



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

(FSKTM)

SEMESTER II 2024/2025

DATA MINING

BIT 33603

SECTION 03

LAB ASSIGNMENT 09+10

TITLE

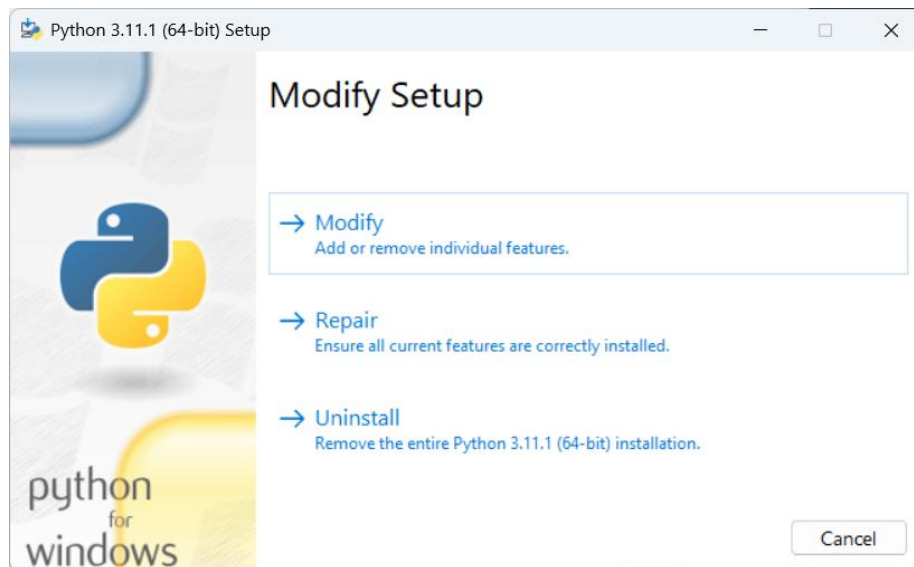
DEEP LEARNING CNN

LECTURER'S NAME

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MATRIC NUMBER	AI220118
DATE SUBMISSION	May 28, 2025

Python Installation



Installation Test

```
Command Prompt
Microsoft Windows [Version 10.0.26100.1301]
(c) Microsoft Corporation. All rights reserved.

C:\Users\wanad>python --version
Python 3.11.1

C:\Users\wanad>
```

TensorFlow Installation

```
Command Prompt
C:\Users\wanad>cd C:\Users\wanad\Downloads

C:\Users\wanad\Downloads>pip install tensorflow-2.19.0-cp311-cp311-win_amd64.whl
Processing c:\users\wanad\downloads\tensorflow-2.19.0-cp311-cp311-win_amd64.whl
Collecting absl-py<=1.0.0
  Downloading absl_py-2.3.0-py3-none-any.whl (135 kB)
    135.7/135.7 kB 2.0 MB/s eta 0:00:00
Collecting astunparse>=1.6.0
  Downloading astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Collecting flatbuffers>=24.3.25
  Downloading flatbuffers-25.2.10-py2.py3-none-any.whl (30 kB)
Collecting gast!=0.5.0,!0.5.1,!0.5.2,>=0.2.1
  Downloading gast-0.6.0-py3-none-any.whl (21 kB)
Collecting google-pasta>=0.1.1
  Downloading google_pasta-0.2.0-py3-none-any.whl (57 kB)
    57.5/57.5 kB 3.0 MB/s eta 0:00:00
Collecting libclang>=13.0.0
  Downloading libclang-18.1.1-py2.py3-none-win_amd64.whl (26.4 MB)
    26.4/26.4 MB 3.2 MB/s eta 0:00:00
Collecting opt-einsum>=2.3.2
  Downloading opt_einsum-3.4.0-py3-none-any.whl (71 kB)
    71.9/71.9 kB 1.3 MB/s eta 0:00:00
Collecting packaging
  Downloading packaging-25.0-py3-none-any.whl (66 kB)
    66.5/66.5 kB 1.8 MB/s eta 0:00:00
Collecting protobuf!=4.21.0,!4.21.1,!4.21.2,!4.21.3,!4.21.4,!4.21.5,<6.0.0dev,>=3.20.3
  Downloading protobuf-5.29.4-cp310-abi3-win_amd64.whl (434 kB)
    434.5/434.5 kB 1.8 MB/s eta 0:00:00
Collecting requests<3,>=2.21.0
  Downloading requests-2.32.3-py3-none-any.whl (64 kB)
    64.9/64.9 kB 3.4 MB/s eta 0:00:00
Requirement already satisfied: setuptools in c:\users\wanad\appdata\local\programs\python\python311\lib\site-packages (from tensorflow==2.19.0) (65.5.0)
Collecting six>=1.12.0
  Downloading six-1.17.0-py2.py3-none-any.whl (11 kB)
Collecting termcolor>=1.1.0
```

