/**

# TABLE OF CONTENTS

**SURAT KETERANGAN** ..... **ii**

**PLAGIARISM FREE LETTER** ..... **iii**

**ACKNOWLEDGEMENT** ..... **iv**

**TABLE OF CONTENTS** ..... **v**

**LIST OF FIGURES** ..... **viii**

**LIST OF TABLES** ..... **ix**

**ABSTRACT** ..... **x**

**INTRODUCTION** ..... **1**

1.1 Research Background ..... 1
1.2 Research Problem ..... 3
1.3 Research Scope ..... 4
1.4 Research Objective ..... 4
1.5 Research Benefits ..... 5
1.6 Research Methodology ..... 5
1.7 Thesis Organization ..... 6

**LITERATURE REVIEW** ..... **8**

**THEORETICAL FRAMEWORK** ..... **16**

3.1 Prediction ..... 16
3.2 Linear Regression ..... 16
3.3 Multi Layer Perceptron ..... 17
3.4 Support Vector Regression ..... 18
3.5 Adam ..... 20
3.6 Rectified Linear Unit ..... 21
3.7 Root Mean Squared Error ..... 22

UNIVERSITAS
GADJAH MADA
**FORECASTING SUGARCANE YIELD USING MACHINE LEARNING ALGORITHM**
FAHMI ZUFARIAN, Anny Kartika Sari, S. Si., M.Sc., Ph. D
**Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/**

3.8 Mean Squared Error ..... 22
3.9 Sugarcane Growth ..... 22
3.9.1 Sugarcane Cultivation in East Java ..... 23
3.9.2 Temperature and Precipitation to Yield ..... 24
3.10 Crop Productivity ..... 24

**MODEL DESIGN ..... 25**
4.1 Research Description ..... 25
4.2 Research Steps ..... 25
4.3 Data Acquisition ..... 27
4.4 Research Plan ..... 28
4.5 Predictors Selection ..... 29
4.6 Data Preprocessing ..... 30
4.7 Multi Layer Perceptron Model ..... 32
4.8 Multiple Linear Regression Model ..... 34
4.9 Support Vector Regression Model ..... 34
4.10 Model Training ..... 35

**IMPLEMENTATION ..... 36**
5.1 Data Collection and Cleaning ..... 36
5.1.1 Sugarcane Yield Dataset ..... 37
5.1.2 Average Temperature and Precipitation Dataset ..... 37
5.2 Import All Libraries ..... 37
5.3 Read Dataset Feature ..... 38
5.4 Showing Sugarcane Yield data ..... 39
5.5 Split the Dataset into Train and Test ..... 39
5.6 Normalization using Min-Max Scaling ..... 40
5.7 Index Sorting ..... 41
5.8 Building the Regressor models ..... 41
5.9 Prediction ..... 42

UNIVERSITAS
GADJAH MADA
**FORECASTING SUGARCANE YIELD USING MACHINE LEARNING ALGORITHM**
FAHMI ZUFARIAN, Anny Kartika Sari, S. Si., M.Sc., Ph. D
**Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/**

5.10 Evaluation ..... 44

**RESULTS AND DISCUSSIONS ..... 45**

6.1 Design of Experiment ..... 45

6.1.1 Raw Sugarcane Yield Data Results ..... 45

6.1.2 Raw Temperature and Precipitation Data Results ..... 47

6.1.3 Merged Data Results ..... 49

6.2 Implementation of Training and Prediction ..... 51

6.2.1 Multiple Linear Regression ..... 51

6.2.2 Multi Layer Perceptron ..... 53

6.2.3 Support Vector Regression ..... 57

6.3 Model Comparison ..... 59

**CONCLUSIONS AND FUTURE WORK ..... 61**

7.1 Conclusions ..... 61

7.2 Future Work ..... 61

**REFERENCES ..... 63**