



## DAFTAR ISI

HALAMAN JUDUL.....	i
PERNYATAAN BEBAS PLAGIARISME.....	ii
KATA PENGANTAR .....	v
DAFTAR TABEL.....	ix
DAFTAR GAMBAR .....	x
DAFTAR LAMBANG DAN SINGKATAN .....	xii
INTISARI.....	xiv
ABSTRACT.....	xv
BAB I PENDAHULUAN.....	1
I.1. Latar Belakang.....	1
I.2. Perumusan Masalah .....	3
I.2.1. Batasan Masalah .....	4
I.3. Tujuan Penelitian .....	5
I.4. Manfaat Penelitian .....	5
BAB II TINJAUAN PUSTAKA.....	6
BAB III DASAR TEORI .....	10
III.1. Nodul Paru .....	10
III.2. Pengolahan Citra Medis .....	11
III.2.1. Citra Digital.....	11
III.2.2. <i>Computed Tomography</i> .....	13
III.3. <i>Artificial Intelligence</i> .....	19
III.4. <i>Machine learning</i> .....	21
III.5. <i>Deep learning</i> .....	21
III.5.1. <i>Convolutional Neural Networks</i> .....	23
III.5.2. <i>Activation dan Loss Function</i> .....	30
III.6. <i>Transfer learning</i> .....	34
III.7. <i>Fine Tuning</i> .....	35
III.8. <i>EfficientNet-L2 (Noisy Student)</i> .....	38
III.9. <i>Data augmentation</i> .....	42





III.10. <i>Backpropagation</i> .....	44
III.11. <i>Regularization</i> .....	46
III.12. <i>Optimizer</i> .....	47
III.13. Evaluasi Model.....	48
III.13.1. <i>Precision, Recall, dan F1-score</i> .....	48
III.13.2. Akurasi, Kurva <i>Precision-Recall</i> .....	50
BAB IV PELAKSANAAN PENELITIAN .....	52
IV.1. Alat dan Bahan Penelitian.....	52
IV.1.1. Alat Penelitian.....	52
IV.1.2. Bahan Penelitian .....	53
IV.2. Tata Laksana Penelitian .....	55
IV.3. Analisis Data dan Kinerja Model.....	57
IV.3.1. Analisis <i>Dataset</i> .....	57
IV.3.2. Peningkatan Variasi Data.....	58
IV.3.3. Arsitektur dan Kompleksitas Model .....	59
IV.3.4. Rancangan dan Analisis Variasi <i>Loss Function</i> pada Model EfficientNet-L2 ( <i>Noisy Student</i> ) .....	61
BAB V HASIL DAN PEMBAHASAN.....	63
V.1. Analisis dan Interpretasi Hasil Klasifikasi Tiap Model .....	63
V.1.1. Model Cross-Entropy <i>Baseline</i> .....	63
V.1.2. Model Cross-Entropy dengan <i>Class Weight</i> .....	66
V.1.3. Model Cross-Entropy dengan <i>Class Weight</i> dan <i>Label Smoothing</i> ...	69
V.1.4. Model Focal <i>Loss</i> ( $\gamma=2.0$ ) .....	72
V.2. Analisis Komparatif Variasi <i>Loss Functions</i> .....	75
BAB VI KESIMPULAN DAN SARAN .....	77
VI.1. Kesimpulan .....	77
VI.2. Saran .....	78
LAMPIRAN.....	83
LAMPIRAN A <i>ETICHAL CLEARANCE</i> .....	84

