



VISI KOMPUTER DEEP LEARNING

by Kelompok 4



CONTENT

01

About Face
Recognition

02

Dataset

03

Preprocessing Data

04

DenseNet

05

ResNet

06

AlexNet

07

GoogleNet

08

VGG-16



ABOUT FACE RECOGNITION

Face recognition adalah teknologi yang mengidentifikasi atau memverifikasi identitas seseorang berdasarkan fitur wajah. Teknologi ini digunakan dalam berbagai bidang, seperti keamanan, pengawasan, otentikasi tanpa kontak, dan peningkatan pengalaman pengguna, misalnya dalam sistem pembayaran digital atau akses perangkat. Manfaatnya meliputi peningkatan keamanan, kemudahan verifikasi identitas, dan efisiensi operasional. Namun, tantangan terkait privasi dan etika juga perlu diperhatikan dalam penggunaannya.





DATASET YANG DIGUNAKAN

Dataset yang digunakan adalah dataset celeb A.
dengan Label Pria dan Wanita

- Dataset yang digunakan dalam pelatihan ini 52000 gambar
- Dengan label male dan female
- Data dibagi dalam Training, Validation dan Testing





TAHAP PRE-PROCESSING



Menggunakan Image Generator untuk Augmentasi Data (rescale, rotasi, flip, zoom, dsb.)



Melakukan Balancing Data



Membagi Data dalam 3 bagian
Total Train Sample Images : 34638
Total Test Sample Images : 5802
Total Validation Sample Images : 2858

PRE PROCESSING

IMAGE GENERATOR



```
1 train_df, test_df = train_test_split(df, test_size=0.2)
  test_df, validation_df = train_test_split(test_df, test_size=0.77)
```

```
2 print('Total Train Sample Images : ', len(train_df))
  print('Total Test Sample Images : ', len(test_df))
  print('Total Validation Sample Images : ', len(validation_df))
```

```
3 Total Train Sample Images : 3403
  Total Test Sample Images : 680
  Total Validation Sample Images : 1654
```

```
4 IMAGE_SIZE = (224, 224)
  BATCH_SIZE = 32
```

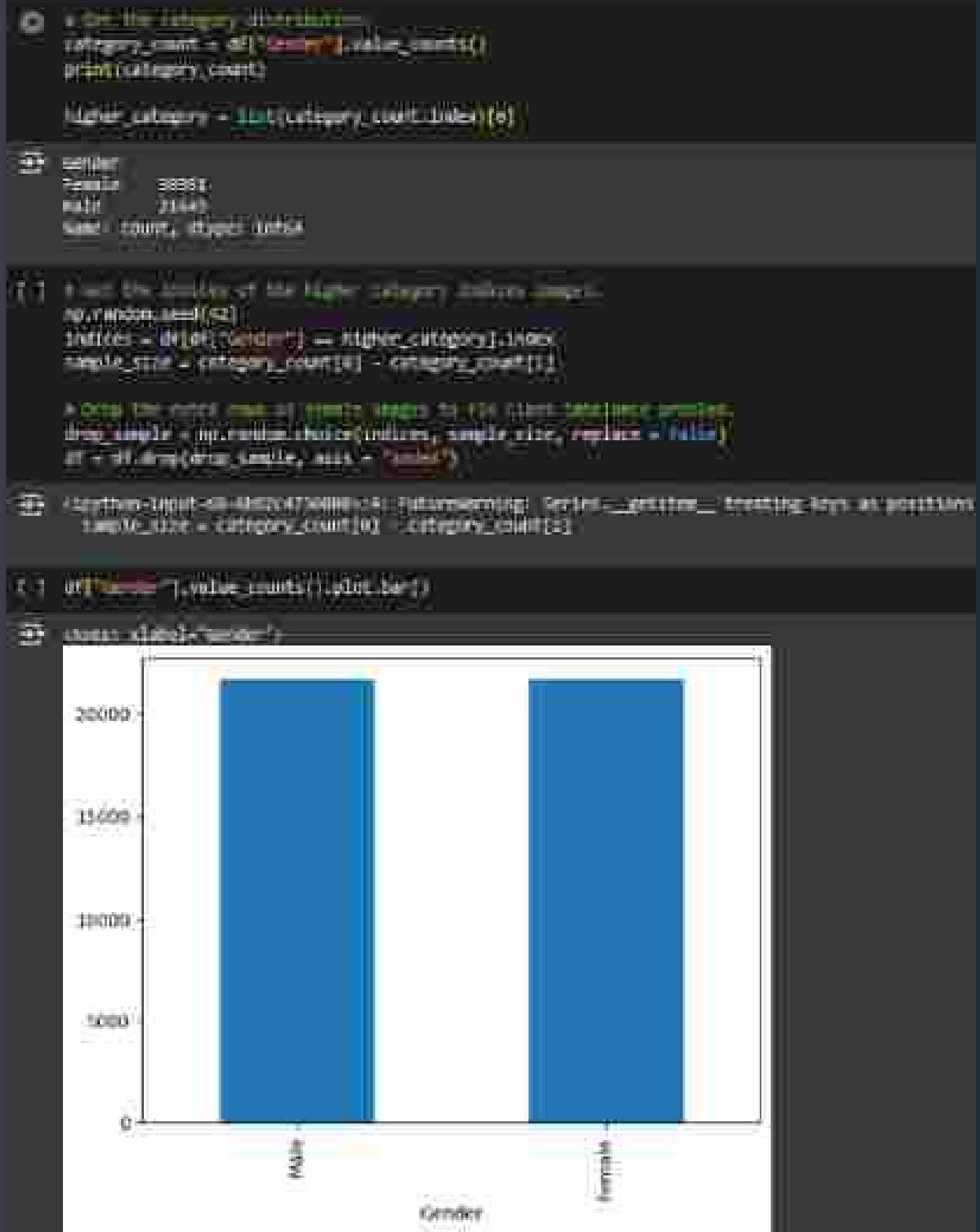
```
5 # generate train image data generator
  train_datagen = ImageDataGenerator(
    rotation_range=15,
    rescale=1./255,
    shear_range=0.1,
    zoom_range=0.2,
    horizontal_flip=True,
    width_shift_range=0.1,
    height_shift_range=0.1
  )

  train_generator = train_datagen.flow_from_dataframe(
    train_df,
    IMG_PATH + '/',
    x_col='image_id',
    y_col='center',
    target_size=IMAGE_SIZE,
    class_mode='binary',
    batch_size=BATCH_SIZE
  )

  # generate validation image data generator
  validation_datagen = ImageDataGenerator(rescale=1./255)
  validation_generator = validation_datagen.flow_from_dataframe(
    validation_df,
    IMG_PATH + '/',
    x_col='image_id',
    y_col='center',
    target_size=IMAGE_SIZE,
    class_mode='binary',
    batch_size=BATCH_SIZE
  )
```

```
6 Found 3403 validated image filenames belonging to 2 classes.
  Found 1654 validated image filenames belonging to 2 classes.
```

