學號：0653440
i. 截圖與步驟描述(安裝的部分將較重要的幾個步驟截圖即可)

安裝 HADOOP
設定 HADOOP 環境變數
$sudo gedit ~/.bashrc

```
# Hadoop Variable
export JAVA_HOME=/usr/lib/jvm/java-7-openjdk-amd64
export HADOOP_HOME=/usr/local/hadoop

export PATH=$PATH:$HADOOP_HOME/bin
export PATH=$PATH:$HADOOP_HOME/sbin

export HADOOP_MAPRED_HOME=$HADOOP_HOME
export HADOOP_COMMON_HOME=$HADOOP_HOME
export HADOOP_HDFS_HOME=$HADOOP_HOME

export YARN_HOME=$HADOOP_HOME

export HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native
export HADOOP_OPTS="-Djava.library.path=$HADOOP_HOME/lib"

export JAVA_LIBRARY_PATH=$HADOOP_HOME/lib/native:$JAVA_LIBRARY_PATH
# Hadoop Variable
```

生效
$source ~/.bashrc

安裝 SCALA
設定 HADOOP 環境變數

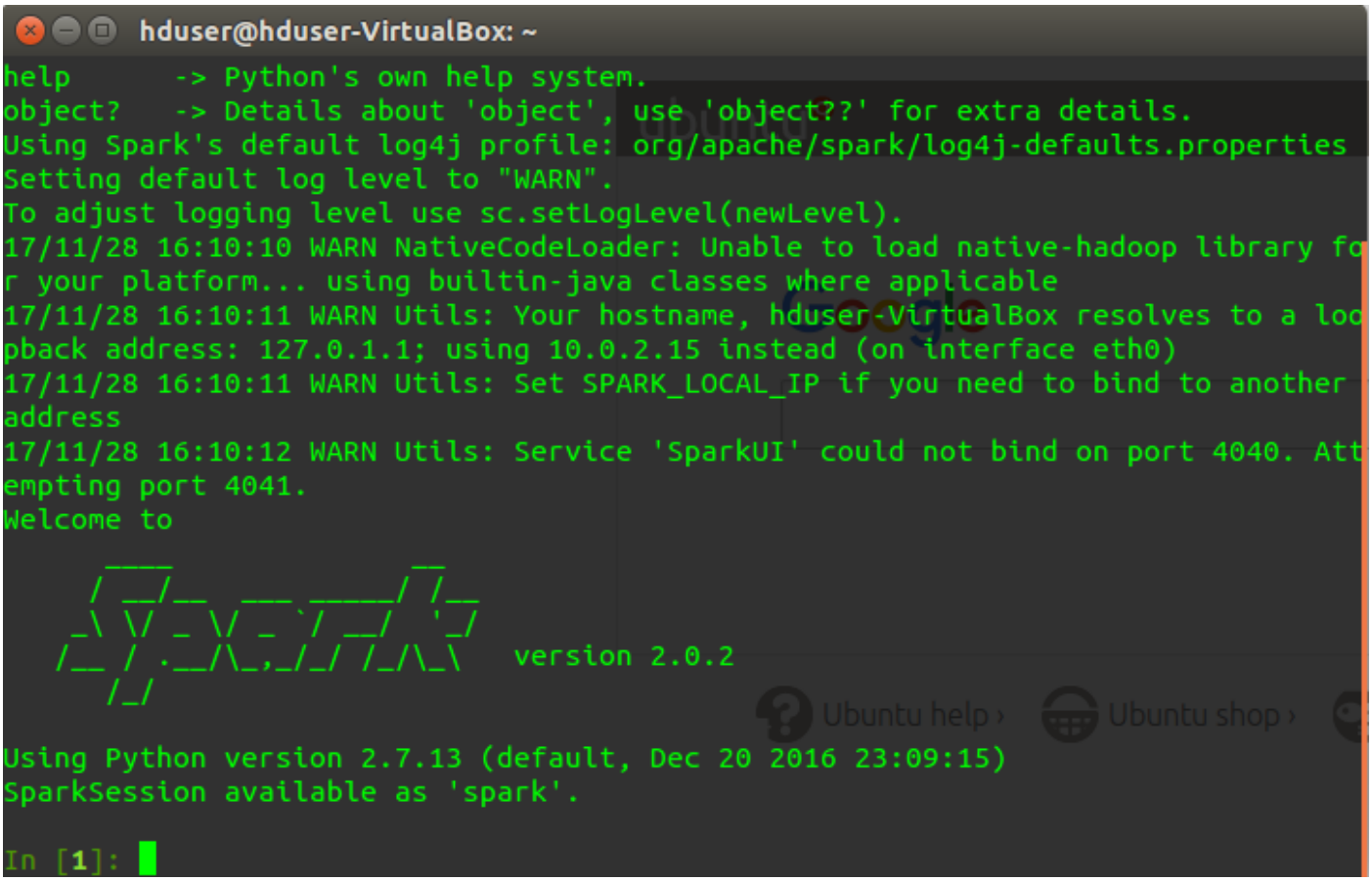
```
export SCALA_HOME=/usr/local/scala
export PATH=$PATH:$SCALA_HOME/bin
```

