Helwan University

كلية الحاسبات والذكاء الإصطناعي
Faculty of Computers & Artificial Intelligence

Faculty of Computers and Artificial Intelligence

Computer Science Department

2021/2022

CS 395 Selected Topics in CS-1

Research Project

Report Submitted for Fulfillment of the Requirements and ILO's for Selected Topics in CS-1 course for Fall 2021

Team No. ****

	ID	Name	Grade
1.	201900548	فادى ملاك عطيه ميخائيل	
2.	201900881	مينا فوزى فايز مينا	
3.	201900179	امير حنا ثابت فهيم	
4.	201900603	مارينا رومانى نصر شنودة	
5.	201900206	ايمان محمد محمود عبد الحميد	
6.	201900199	اياد ايمن محمد مصيلحى	
7.	201900020	احمد امير احمد شفيق	
8.	201600253	حازم حافظ محمد حافظ	

Delivered to:

Dr. Wessam El-Behaidy

Eng. Islam Gamal

Eng. Muhammed Kamal

I. NUMERICAL DATASET

1. Project Introduction

a. Dataset Name

(What is the dataset used?)

b. Number of classes and their labels

(Specify number of classes and their labels.)
There are 2 Classes
Labels:
1 - Spruce/Fir
2 - Lodgepole Pine

c. Dataset Samples Numbers

(The total number of samples in dataset)
500K Samples

d. Training, Validation and Testing

(The number of samples used in training, validation and testing.)

Training = 75% (375K)
Testing = 25% (125K)

2. Implementation Details

a. Extracted Features

(How many features were extracted, their names, the dimension of resulted features)

b. Cross-validation

(Is cross-validation is used in any of implemented models? If yes, specify the number of fold and ratio of training/validation)

c. Artificial Neural Network (ANN)

℘ Hyper-parameters

(Specify all the hyper-parameters (initial learning rate, optimizer, regularization, batch size, no. of epochs…) with their specified value in implementation)

d. Support Vector Machine (SVM)

℘ Hyper-parameters

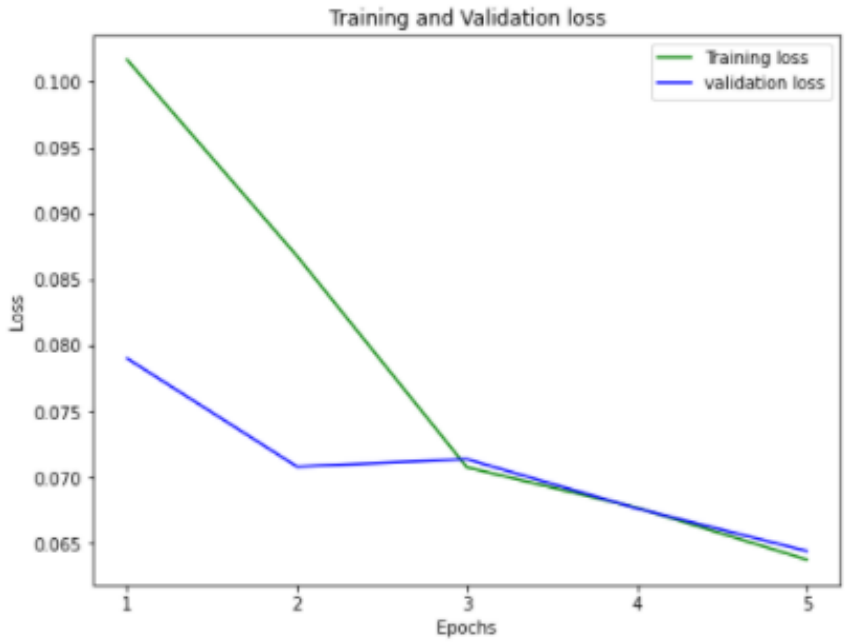
(Specify all the hyper-parameters (optimizer, regularization, …) with their specified value in implementation)

3. Models Results

For each model you should show all these results for your model on testing data (loss curve, accuracy, confusion matrix, ROC curve)

a. ANN Results

```
plt.figure(figsize=(8,6))
loss_train = history.history['loss']
loss_val = history.history['val_loss']
epochs = range(1,6)
plt.plot(epochs, loss_train, 'g', label='Training loss')
plt.plot(epochs, loss_val, 'b', label='validation loss')
plt.title('Training and Validation loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.xticks(np.arange(1,6))
plt.legend()
plt.show()
```