BALANCING DATA



PRE
PROCESSING

GAMBAR DUPLIKAT



Contoh file duplikat:
169497.jpg
004341.jpg
170605.jpg
134995.jpg
161185.jpg
029109.jpg
056985.jpg
015484.jpg
Total File duplikat: 8

Contoh Foto Duplikat

169497.jpg



004341.jpg



170605.jpg



134995.jpg



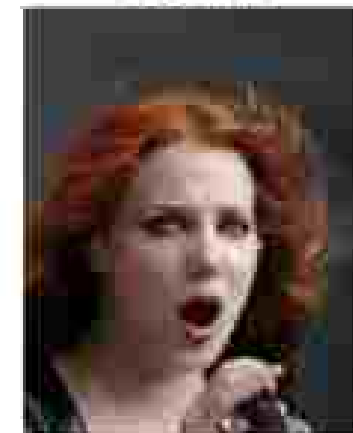
161185.jpg



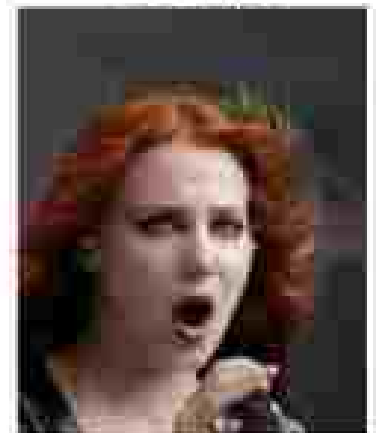
029109.jpg



056985.jpg



015484.jpg



PRE PROCESSING

AUGMENTASI DATA



PRE

PROCESSING



LINGKUNGAN PENGUJIAN

DATASET

Terbatas pada 52000 gambar dengan label male dan female

EPOCH

Epoch yang dilakukan dalam pengujian ini 5 epoch

BATCH SIZE

Batch size yang digunakan adalah 128 batch size

LEARNING RATE

Learning rate yang digunakan 0.00001



ARSITEKTUR DENSENET

DenseNet201 adalah varian dari arsitektur jaringan saraf dalam yang dikenal sebagai DenseNet (Densely Connected Convolutional Networks), yang memperkenalkan konsep koneksi padat antara layer. Dalam DenseNet, setiap layer menerima input dari semua layer sebelumnya, bukan hanya dari layer terdekat, yang membantu meningkatkan efisiensi model dan mengatasi masalah vanishing gradient. Dengan 201 layer dan struktur dense block yang saling terhubung, DenseNet201 mampu menangkap fitur dengan baik sambil menggunakan lebih sedikit parameter dibandingkan dengan arsitektur lain yang lebih dalam. Karena keunggulannya, DenseNet201 sering digunakan dalam berbagai tugas computer vision, seperti pengenalan citra dan deteksi objek.

```
1) # Definisi layer untuk DenseNet201
from keras.layers import Dense, Conv2D, BatchNormalization, Activation, GlobalAveragePooling2D, Input, Flatten
from keras.regularizers import l2
from keras.models import Model
from keras.optimizers import Adam

# Definisi layer untuk DenseNet201
def DenseNet201():
    # Definisi layer untuk DenseNet201
    input_shape = (224, 224, 3)
    input_layer = Input(input_shape)
    x = input_layer

    # Definisi layer untuk DenseNet201
    x = Conv2D(64, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = Conv2D(128, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = Conv2D(256, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = Conv2D(512, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = Conv2D(1024, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = Conv2D(2048, (3, 3), padding='same', kernel_regularizer=l2(0.001))(x)
    x = BatchNormalization()(x)
    x = Activation('relu')(x)

    # Definisi layer untuk DenseNet201
    x = GlobalAveragePooling2D()(x)
    x = Flatten()(x)

    # Definisi layer untuk DenseNet201
    x = Dense(1000, kernel_regularizer=l2(0.001))(x)
    x = Activation('softmax')(x)

    # Definisi model untuk DenseNet201
    model = Model(input_shape, x)

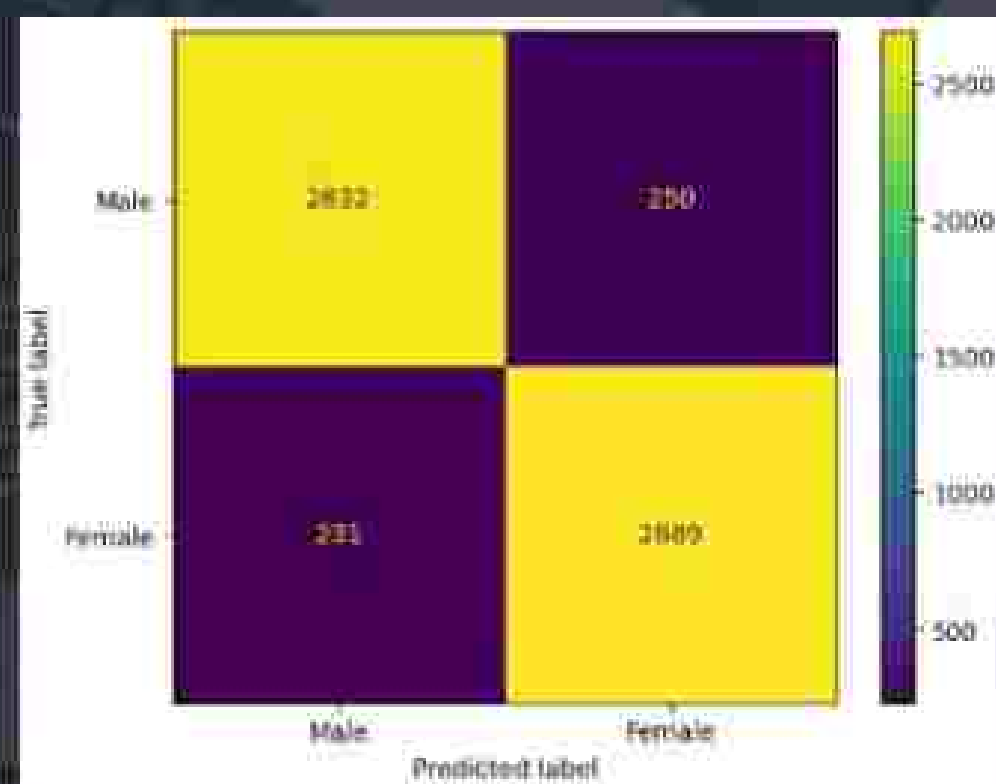
    # Definisi optimizer untuk DenseNet201
    optimizer = Adam()

    # Definisi model untuk DenseNet201
    model.compile(optimizer=optimizer)
```