安裝 Spark 2.0.2
設定 HADOOP 環境變數

```
export SPARK_HOME=/usr/local/spark
export PATH=$PATH:$SPARK_HOME/bin
```

啟動 Spark

$pyspark



ii. 作業目標對應之結果

1. 前處理

```
Import pandas as pd
#from sklearn import tree
Import graphviz
#from sklearn.model_selection import train_test_split
from pyspark.mllib.regression Import LabeledPoint
from pyspark.mllib.tree Import DecisionTree
from pyspark.mllib.util Import MLUtils
from pyspark.mllib.evaluation Import MulticlassMetrics

df = pd.read_csv("file:/home/hduser/pythonwork/dmhw1208/data/character-deaths.csv")#讀取資料
df=df.fillna(0)#把空值以0替代
df.loc[df['Death Year'] > 0, 'Death Year'] = 1.0
df=df.drop('Book of Death',axis = 1)
df=df.drop('Death Chapter',axis = 1)
df = pd.get_dummies(df, columns=['Allegiances'])#將Allegiances底下的家族轉成dummy的特徵
df = df.drop('Name',axis = 1)
```

2. 格式轉換

```
x = df.drop('Death Year', axis=1)
y = df['Death Year']


from sklearn.datasets Import dump_svmlight_file
dump_svmlight_file(x, y, 'svm-output.libsvm')  # where is your y?
from sklearn.datasets Import load_svmlight_file
```

3. 製作 model

```
from pyspark.mllib.tree import DecisionTree, DecisionTreeModel
from pyspark.mllib.util import MLUtils
from pyspark.mllib.evaluation import BinaryClassificationMetrics
from pyspark.mllib.evaluation import MulticlassMetrics
from pyspark.mllib.evaluation import MultilabelMetrics

data  = MLUtils.loadLibSVMFile(sc,"svm-output.libsvm")
(trainingData, testData) = data.randomSplit([0.75, 0.25])
model = DecisionTree.trainClassifier(trainingData, numClasses=2, categoricalFeaturesInfo={},impurity='gini', maxDepth=5, maxBins=32)
```

4. 預測

```
predictions = model.predict(testData.map(lambda x: x.features))
labelsAndPredictions = testData.map(lambda lp: lp.label).zip(predictions)
```

5. 計算 ccuracy, recall, precision

```
metrics = MulticlassMetrics(labelsAndPredictions)
precision = metrics.precision(label=1)
recall = metrics.recall(label=1)
Accuracy = metrics.accuracy
print("Precision = %s" % precision)
print("Recall = %s" % recall)
print("Accuracy = %s" % Accuracy)
```

6. 結果

(1) 產出預測結果(僅列出前三十項，第一欄為原始資料，第二欄為預測的結果。)

```
[(1.0, 0.0),  (0.0, 0.0),  (0.0, 0.0),
 (0.0, 1.0),  (0.0, 1.0),  (0.0, 0.0),
 (1.0, 1.0),  (1.0, 1.0),  (0.0, 0.0),
 (0.0, 1.0),  (0.0, 0.0),  (1.0, 0.0),
 (0.0, 1.0),  (0.0, 1.0),  (0.0, 0.0),
 (1.0, 1.0),  (0.0, 1.0),  (0.0, 0.0),
 (1.0, 1.0),  (0.0, 0.0),  (0.0, 1.0),
 (0.0, 1.0),  (0.0, 1.0),  (0.0, 0.0),
 (0.0, 0.0),  (0.0, 0.0),  (0.0, 0.0),
 (0.0, 1.0),  (0.0, 0.0),  (0.0, 1.0)]
```

(2) 計算 accuracy, recall, precision

Precision = 0.626666666667

Recall = 0.61038961039

Accuracy = 0.725118483412

iii. 討論

- 環境設定：安裝版本若與參考資料不同，則檔案路徑也會不同，在下指令時要特別更改。
- 程式：pandas 前處理後的資料格式為 dataframe，須轉為 mllib 用的 libsvm 格式才能做後續的建樹及預測。