

CONTENTS

PREFACE	vii
CONTENTS	viii
LIST OF TABLES	xi
LIST OF FIGURES	xii
INTISARI	1
ABSTRACT	2
I INTRODUCTION	3
1.1 Research Background	3
1.2 Problem Formulation	5
1.3 Research Objective	6
1.4 Research Scope	6
1.5 Research Advantage	6
1.6 Research Schematic	7
II LITERATURE REVIEW	9
2.1 Application of Convolutional Neural Networks for Medical Image Segmentation	9
2.2 Loss Function in Segmentation Models	14
2.3 Knowledge Distillation	15
2.4 Medical Image Analysis	17
III RESEARCH METHODOLOGY	20
3.1 Research Description	20
3.2 Dataset Description	21
3.2.1 Data Acquisition by Authors	22
3.3 Data Pre-Processing	23
3.4 Model Architecture	26
3.4.1 Model Architecture of U-Net	26
3.5 Segmentation Model	31

3.6	Training Configuration	31
3.6.1	Hyperparameter Settings and Optimization Strategy	31
3.6.2	Hybrid Loss Function Strategy	32
3.7	Knowledge Distillation Model	33
3.7.1	Teacher Model	35
3.7.2	Student Model	36
3.7.3	Knowledge Distillation Hyperparameter Determination	37
3.7.4	Distilled Knowledge Model Training	40
3.8	Evaluation Procedure	41
3.8.1	Segmentation Performance Metrics	41
3.8.2	Segmentation Computational Efficiency	42
IV	IMPLEMENTATION	44
4.1	Implementation Tools	44
4.2	Library Preparation	44
4.3	Pre-Processing Configuration Implementation	47
4.4	Pre-Processing Implementation	48
4.5	Data Splitting Implementation	49
4.6	Teacher Model Implementation	50
4.6.1	ResUNet-152 Model Component Module	50
4.6.2	ResUNet-152 Main Model Components	51
4.7	Student Model Implementation	52
4.7.1	ResUNet-18 Model Component Module	52
4.7.2	ResUNet-18 Main Model Components	53
4.8	Teacher and Student Model Training Implementation	54
4.9	Knowledge Distillation Model Training Implementation	55
4.10	Model Evaluation Implementation	56
V	RESULT AND DISCUSSION	58
5.1	Pre-Processing Result	58
5.2	Model Training Result	60
5.2.1	Teacher Model using ResNet-152 Architecture	61
5.2.2	Student Model using ResNet-18 Architecture	82
5.2.3	Distilled Model using ResNet-18 Architecture	87
5.3	Research Analysis	88
5.3.1	Quantitative Analysis	88

5.3.2	Qualitative Analysis	93
5.3.3	External Validation and Domain Shift	97
VI CONCLUSION AND RECOMMENDATION		98
6.1	Conclusion	98
6.2	Recommendation	99
BIBLIOGRAPHY		100
APPENDIX		108