Model Arsitektur



ARSITEKTUR DENSENET



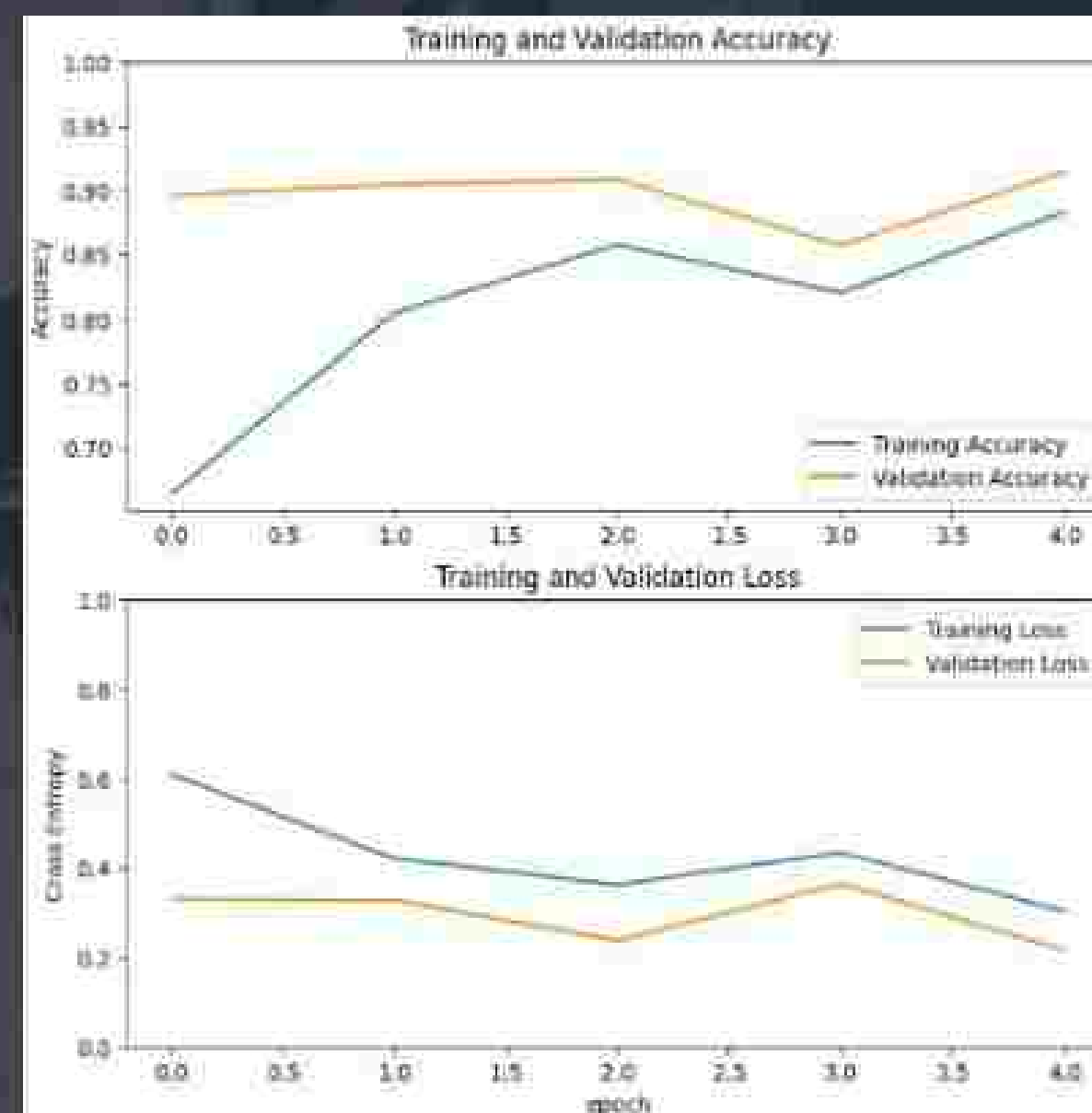
Confusion Matrix:

	Male	Female
Male	2632	250
Female	211	2689

Classification Report:

	precision	recall	f1-score	support
Male	0.914937	0.938898	0.917804	2920.000000
Female	0.919315	0.913255	0.916275	2882.000000
accuracy	0.917898	0.917898	0.917898	0.917898
macro avg	0.917126	0.917873	0.917898	5802.000000
weighted avg	0.917112	0.917898	0.917895	5802.000000

