

TABLE OF CONTENTS

APPROVAL PAGE I.....	ii
APPROVAL PAGE II.....	iii
PREFACE	iv
ABSTRACT.....	v
ABSTRAK.....	vi
TABLE OF CONTENTS	vii
LIST OF TABLES.....	x
LIST OF FIGURES.....	xi
LIST OF APPENDICES	xii
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Identification.....	4
1.3 Problem Limitation	5
1.4 Aim of Study	5
CHAPTER 2 LITERATURE REVIEW.....	6
2.1. Clustering Fundamentals.....	6
2.1.1 Clustering	6
2.1.2 Model-Based Clustering.....	8
2.2. Gaussian Mixture Model.....	10
2.2.1 Gaussian Distribution	10
2.2.2 Gaussian Mixture Model (GMM) Definition.....	12
2.2.3 Non-Multicollinearity Assumption in GMM.....	14
2.3. Parameter Estimation in GMM	16
2.3.1 Expectation-Maximization (EM) Algorithm	16
2.3.1.1 Expectation Step.....	16
2.3.1.2 Maximization Step	17
2.3.2 Initialization and Stopping Criteria	25
2.3.2.1 Initialization with Model-Based Agglomerative Hierarchical Clustering (MBAHC)	25
2.3.2.2 Stopping Criteria	26
2.4. Model Evaluation	28
2.4.1 Normality Test	28

2.4.2	Bayesian Information Criterion (BIC).....	29
2.5.	Nutritional Status and Their Importance	30
2.5.1	Overview of Health and Nutritional Status	30
2.5.2	Interconnectivity among Undernutritional Variables	34
2.5.3	Interconnectivity between Undernutritional and Overnutritional Variables	34
2.5.4	Nutritional Challenges in Java Island.....	35
CHAPTER 3	RESEARCH METHOD	37
3.1.	Data Type and Resource	37
3.2.	Data Analysis Step	38
3.3.	Flowchart.....	40
CHAPTER 4	RESULT AND DISCUSSION.....	42
4.1.	Descriptive Overview.....	42
4.1.1	Stunting.....	43
4.1.2	Wasting	43
4.1.3	Underweight	43
4.1.4	Overweight	44
4.2.	Non-Multicollinearity Test.....	44
4.3.	Model Implementation	45
4.3.1	Data Compatibility with Gaussian Mixture Model	45
4.3.2	Parameter Initialization	47
4.4.	Clustering Results	49
4.4.1	Optimal Number of Clusters	49
4.4.2	Normality Test	50
4.5.	Cluster Interpretation.....	50
4.5.1	Mean Interpretation	50
4.5.2	Covariance Matrix Interpretation of Cluster 1	52
4.5.3	Covariance Matrix Interpretation of Cluster 2	53
4.5.4	Mixing Coefficient Interpretation.....	55
4.5.5	Visualization of Clusters and Labeling.....	55
4.5.6	Uncertainty in Soft-Clustering	58
CHAPTER 5	CONCLUSION.....	60
5.1	Conclusion.....	60

5.2 Recommendation.....	61
REFERENCES.....	63
APPENDICES	67