

DAFTAR ISI

HALAMAN PENGESAHAN	ii
PERNYATAAN BEBAS PLAGIASI	iv
HALAMAN PERSEMBAHAN	iv
KATA PENGANTAR	v
DAFTAR ISI	vi
DAFTAR TABEL	xi
DAFTAR GAMBAR	xii
DAFTAR SINGKATAN	xv
INTISARI	xvi
ABSTRACT	xvii
BAB I Pendahuluan	1
1.1 Latar Belakang	1
1.2 Rumusan Masalah	2
1.3 Tujuan Penelitian	2
1.4 Batasan Penelitian	2
1.5 Manfaat Penelitian	3
1.6 Sistematika Penulisan	3
BAB II Tinjauan Pustaka dan Dasar Teori	5
2.1 Tinjauan Pustaka	5
2.2 Dasar Teori	12
2.2.1 Klasifikasi Biner (<i>Binary Classification</i>)	12
2.2.2 <i>Imbalanced Dataset</i> dan <i>Balanced Dataset</i>	12
2.2.3 Augmentasi Data (<i>Data Augmentation</i>)	12
2.2.4 Pembagian <i>Dataset</i> (<i>Splitting Dataset</i>)	13
2.2.5 Transformasi Fourier (<i>Fourier Transform</i>)	13
2.2.6 <i>Short Time Fourier Transform</i> (STFT)	14
2.2.7 Spektrogram	15
2.2.8 Pembelajaran Mesin (<i>Machine Learning</i>)	15
2.2.9 Jaringan Syaraf Tiruan (<i>Neural Network</i>)	16
2.2.10 Operasi Matematis dalam Jaringan Syaraf Tiruan (<i>Neural Network</i>)	17
2.2.10.1 Lapisan Masukan (<i>Input Layer</i>)	17
2.2.10.2 <i>Reshape</i>	17
2.2.10.3 Konvolusi (<i>Convolution</i>)	17
2.2.10.4 Transpose Konvolusi	18
2.2.10.5 Fungsi Aktivasi (<i>Activation Function</i>)	18
2.2.10.6 <i>Batch Normalization</i>	19

2.2.10.7	<i>Flatten</i>	19
2.2.10.8	<i>Dense</i>	19
2.2.10.9	<i>Keluaran (Output)</i>	20
2.2.11	<i>Model Generatif (Generative Modelling)</i>	20
2.2.11.1	<i>Generative Adversarial Networks (GAN)</i>	20
2.2.11.2	<i>Variational Autoencoder (VAE)</i>	20
2.2.12	<i>Loss Function</i>	21
2.2.12.1	<i>Generative Adversarial Networks (GAN)</i>	21
2.2.12.2	<i>Variational Autoencoder (VAE)</i>	22
2.2.13	<i>Model Klasifikator</i>	23
2.2.13.1	<i>Support Vector Machine (SVM)</i>	23
2.2.13.2	<i>Random Forest (RF)</i>	23
2.2.13.3	<i>K-Nearest Neighbour (KNN)</i>	24
2.2.14	<i>Hyperparameter Tuning</i>	24
2.2.15	<i>Metrik Evaluasi Model Generatif</i>	24
2.2.15.1	<i>Structural Similarity Index Measure (SSIM)</i>	24
2.2.15.2	<i>Inception Score (IS)</i>	25
2.2.15.3	<i>Fréchet Inception Distance (FID)</i>	25
2.2.15.4	<i>Discriminator Score</i>	26
2.2.16	<i>Metrik Evaluasi Model Klasifikator</i>	26
2.2.16.1	<i>Confusion Matrix</i>	27
2.2.16.2	<i>Akurasi</i>	27
2.2.16.3	<i>Presisi</i>	28
2.2.16.4	<i>Recall</i>	28
2.2.16.5	<i>F1 Score</i>	28
BAB III	<i>Metode Penelitian</i>	29
3.1	<i>Alat dan Bahan Penelitian</i>	29
3.1.1	<i>Alat Penelitian</i>	29
3.1.2	<i>Bahan Penelitian</i>	29
3.2	<i>Metode Penelitian</i>	31
3.2.1	<i>Pra-pengolahan (Preprocessing)</i>	31
3.2.1.1	<i>Analisis Data</i>	31
3.2.1.2	<i>Ekstraksi Fitur (Feature Extraction)</i>	34
3.2.1.3	<i>Pengolahan Citra (Image Processing)</i>	35
3.2.1.4	<i>Visualisasi Data (Data Visualization)</i>	36
3.2.2	<i>Perancangan Model Generatif</i>	37
3.2.2.1	<i>Deep Convolutional Generative Adversarial Networks (DCGAN)</i>	37
3.2.2.2	<i>Variational Autoencoder (VAE)</i>	42