Confusion Matrix



Training & Validation Accuracy and Loss



ARSITEKTUR DENSENET

Gambar Male yang Diprediksi sebagai Female



Aktual Male diprediksi Female

Gambar Female yang Diprediksi sebagai Male



Aktual Female diprediksi Male



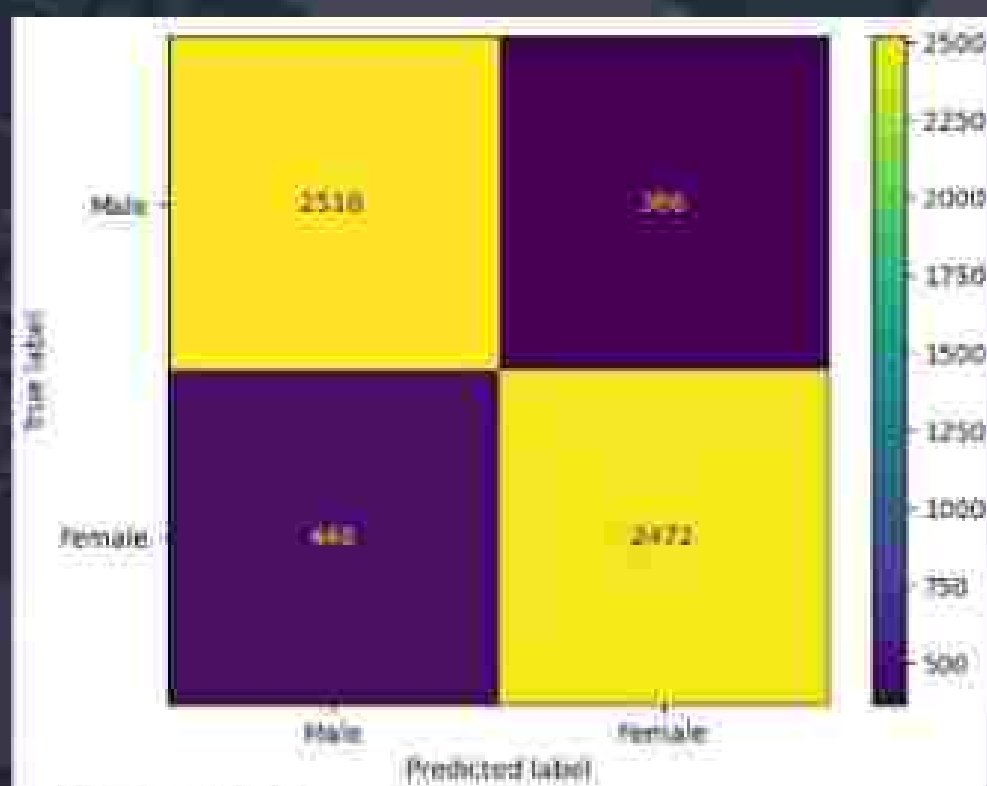
ARSITEKTUR ALEXNET

AlexNet adalah arsitektur jaringan saraf dalam yang dikembangkan oleh Alex Krizhevsky, Ilya Sutskever, dan Geoffrey Hinton, dan terkenal karena menang dalam kompetisi ImageNet Large Scale Visual Recognition Challenge (ILSVRC) pada tahun 2012. Dengan kedalaman 8 lapisan, termasuk 5 lapisan konvolusi diikuti oleh 3 lapisan fully connected, AlexNet merevolusi bidang computer vision dengan menunjukkan bahwa jaringan saraf dalam dapat mencapai akurasi yang jauh lebih tinggi dibandingkan metode tradisional. Arsitektur ini menggunakan teknik seperti ReLU (Rectified Linear Unit) sebagai fungsi aktivasi, pengurangan dimensi melalui max pooling, dan dropout untuk mengurangi overfitting. Selain itu, AlexNet memanfaatkan GPU untuk mempercepat pelatihan, yang menjadi salah satu faktor kunci kesuksesannya. Kontribusi AlexNet tidak hanya meningkatkan performa dalam pengenalan citra, tetapi juga menginspirasi pengembangan berbagai model jaringan saraf dalam lainnya yang lebih kompleks dan efisien.

```
1 import sys
2 import os
3 import random
4 import numpy as np
5 import cv2
6 import argparse
7 import time
8 import math
9 import logging
10 import pickle
11 import glob
12 import shutil
13 import subprocess
14 import multiprocessing
15 import threading
16 import queue
17 import itertools
18 import collections
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ARSITEKTUR ALEXNET



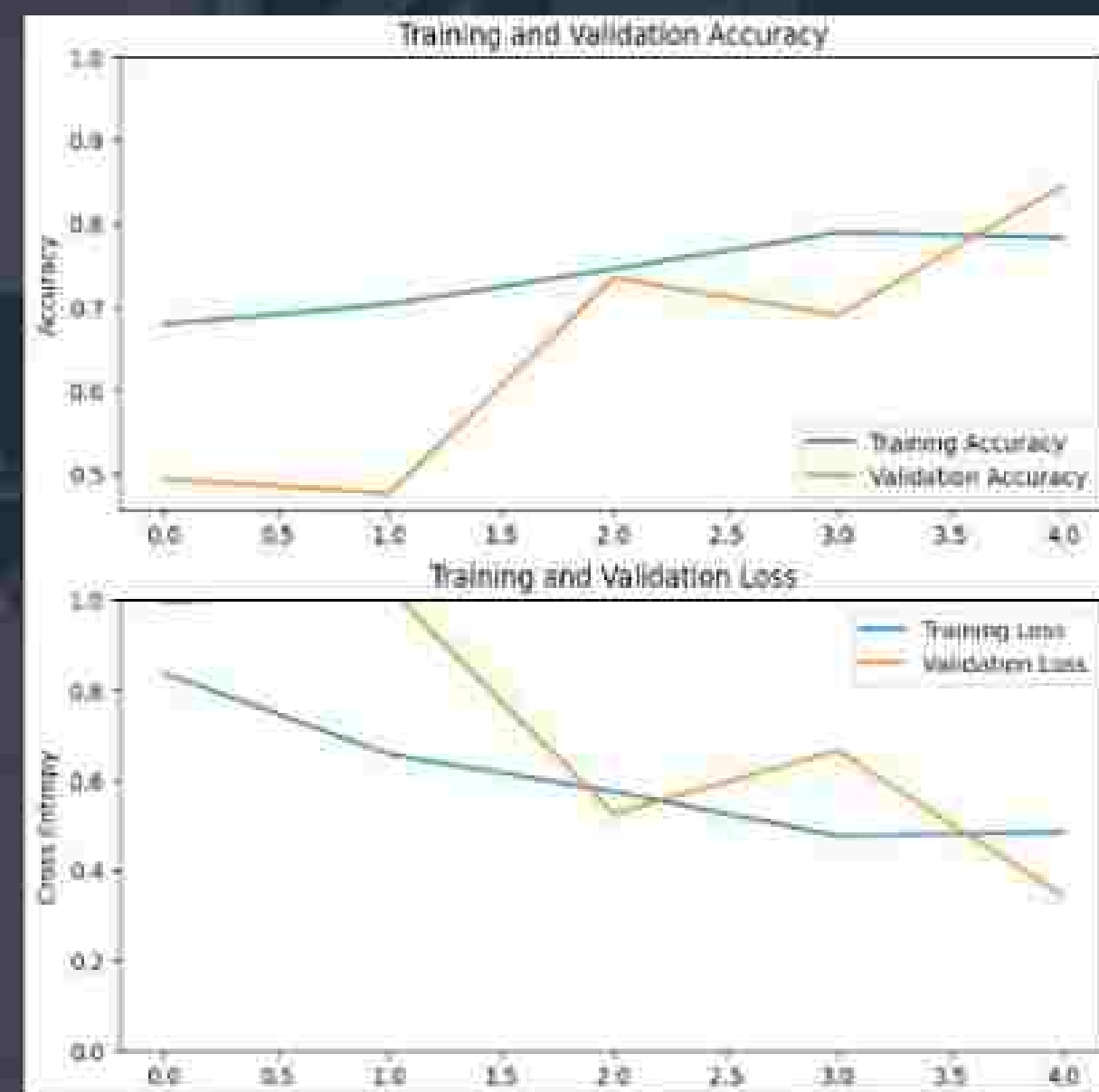
Confusion Matrix:

	Male	Female
Male	2516	366
Female	448	2472

Classification Report:

	precision	recall	f1-score	support
Male	0.871836	0.846575	0.858531	2920.000000
Female	0.848853	0.871805	0.860759	2882.000000
accuracy	0.859784	0.859784	0.859784	0.859784
macro avg	0.859944	0.859190	0.859645	5802.000000
weighted avg	0.858817	0.859764	0.859689	5802.000000

Confusion Matrix



Training & Validation Accuracy and Loss



ARSITEKTUR ALEXNET



Aktual Male diprediksi Female



Aktual Female diprediksi Male