Accuarcy of the NN FM

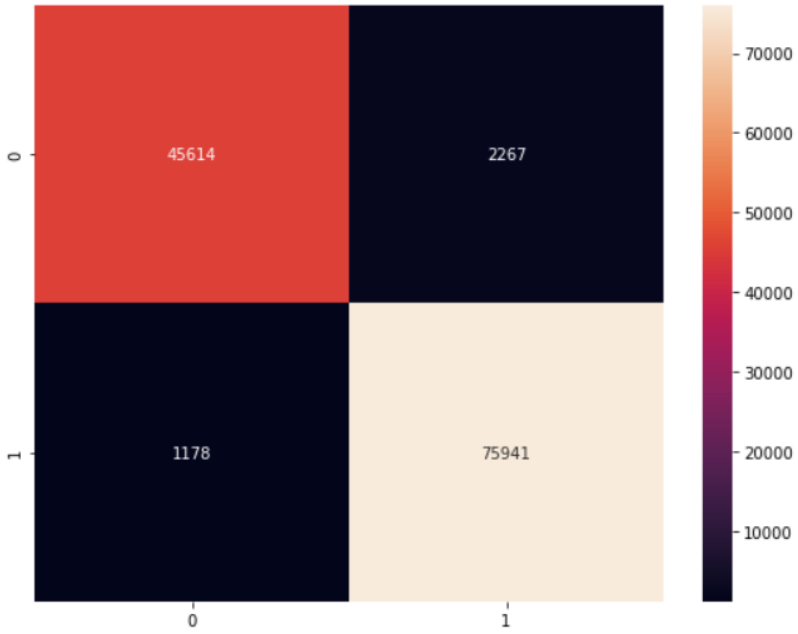
```
In [40]: nn_model.evaluate(X_test_nn, y_test_nn)
         3907/3907 [==============================] - 45s 12ms/step - loss: 0.0644 - acc: 0.9724
Out[40]: [0.06441473215818405, 0.9724400043487549]
```

Confusion Matrix

FM

In [68]:
```
plt.figure(figsize=(9,7))
sns.heatmap(cm, annot=True, fmt='d')
```

Out[68]: <AxesSubplot:>



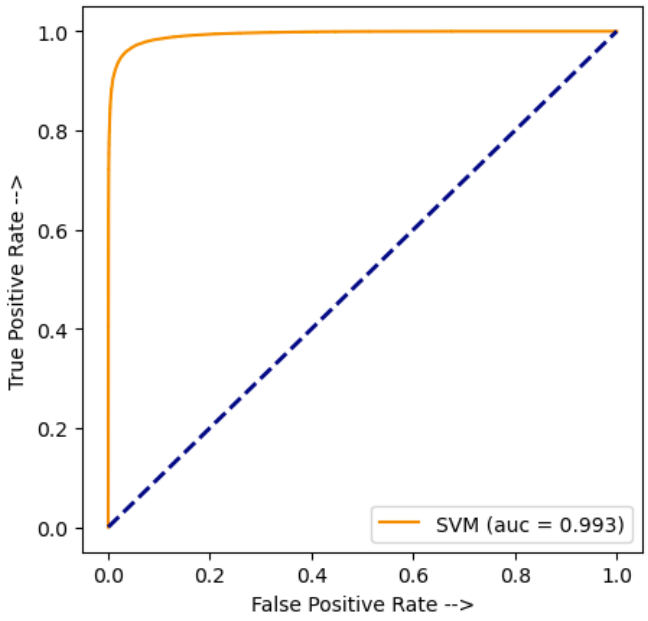
b.SVM Results

ROC Curve

In [42]:
```
y_pred_svm = svm_model.decision_function(X_test)
```

In [47]:
```
y_test_repl = y_test.replace(to_replace=[1,2], value=[0,1])
```

In [138]:
```
svm_fpr, svm_tpr, _ = roc_curve(y_test_repl, y_pred_svm)
auc_svm = auc(svm_fpr, svm_tpr)

plt.figure(figsize=(5, 5), dpi=100)
plt.plot(svm_fpr, svm_tpr, color="darkorange", label='SVM (auc = %0.3f)' % auc_svm)
plt.plot([0, 1], [0, 1], color="navy", lw=2, linestyle="--")

plt.xlabel('False Positive Rate -->')
plt.ylabel('True Positive Rate -->')

plt.legend()

plt.show()
```



Accuarcy of the model

In [31]:
```
svm_model = SVC()
train(svm_model, "SVM")
```

```
SVM model score on Training data: 96.91733333333333%
SVM model score on Testing data: 96.188%
```

II. IMAGE DATASET

1. Project Introduction

a. Dataset Name

(What is the dataset used?)