Related Packages Installation

1. Install this package for performance metrics: pip install scikit-learn

```
Command Prompt
Downloading mdurl-0.1.2-py3-none-any.whl (10.0 kB)
Installing collected packages: namex, libclang, flatbuffers, wrapt, wheel, urllib3, typing-extensions, termcolor, tensorflow-
io-gcs-filestore, tensorboard-data-server, six, pygments, protobuf, packaging, opt-einsum, numpy, mdurl, MarkupSafe, markdow
n, idna, grpcio, gast, charset-normalizer, certifi, absl-py, werkzeug, requests, optree, ml-dtypes, markdown-it-py, h5py, goo
gle-pasta, astunparse, tensorboard, rich, keras, tensorflow
Successfully installed MarkupSafe-3.0.2 absl-py-2.3.0 astunparse-1.6.3 certifi-2025.4.26 charset-normalizer-3.4.2 flatbuffers
-25.2.10 gast-0.6.0 google-pasta-0.2.0 grpcio-1.71.0 h5py-3.13.0 idna-3.10 keras-3.10.0 libclang-18.1.1 markdown-3.8 markdown
-it-py-3.0.0 mdurl-0.1.2 ml-dtypes-0.5.1 namex-0.1.0 numpy-2.1.3 opt-einsum-3.4.0 optree-0.15.0 packaging-25.0 protobuf-5.29.
4 pygments-2.19.1 requests-2.32.3 rich-14.0.0 six-1.17.0 tensorboard-2.19.0 tensorboard-data-server-0.7.2 tensorflow-2.19.0 t
ensorflow-io-gcs-filestore-0.31.0 termcolor-3.1.0 typing-extensions-4.13.2 urllib3-2.4.0 werkzeug-3.1.3 wheel-0.45.1 wrapt-1
.17.2

[notice] A new release of pip available: 22.3.1 -> 25.1.1
[notice] To update, run: python.exe -m pip install --upgrade pip

C:\Users\wanad\Downloads>pip install scikit-learn
Collecting scikit-learn
  Downloading scikit_learn-1.6.1-cp311-cp311-win_amd64.whl (11.1 MB)
    11.1/11.1 MB 3.4 MB/s eta 0:00:00
Requirement already satisfied: numpy>=1.19.5 in c:\users\wanad\appdata\local\programs\python\python311\lib\site-packages (fro
m scikit-learn) (2.1.3)
Collecting scipy>=1.6.0
  Downloading scipy-1.15.3-cp311-cp311-win_amd64.whl (41.2 MB)
    41.2/41.2 MB 2.6 MB/s eta 0:00:00
Collecting joblib>=1.2.0
  Downloading joblib-1.5.1-py3-none-any.whl (307 kB)
    307.7/307.7 kB 1.4 MB/s eta 0:00:00
Collecting threadpoolctl>=3.1.0
  Downloading threadpoolctl-3.6.0-py3-none-any.whl (18 kB)
Installing collected packages: threadpoolctl, scipy, joblib, scikit-learn
Successfully installed joblib-1.5.1 scikit-learn-1.6.1 scipy-1.15.3 threadpoolctl-3.6.0

[notice] A new release of pip available: 22.3.1 -> 25.1.1
[notice] To update, run: python.exe -m pip install --upgrade pip

C:\Users\wanad\Downloads>
C:\Users\wanad\Downloads>
```