```
# Example 1: Simple Logistic
data_train_model = LogisticRegression(solver='lbfgs', random_state=123)
data_train_model.fit(X_train, y_train)

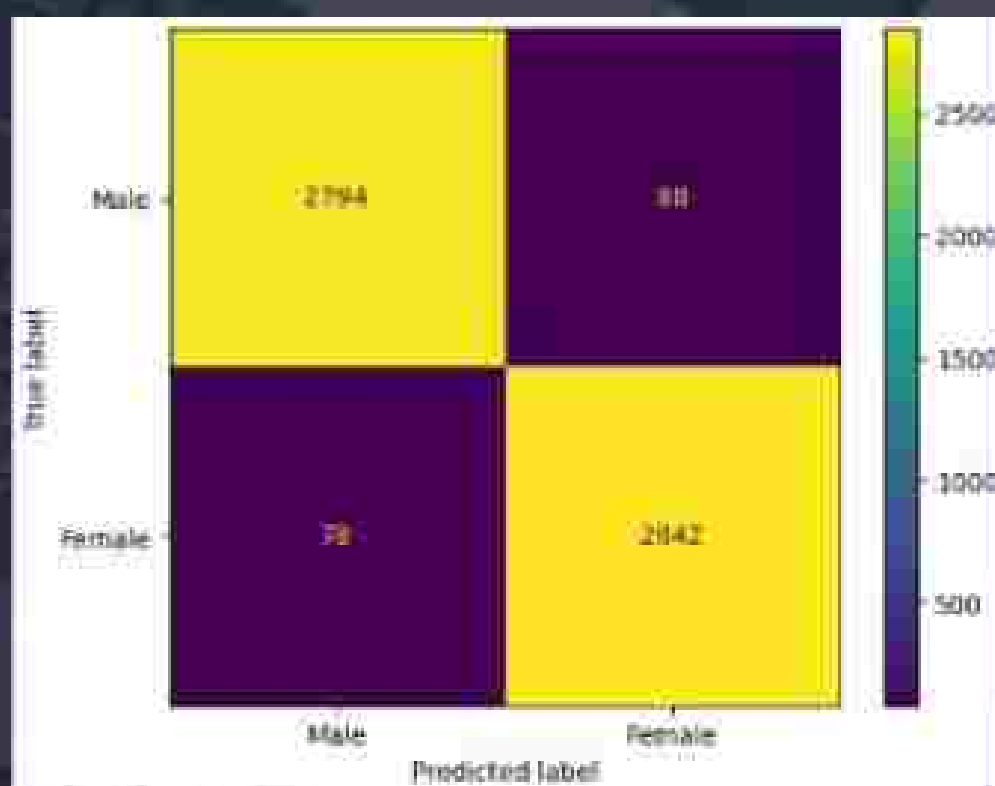
# Example 2: More Complex
data_train_model = GradientBoostingClassifier()
data_train_model.fit(X_train, y_train)

# Example 3: Using Grid Search
from sklearn.model_selection import GridSearchCV
param_grid = {'C': [0.1, 1, 10], 'gamma': [0.1, 0.2, 0.3]}
grid_search = GridSearchCV(LogisticRegression(solver='lbfgs'), param_grid, cv=5)
grid_search.fit(X_train, y_train)

# Example 4: Using Cross Validation
from sklearn.cross_validation import cross_val_score
scores = cross_val_score(LogisticRegression(solver='lbfgs'), X_train, y_train, cv=5)
```



ARSITEKTUR RESNET



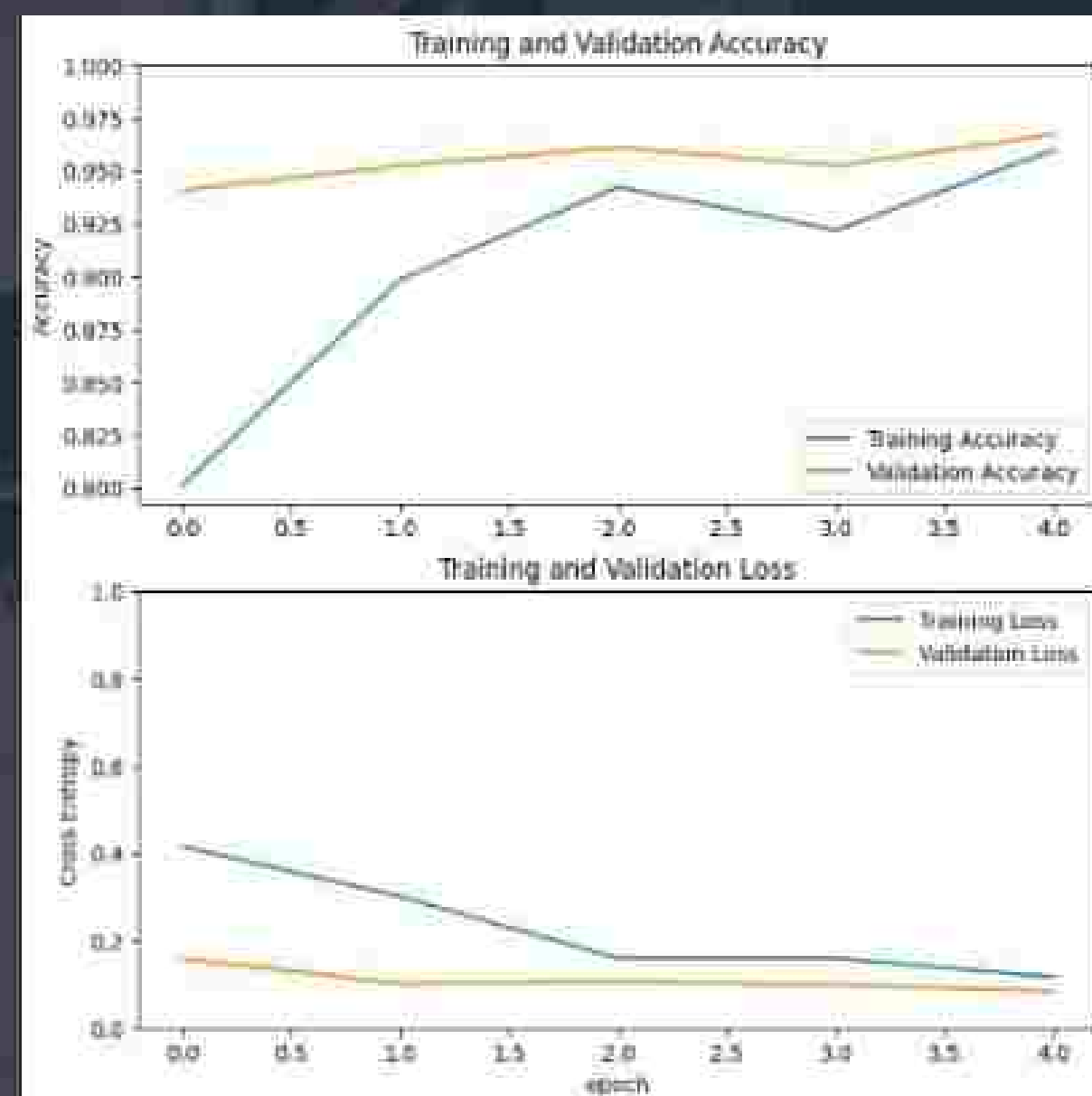
Confusion Matrix:

	Male	Female
Male	2794	88
Female	78	2842

Classification Report:

	precision	recall	f1-score	support
Male	0.969066	0.971389	0.970724	2920.000000
Female	0.972841	0.968466	0.971151	2842.000000
accuracy	0.971389	0.971389	0.971389	0.971389
macro avg	0.971484	0.971377	0.971387	5882.000000
weighted avg	0.971394	0.971389	0.971389	5882.000000

Confusion Matrix



Training & Validation Accuracy and Loss



ARSITEKTUR RESNET

Gambar Male yang Diprediksi sebagai Female



Aktual Male diprediksi Female

Gambar Female yang Diprediksi sebagai Male



Aktual Female diprediksi Male



ARSITEKTUR GOOGLNET

Arsitektur GoogLeNet adalah sebuah modifikasi arsitektur CNN yang berhasil menjadi model terbaik pada ILSVRC14. Arsitektur ini bekerja dengan mendeteksi citra dengan lapisan yang dimiliki sejumlah lima hingga 22 lapisan tetapi tetap memiliki akurasi yang tinggi. Konsep kerja arsitektur ini didasarkan pada activation values pada deep network yang tidak sepenuhnya penting karena terdapat value of zero akibat korelasi sebelumnya, sehingga dibutuhkan activation values yang tidak terkoneksi sepenuhnya. Untuk memenuhi kondisi tersebut, pada GoogLeNet terdapat lapisan inception module yang terinspirasi dari model visual cortex manusia yang berperan untuk mengoptimalkan sparse structure sehingga menunjang komputasi.