Bayern

b. Number of classes and their labels

(Specify number of classes and their labels.)

5 Classes

Labels:

1. Kingsley Coman
2. Joshua Kimmich
3. Robert Lewandowski
4. Manuel Neuer
5. Leory Sane

c. Dataset Images Numbers and size

(The total number of images in dataset and the size of each.)

The data contains 230 images

Each image is 64 * 64 Pixels

Data contains 5 Classes

d. Training, Validation and Testing

(The number of images used in training, validation and testing.)

Number of Training data: 172 (75%)

Number of Testing data: 58 (25%)

2. Implementation Details

a. Extracted Features

(How many features were extracted, their names, the dimension of resulted features)

b. Cross-validation

(Is cross-validation is used in any of implemented models? If yes, specify the number of fold and ratio of training/validation)

Cross Validation

```
In [27]: svm_model = SVC(kernel='linear', gamma='auto')
         scores = cross_val_score(svm_model,X,y, cv=10)
         np.average(scores)

Out[27]: 0.8434782608695652
```

c. Artificial Neural Network (ANN)

℘ Hyper-parameters

(Specify all the hyper-parameters (initial learning rate, optimizer, regularization, batch size, no. of epochs…) with their specified value in implementation)

batch_size = 10.
epochs = 8.
optimizer = Adam
learning_rate = 0.0001.
loss = 'categorical_crossentropy'.

d. Support Vector Machine (SVM)

℘ Hyper-parameters

(Specify all the hyper-parameters (optimizer, regularization, …) with their specified value in implementation)

cv=10 , gamma =’auto’ ,Kernel= ‘linear’

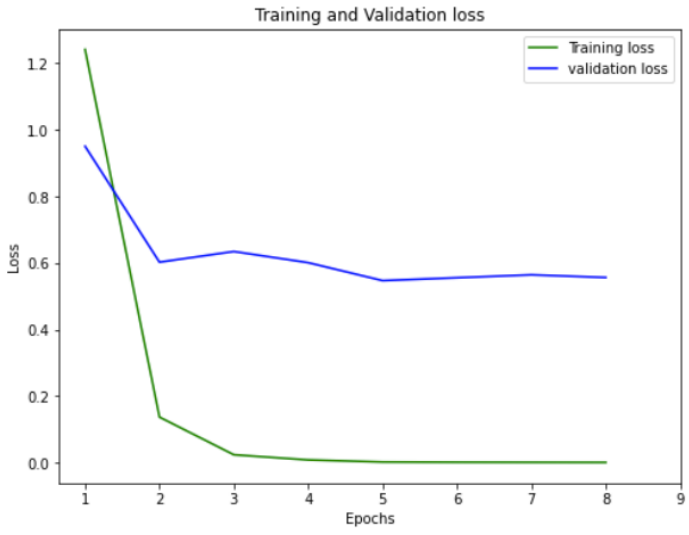
3. Models Results

For each model you should show all these results for your model on testing data (loss curve, accuracy, confusion matrix, ROC curve)

a. ANN Results

Loss Curve

```
In [64]: plt.figure(figsize=(8,6))
         loss_train = history.history['loss']
         loss_val = history.history['val_loss']
         epochs = range(1,9)
         plt.plot(epochs, loss_train, 'g', label='Training loss')
         plt.plot(epochs, loss_val, 'b', label='validation loss')
         plt.title('Training and Validation loss')
         plt.xlabel('Epochs')
         plt.ylabel('Loss')
         plt.xticks(np.arange(1,10))
         plt.legend()
         plt.show()
```