3.2.3	Proses Pelatihan (<i>Training</i>) Model Generatif	49
3.2.3.1	<i>Deep Convolutional Generative Adversarial Networks</i> (DCGAN)	50
3.2.3.2	<i>Variational Autoencoder</i> (VAE).....	53
3.2.4	Proses Augmentasi Data (<i>Data Augmentation</i>) dengan Model Generatif.....	55
3.2.5	Persiapan & Pelatihan (<i>Training</i>) Model Klasifikator (Classifier) ..	56
3.2.6	Analisis dan Evaluasi Hasil	58
3.2.6.1	Hasil Model Generatif	58
3.2.6.2	Hasil Model Klasifikator	59
3.3	Alur Tugas Akhir.....	62
BAB IV	Hasil dan Pembahasan.....	64
4.1	Pembahasan Hasil Model Generatif.....	64
4.1.1	Data Hasil <i>Generative Adversarial Networks</i> (GAN)	65
4.1.2	Data Hasil <i>Variational Autoencoder</i> (VAE)	69
4.1.3	Analisis	72
4.2	Pembahasan Hasil Klasifikasi Model Klasifikator (<i>Classifier</i>)	73
4.2.1	Dataset Tanpa Augmentasi Data	74
4.2.1.1	<i>Support Vector Machine</i> (SVM)	74
4.2.1.2	<i>Random Forest</i> (RF)	76
4.2.1.3	<i>K-Nearest Neighbour</i> (KNN)	77
4.2.2	Dataset Baru Hasil Augmentasi Data Menggunakan <i>Generative</i> <i>Adversarial Networks</i>	79
4.2.2.1	<i>Support Vector Machine</i> (SVM)	80
4.2.2.2	<i>Random Forest</i> (RF)	82
4.2.2.3	<i>K-Nearest Neighbour</i> (KNN)	83
4.2.3	Dataset Baru Hasil Augmentasi Data Menggunakan <i>Variational</i> <i>Autoencoder</i> (VAE)	86
4.2.3.1	<i>Support Vector Machine</i> (SVM)	86
4.2.3.2	<i>Random Forest</i> (RF)	88
4.2.3.3	<i>K-Nearest Neighbour</i> (KNN)	90
4.2.4	Analisis	92
BAB V	Kesimpulan dan Saran.....	101
5.1	Kesimpulan.....	101
5.2	Saran.....	102
DAFTAR PUSTAKA		103
LAMPIRAN		L-1
L.1	Model Generatif dan Hasil	L-1
L.1.1	Arsitektur Model Generatif	L-1



L.1.2	Hasil Data Sintetis Model GAN	L-3
L.1.3	Hasil Data Sintetis Model VAE	L-9
L.2	Source Code Penelitian	L-15
L.2.1	Script Menampilkan Waveform	L-15
L.2.2	Script Menampilkan Spektrum	L-15
L.2.3	Fungsi Membuat Spektrogram	L-15
L.2.4	Fungsi Pipeline Preprocessing.....	L-16
L.2.5	Fungsi Model Generator	L-18
L.2.6	Fungsi Model Discriminator.....	L-18
L.2.7	Fungsi Loss Model GAN	L-19
L.2.8	Pengaturan Parameter GAN	L-19
L.2.9	Fungsi Pelatihan GAN	L-19
L.2.10	Fungsi Plotting Loss Model Generatif	L-20
L.2.11	Fungsi <i>Generate</i> Data GAN	L-21
L.2.12	Fungsi <i>Reparametrization</i>	L-22
L.2.13	Fungsi Model VAE.....	L-22
L.2.14	Fungsi Loss VAE.....	L-23
L.2.15	Fungsi Pelatihan VAE.....	L-23
L.2.16	Fungsi Plot Loss VAE	L-24
L.2.17	Fungsi <i>Generate</i> Data Sintetis VAE.....	L-24
L.2.18	Fungsi SSIM	L-25
L.2.19	Fungsi IS	L-25
L.2.20	Fungsi FID	L-25
L.2.21	Fungsi DS	L-26
L.2.22	Fungsi Augmentasi Data GAN.....	L-27
L.2.23	Fungsi Augmentasi Data VAE.....	L-27
L.2.24	Fungsi Preprocessing Data	L-28
L.2.25	Parameter Pembagian Data	L-28
L.2.26	Hyperparameter Model Klasifikator	L-28
L.2.27	Fungsi Pelatihan Dengan Hyperparameter Tuning	L-29
L.2.28	Fungsi Evaluasi Model Klasifikator.....	L-29
L.3	Hasil Log GridSearch CV	L-30
L.3.1	<i>Dataset</i> Lama	L-30
L.3.1.1	<i>Support Vector Machine</i>	L-30
L.3.1.2	<i>Random Forest</i>	L-32
L.3.1.3	<i>KNN</i>	L-40
L.3.2	<i>Dataset</i> Baru GAN.....	L-41
L.3.2.1	<i>Support Vector Machine</i>	L-41
L.3.2.2	<i>Random Forest</i>	L-44



L.3.2.3	<i>KNN</i>	L-51
L.3.3	<i>Dataset Baru VAE</i>	L-54
L.3.3.1	<i>Support Vector Machine</i>	L-54
L.3.3.2	<i>Random Forest</i>	L-56
L.3.3.3	<i>KNN</i>	L-64