```
# Transfer Learning dengan GoogLeNet (InceptionV3)
base_inception_model = tf.keras.applications.InceptionV3(weights='imagenet', include_top=False, input_shape=IMAGE_SIZE + (3,))

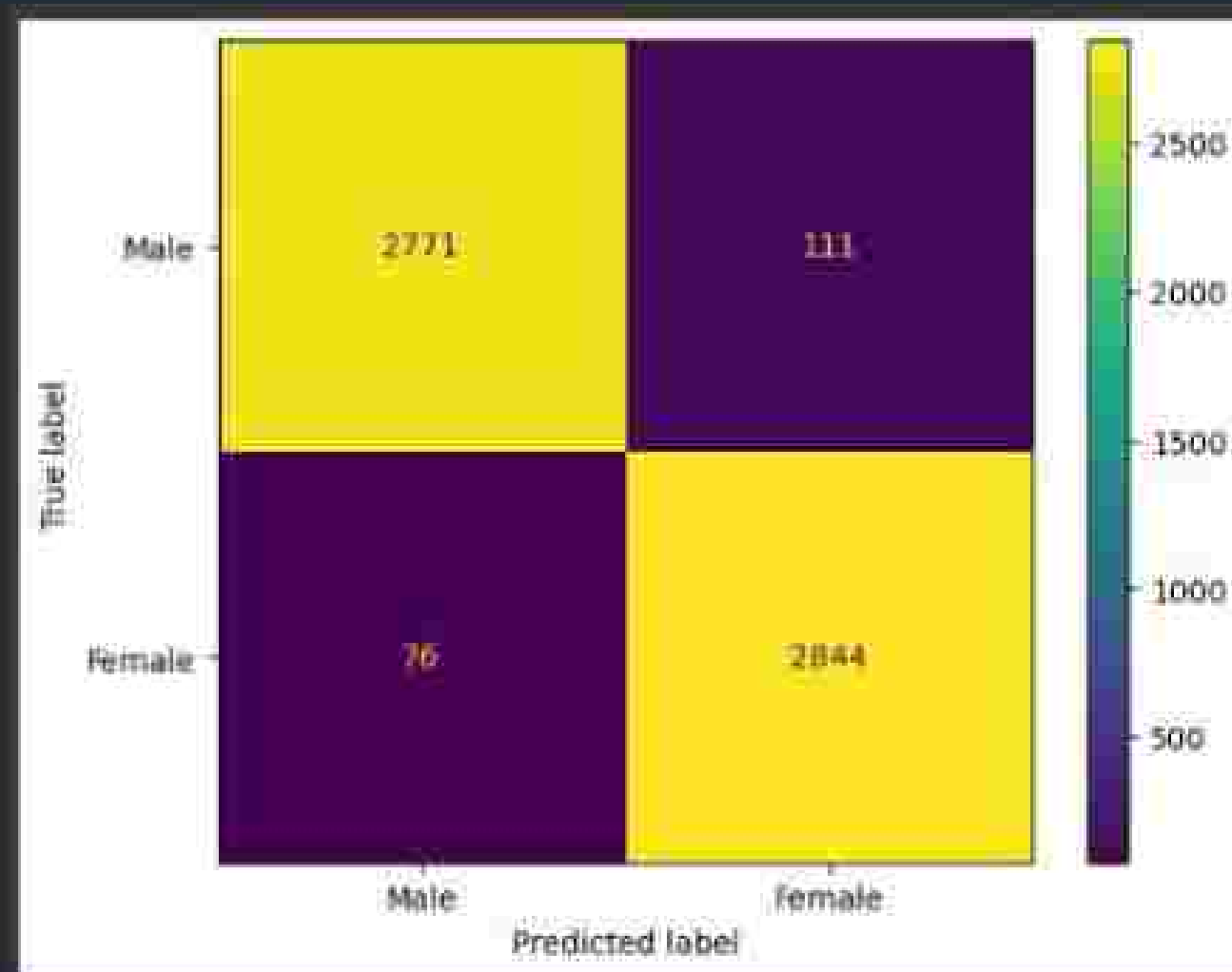
for layer in base_inception_model.layers[-5:]: # unfreeze 5 layer terakhir
    layer.trainable = False