2. Install this package for plot auc :pip install matplotlib

```
Command Prompt
C:\Users\wanad\Downloads>pip install matplotlib
Collecting matplotlib
  Downloading matplotlib-3.10.3-cp311-cp311-win_amd64.whl (8.1 MB)
    8.1/8.1 MB 3.3 MB/s eta 0:00:00
Collecting contourpy>=1.0.1
  Downloading contourpy-1.3.2-cp311-cp311-win_amd64.whl (222 kB)
    222.0/222.0 kB 1.4 MB/s eta 0:00:00
Collecting cycler>=0.10
  Downloading cycler-0.12.1-py3-none-any.whl (8.3 kB)
Collecting fonttools>=4.22.0
  Downloading fonttools-4.58.0-cp311-cp311-win_amd64.whl (2.2 MB)
    2.2/2.2 MB 1.8 MB/s eta 0:00:00
Collecting kiwisolver>=1.3.1
  Downloading kiwisolver-1.4.8-cp311-cp311-win_amd64.whl (71 kB)
    72.0/72.0 kB 3.9 MB/s eta 0:00:00
Requirement already satisfied: numpy>=1.23 in c:\users\wanad\appdata\local\programs\python\python311\lib\site-packages (from
matplotlib) (2.1.3)
Requirement already satisfied: packaging>=20.0 in c:\users\wanad\appdata\local\programs\python\python311\lib\site-packages (f
rom matplotlib) (25.0)
Collecting pillow>=8
  Downloading pillow-11.2.1-cp311-cp311-win_amd64.whl (2.7 MB)
    2.7/2.7 MB 2.3 MB/s eta 0:00:00
Collecting pyparsing>=2.3.1
  Downloading pyparsing-3.2.3-py3-none-any.whl (111 kB)
    111.1/111.1 kB 3.3 MB/s eta 0:00:00
Collecting python-dateutil>=2.7
  Downloading python_dateutil-2.9.0.post0-py2.py3-none-any.whl (229 kB)
    229.9/229.9 kB 2.3 MB/s eta 0:00:00
Requirement already satisfied: six>=1.5 in c:\users\wanad\appdata\local\programs\python\python311\lib\site-packages (from pyt
hon-dateutil>=2.7->matplotlib) (1.17.0)
Installing collected packages: python-dateutil, pyparsing, pillow, kiwisolver, fonttools, cycler, contourpy, matplotlib
Successfully installed contourpy-1.3.2 cycler-0.12.1 fonttools-4.58.0 kiwisolver-1.4.8 matplotlib-3.10.3 pillow-11.2.1 pypars
ing-3.2.3 python-dateutil-2.9.0.post0

[notice] A new release of pip available: 22.3.1 -> 25.1.1
[notice] To update, run: python.exe -m pip install --upgrade pip
```

Source Code

```
Lab9-10.py - C:/Users/wanad/AppData/Local/Programs/Python/Python311/Lab9-10.py (3.11.1)
File Edit Format Run Options Window Help

#Python code
import os
import numpy as np
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
from tensorflow.keras.optimizers import Adam
from sklearn.metrics import precision_score, recall_score, f1_score, roc_auc_score, roc_curve
import matplotlib.pyplot as plt

# Set the dataset path
path_to_data = 'C:\\Users\\wanad\\AppData\\Local\\Programs\\Python\\Python311\\Cats_Dogs'

# Splitting the dataset into training and testing
# Preparing the training data
train_data_generator = ImageDataGenerator(rescale=1.0 / 255)

train_data = train_data_generator.flow_from_directory(
    directory=os.path.join(path_to_data, "training_set"),
    target_size=(64, 64),
    batch_size=32,
    class_mode='binary'
)

# Preparing the testing data
test_data_generator = ImageDataGenerator(rescale=1.0 / 255)

test_data = test_data_generator.flow_from_directory(
    directory=os.path.join(path_to_data, "test_set"),
    target_size=(64, 64),
    batch_size=32,
    class_mode='binary',
    shuffle=False
)

# Building the CNN model
model = Sequential([
    Conv2D(32, (3, 3), activation='relu', input_shape=(64, 64, 3)),
    MaxPooling2D(pool_size=(2, 2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dense(1, activation='sigmoid')
])

# Compile the model
model.compile(
    optimizer=Adam(),
    loss='binary_crossentropy',
    metrics=['accuracy']
)

# Train the model
history = model.fit(
    train_data,
    steps_per_epoch=100, # Adjust based on your dataset
    epochs=10,
    validation_data=test_data,
    validation_steps=50 # Adjust based on your validation dataset
)

# Evaluate the model on test data
model_evaluation = model.evaluate(
    test_data,
    steps=len(test_data)
)

test_loss, test_accuracy = model_evaluation
print(f"Test Loss: {test_loss}")
print(f"Test Accuracy: {test_accuracy}")

# Predictions on test data for additional metrics
predictions = model.predict(
    test_data,
    steps=len(test_data),
    verbose=1
)

# Process predictions and true labels
predictions = predictions.flatten()
predicted_classes = (predictions > 0.5).astype(int)
true_classes = test_data.classes

# Calculate accuracy and error rate
accuracy = np.mean(predicted_classes == true_classes)
error_rate = 1 - accuracy

# Calculate precision, recall, and F1 score
precision_value = precision_score(true_classes, predicted_classes)
recall_value = recall_score(true_classes, predicted_classes)
f1_score_value = f1_score(true_classes, predicted_classes)

# ROC and AUC
auc_value = roc_auc_score(true_classes, predictions)
fpr, tpr, _ = roc_curve(true_classes, predictions)

# Print additional metrics
print(f"Accuracy: {accuracy * 100:.2f}%")
print(f"Error Rate: {error_rate * 100:.2f}%")
print(f"Precision: {precision_value}")
print(f"Recall: {recall_value}")
print(f"F1 Score: {f1_score_value}")
print(f"AUC: {auc_value}")

# Plot ROC curve
plt.figure()
plt.plot(fpr, tpr, label=f"ROC Curve (AUC = {auc_value:.2f})")
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC Curve')
plt.legend(loc='lower right')
plt.show()
```

Output

[illegible]

