

DAFTAR ISI

| | |
|---|-------------|
| HALAMAN PENGESAHAN PEMBIMBING | ii |
| HALAMAN PENGESAHAN PENGUJI..... | iii |
| SURAT PERNYATAAN KARYA ASLI TUGAS AKHIR..... | iv |
| PERNYATAAN BEBAS PLAGIASI..... | v |
| ABSTRAK..... | vi |
| ABSTRACT | vii |
| KATA PENGANTAR | viii |
| DAFTAR ISI | ix |
| DAFTAR GAMBAR..... | xii |
| DAFTAR TABEL..... | xiv |
| BAB I PENDAHULUAN | 1 |
| 1.1 Latar Belakang | 1 |
| 1.2 Rumusan Masalah..... | 2 |
| 1.3 Batasan Masalah | 2 |
| 1.4 Tujuan Penelitian | 3 |
| 1.5 Manfaat Penelitian | 3 |
| 1.6 Tahapan Penelitian | 3 |
| 1.7 Sistematika Penulisan | 3 |
| BAB II TINJAUAN LITERATUR..... | 5 |
| 2.1 Ekspresi Wajah..... | 5 |
| 2.2 Computer Vision | 5 |
| 2.3 CNN | 6 |
| 2.3.1 Convolution Layer..... | 6 |
| 2.3.2 Pooling Layer | 8 |
| 2.3.3 Fully-Connected Layer | 8 |
| 2.3.4 Fungsi Aktivasi | 9 |
| 2.4 VGG-16 (<i>Visual Geometry Group-16 Weight Layer</i>) | 10 |
| 2.5 YOLO (<i>You Only Look Once</i>)..... | 10 |
| 2.6 YOLOv8 | 11 |
| 2.7 Arsitektur YOLOv8 | 12 |
| 2.7.1 Backbone | 13 |

| | | |
|---|---|-----------|
| 2.7.2 | Neck..... | 15 |
| 2.7.3 | Head..... | 16 |
| 2.8 | Pre-trained Model YOLOv8 | 16 |
| 2.9 | Confusion Matrix..... | 17 |
| 2.9.1 | Accuracy..... | 18 |
| 2.9.2 | Precision | 18 |
| 2.9.3 | Recall..... | 18 |
| 2.9.4 | Mean Average Precision | 18 |
| 2.10 | Data Augmentasi..... | 18 |
| 2.11 | Penelitian Terkait | 19 |
| BAB III METODOLOGI PENELITIAN..... | | 22 |
| 3.1 | Identifikasi Masalah..... | 22 |
| 3.2 | Studi Literatur | 22 |
| 3.3 | Pengumpulan Data..... | 23 |
| 3.4 | Data Pre-Processing..... | 23 |
| 3.4.1 | Pre-Processing untuk Mendeteksi Wajah | 23 |
| 3.4.2 | Pre-Processing untuk Mengklasifikasi Ekspresi Wajah | 25 |
| 3.5 | Pemodelan YOLOv8..... | 27 |
| 3.5.1 | Input Layer | 29 |
| 3.5.2 | Convolutional Layer..... | 29 |
| 3.5.3 | Batch Normalization..... | 30 |
| 3.5.4 | Fungsi Aktivasi SiLU | 32 |
| 3.5.5 | Split..... | 32 |
| 3.5.6 | Concat..... | 33 |
| 3.5.7 | Max Pooling | 33 |
| 3.5.8 | Upsample..... | 33 |
| 3.5.9 | Prediction Layer | 34 |
| 3.6 | Pemodelan CNN | 34 |
| 3.6.1 | Input Layer | 35 |
| 3.6.2 | Convolutional Layer..... | 36 |
| 3.6.3 | Batch Normalization..... | 37 |
| 3.6.4 | Fungsi Aktivasi ReLU | 38 |
| 3.6.5 | Max Pooling | 39 |
| 3.6.6 | Fully Connected layer..... | 39 |

| | | |
|--|---|-----------|
| 3.7 | Rancangan Pengujian..... | 41 |
| 3.7.1 | Rancangan Pengujian YOLOv8 | 41 |
| 3.7.2 | Rancangan Pengujian CNN..... | 41 |
| 3.8 | Evaluasi..... | 41 |
| 3.8.1 | Evaluasi Model YOLOv8 | 42 |
| 3.8.2 | Evaluasi Model CNN | 42 |
| 3.9 | Pengembangan Sistem | 42 |
| 3.9.1 | Planning | 42 |
| 3.9.2 | Design..... | 43 |
| 3.9.3 | Coding | 45 |
| 3.9.4 | Testing | 45 |
| BAB IV HASIL DAN PEMBAHASAN | | 47 |
| 4.1 | Hasil..... | 47 |
| 4.1.1 | Pre-Processing untuk Mendeteksi Wajah | 47 |
| 4.1.2 | Pre-Processing untuk Mengklasifikasi Ekspresi Wajah | 49 |
| 4.1.3 | Pemodelan YOLOv8 | 50 |
| 4.1.4 | Pemodelan CNN..... | 52 |
| 4.1.5 | Pengujian dan Evaluasi Model YOLOv8 | 55 |
| 4.1.6 | Pengujian dan Evaluasi Model CNN..... | 59 |
| 4.1.7 | Pengembangan Sistem..... | 67 |
| 4.1.8 | Pengujian Sistem | 72 |
| 4.2 | Pembahasan | 72 |
| 4.2.1 | Pembahasan Model YOLOv8..... | 72 |
| 4.2.2 | Pembahasan Model CNN | 73 |
| 4.2.3 | Pembahasan Sistem | 73 |
| BAB V KESIMPULAN DAN SARAN..... | | 74 |
| 5.1 | Kesimpulan | 74 |
| 5.2 | Saran | 74 |
| DAFTAR PUSTAKA | | 75 |