# Menambahkan arsitektur fully connected
inception_model = tf.keras.Sequential([
    base_inception_model,
    tf.keras.layers.GlobalAveragePooling2D(),
    tf.keras.layers.Dense(1024, activation='relu'),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(256, activation='relu'),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(64, activation='relu'),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(32, activation='relu'),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(2, activation='softmax') # Tentukan jumlah output sesuai dengan kebutuhan Anda
])

# Kompilasi model
base_learning_rate = 0.0001
inception_model.compile(
    optimizer=tf.keras.optimizers.Adam(learning_rate=base_learning_rate),
    loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
    metrics=['accuracy']
)
```

ARSITEKTUR

GOOGLNET



Confusion Matrix

```
[39] Confusion Matrix:
      Male  Female
Male    2771     111
Female    76    2844

Classification Report:
              precision    recall  f1-score   support
Male         0.962437    0.973973    0.968170    2928.000000
Female         0.973105    0.961485    0.967359    2882.000000
accuracy         0.967778    0.967778    0.967778    5802.000000
macro avg         0.967871    0.967729    0.967765    5802.000000
weighted avg         0.967835    0.967770    0.967767    5802.000000

[40] > Matrix Evalua
print(classification_report(test_df['Gender'], test_df['

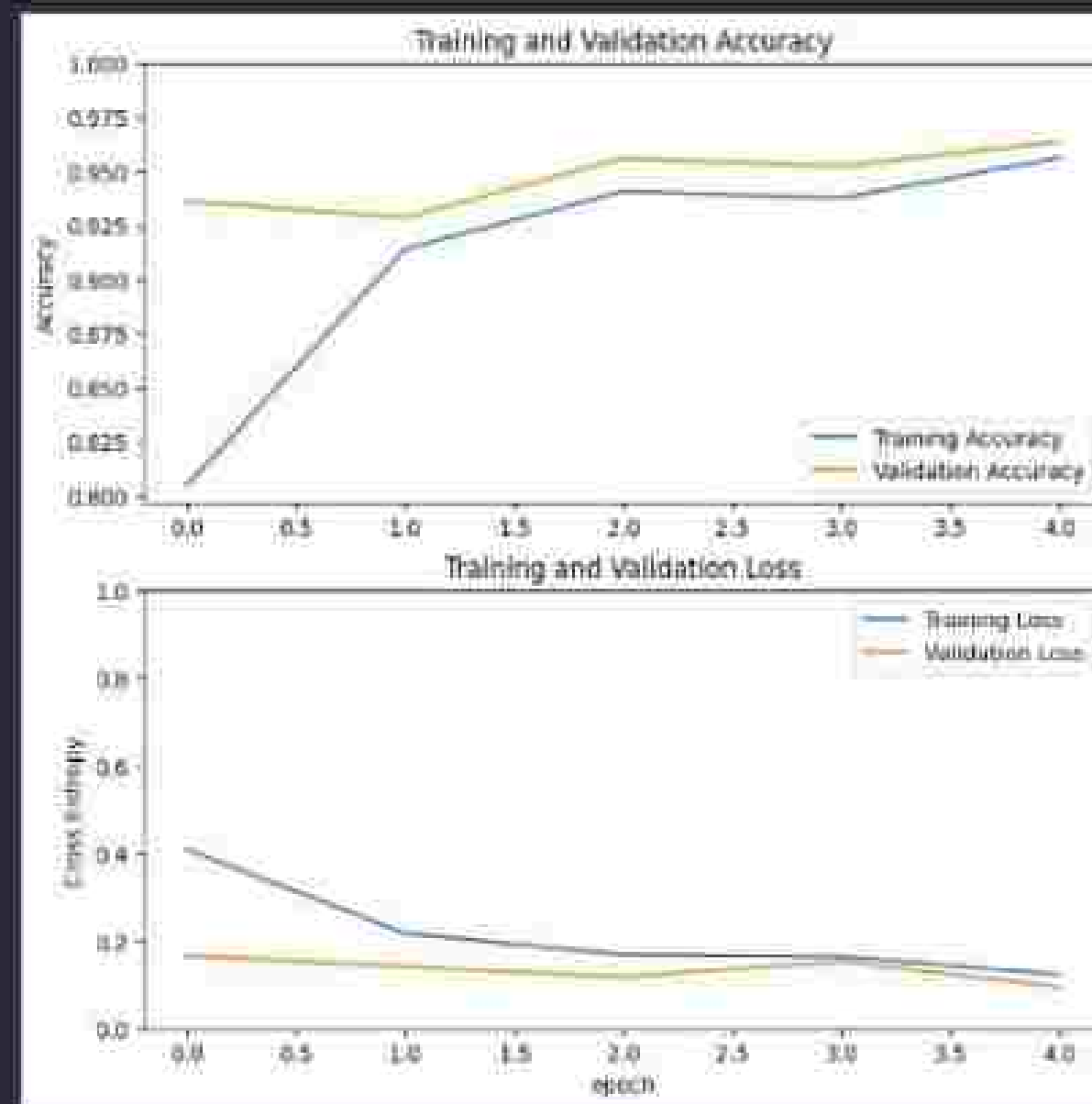
> Code Modif from Chat GPT.
```

	precision	recall	f1-score	support
Male	0.96	0.97	0.97	2928
Female	0.97	0.96	0.97	2882
accuracy			0.97	5802
macro avg	0.97	0.97	0.97	5802
weighted avg	0.97	0.97	0.97	5802

Confusion Matrix

ARSITEKTUR

GOOGLNET



Traning and Validation Accuracy

ARSITEKTUR GOOGLNET

Gambar Male yang Diprediksi sebagai Female



Aktual Male diprediksi Female

Gambar Female yang Diprediksi sebagai Male



Aktual Female diprediksi Male



ARSITEKTUR VGG-16

VGG (Visual Geometri Group) adalah arsitektur convolutional neural network yang pertama kali diperkenalkan pada tahun 2014 oleh tim peneliti dari Universitas Oxford. Model arsitektur VGG telah menjadi salah satu model pembelajaran yang paling populer dan banyak digunakan untuk visi komputer, termasuk klasifikasi gambar, deteksi objek, dan segmentasi. VGG sendiri memiliki dua model yaitu VGG-16 dan VGG-19, yang dipakai saat ini adalah model VGG-16. Arsitektur VGG-16 menggunakan 16 layer dengan bobot dan dianggap sebagai salah satu arsitektur model visi terbaik hingga saat ini. 13 layer merupakan lapisan konvolusi, 2 lapisan digunakan sebagai fully connected, dan 1 lapisan lagi untuk klasifikasi.