Accuracy of ANN

In [62]:
```
nn_model.evaluate(X_test_nn, y_test_nn)
```

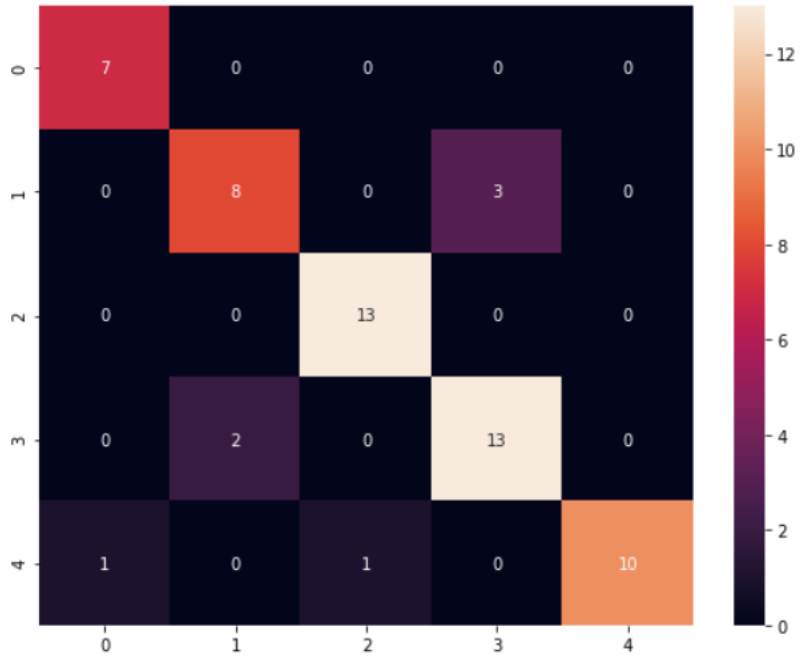
```
2/2 [==============================] - 0s 55ms/step - loss: 0.5565 - acc: 0.8793
```

Out[62]:
```
[0.5564684271812439, 0.8793103694915771]
```

Confusion Matrix

In [73]:
```
plt.figure(figsize=(9,7))
sns.heatmap(cm, annot=True)
```

Out[73]:
```
<AxesSubplot:>
```



b.SVM Results

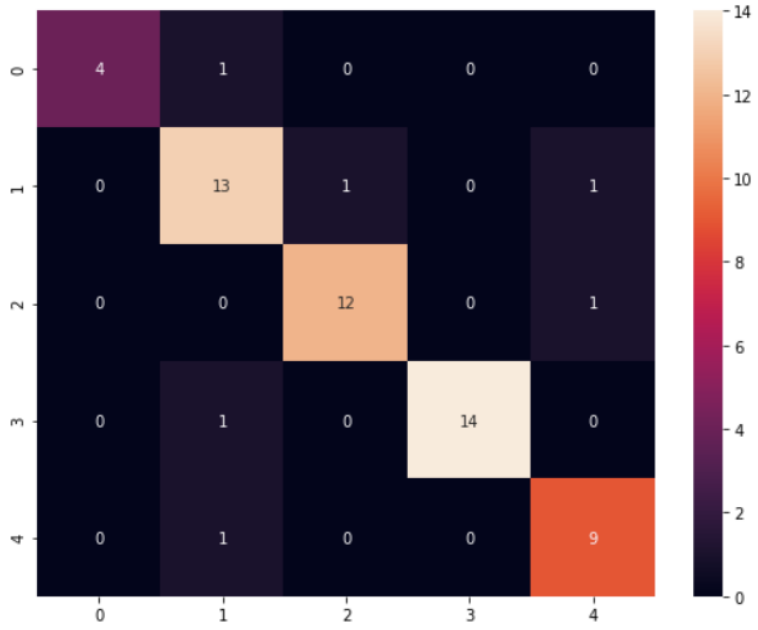
Score of the model

```
In [29]: svm_model.score(X_test, y_test)

Out[29]: 0.896551724137931
```

Confusion Matrix

```
In [30]: cm = confusion_matrix(y_test, svm_model.predict(X_test))
         cm

Out[30]: array([[ 4,  1,  0,  0,  0],
                [ 0, 13,  1,  0,  1],
                [ 0,  0, 12,  0,  1],
                [ 0,  1,  0, 14,  0],
                [ 0,  1,  0,  0,  9]], dtype=int64)
```

```
In [31]: plt.figure(figsize=(9,7))
         sns.heatmap(cm, annot=True);
```



ROC Curve

In [46]:
```
plt.figure(figsize=(10,7))
lw = 2
plt.plot(
    fpr[2],
    tpr[2],
    color="darkorange",
    lw=lw,
    label="ROC curve (area = %0.2f)" % roc_auc[2],
)
plt.plot([0, 1], [0, 1], color="navy", lw=lw, linestyle="--")
plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.title("Receiver operating characteristic")
plt.legend(loc="lower right")
plt.show()
```