```
[29] from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import GlobalAveragePooling2D, Dense, Dropout

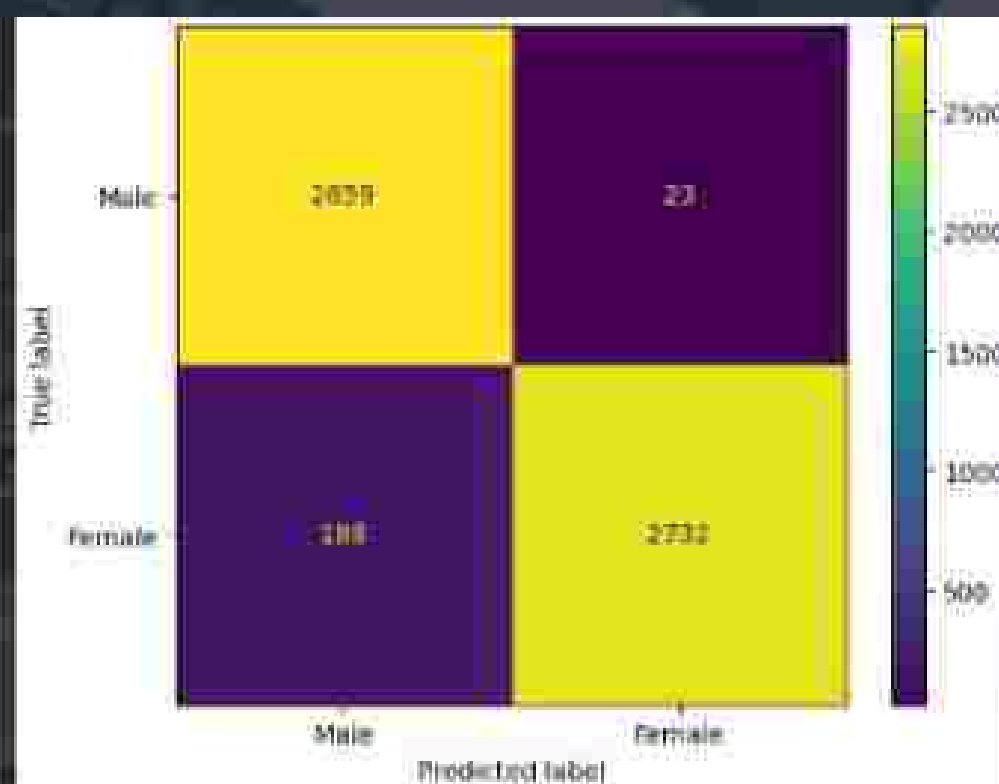
# Model Arsitektur Fully Connected dengan 10000
vgg_model = Sequential([
    GlobalAveragePooling2D(),
    Dense(1000, activation='relu'),
    Dropout(0.2),
    Dense(100, activation='relu'),
    Dropout(0.2),
    Dense(10, activation='relu'),
    Dropout(0.2),
    Dense(2, activation='softmax')
])
```

Model Arsitektur



ARSITEKTUR

VGG-16



Confusion Matrix:

	Male	Female
Male	2859	23
Female	188	2732

Classification Report:

	precision	recall	f1-score	support
Male	0.991652	0.931636	0.962819	2929.000000
Female	0.938388	0.992819	0.964432	2882.000000
accuracy	0.963633	0.963633	0.963633	0.963633
macro avg	0.964975	0.962818	0.963636	5882.000000
weighted avg	0.965150	0.962633	0.963633	5882.000000

Confusion Matrix



Training & Validation Accuracy and Loss



ARSITEKTUR

VGG-16

Gambar Male yang Diprediksi sebagai Female



Aktual Male diprediksi Female

Gambar Female yang Diprediksi sebagai Male



Aktual Female diprediksi Male



AKURASI EPOCH

	Alexnet	Resnet	GoogleNet	VGG-16	DenseNet
EPOCH 5	0.86	0.97	0.97	0.96	0.92
EPOCH 10	0.87	0.98	0.97	0.98	0.93
EPOCH 15	0.88	0.98	0.97	0.93	0.93

Dataset: 52000
Batch Size: 128



AKURASI DATASET

	Alexnet	Resnet	GoogleNet	VGG-16	DenseNet
DATASET 22000	0.76	0.96	0.95	0.95	0.91
DATASET 52000	0.86	0.97	0.97	0.96	0.92
DATASET 102000	0.89	0.98	0.98	0.97	0.93

Epoch: 5
Batch Size: 128



AKURASI BATCH SIZE

	Alexnet	Resnet	GoogleNet	VGG-16	DenseNet
BATCH SIZE 32	0.86	0.98	0.97	0.98	0.93
BATCH SIZE 64	0.87	0.97	0.97	0.98	0.92
BATCH SIZE 128	0.86	0.97	0.97	0.96	0.92

Dataset: 52000
Epoch: 5

PENGUJIAN PREDIKSI



Gambar 1



Gambar 2



Gambar 3



PENGUJIAN PREDIKSI

	Alexnet	Resnet	GoogLeNet	VGG-16	DenseNet
Gambar 1	Male	Male	Male	Male	Male
Gambar 2	Male	Male	Male	Male	Male
Gambar 3	Female	Female	Female	Female	Female



LINK GITHUB

ISAAC

<https://github.com/isaacyeremia/Face-Recognition-Gender.git>

RICKY

<https://github.com/sLytherin131/Face-Recognition-Gender.git>

THEOFILUS DEWA

https://github.com/lahelu07/Visi_Komputer_Deep_Learning_Tugas_1.git



LINK COLLAB

DENSENET

<https://colab.research.google.com/drive/1kkMZLLfPVtxF9AEavMmJVAWQ2DqdEev2?usp=sharing>

ALEXNET

<https://colab.research.google.com/drive/1kkMZLLfPVtxF9AEavMmJVAWQ2DqdEev2?usp=sharing>

RESNET

https://colab.research.google.com/drive/1uB1ZUzbq2NBtfQr_UICGp9dN4SXVyl1i?usp=sharing

GOOGLNET

https://colab.research.google.com/drive/1Ux4p_QkLxfoHxa6eQZa_JRQ8ATCKmzVy?usp=sharing

VGG-16

<https://colab.research.google.com/drive/1EHUY3r1vim-JeYj3N2Lcao5FJ16MkP9O?usp=sharing>



TERIMA KASIH ATAS PERHATIANNYA

Matur Nuhun

