[1]
```
# 授權綁定Google Drive
!apt-get install -y -qq software-properties-common python-software-properties module-init-tools
!add-apt-repository -y ppa:alessandro-strada/ppa 2>&1 > /dev/null
!apt-get update -qq 2>&1 > /dev/null
!apt-get -y install -qq google-drive-ocamlfuse fuse
from google.colab import auth
auth.authenticate_user()
from oauth2client.client import GoogleCredentials
creds = GoogleCredentials.get_application_default()
import getpass
!google-drive-ocamlfuse -headless -id={creds.client_id} -secret={creds.client_secret} < /dev/null 2>&1 | grep URL
vcode = getpass.getpass()
!echo {vcode} | google-drive-ocamlfuse -headless -id={creds.client_id} -secret={creds.client_secret}
```

```
E: Package 'python-software-properties' has no installation candidate
Selecting previously unselected package google-drive-ocamlfuse.
(Reading database ... 134985 files and directories currently installed.)
Preparing to unpack .../google-drive-ocamlfuse_0.7.14-0ubuntu1~ubuntu18.04.1_amd64.deb ...
Unpacking google-drive-ocamlfuse (0.7.14-0ubuntu1~ubuntu18.04.1) ...
Setting up google-drive-ocamlfuse (0.7.14-0ubuntu1~ubuntu18.04.1) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
WARNING:tensorflow:
The TensorFlow contrib module will not be included in TensorFlow 2.0.
For more information, please see:
  * https://github.com/tensorflow/community/blob/master/rfcs/20180907-contrib-sunset.md
  * https://github.com/tensorflow/addons
  * https://github.com/tensorflow/io (for I/O related ops)
If you depend on functionality not listed there, please file an issue.

Please, open the following URL in a web browser: https://accounts.google.com/o/oauth2/auth?client_id=32555940559.apps.googleusercontent.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%
.........
Please, open the following URL in a web browser: https://accounts.google.com/o/oauth2/auth?client_id=32555940559.apps.googleusercontent.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%
Please enter the verification code: Access token retrieved correctly.
```

[2]
```
# 取得雲端資料夾
from google.colab import drive
drive.mount('/content/drive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%

Enter your authorization code:
.........
Mounted at /content/drive
```

[3]
```
# 列出資料夾底下的檔案列表
import os
os.chdir("/content/drive/My Drive/04 中興資管所/5 上課資料/電腦視覺與人機互動/final_project/final_project")
!ls
```

```
 glove.6B
 glove.6B.zip
 model_plot4a.png
 model_plot4b.png
'Multi-label Text Classification with Keras.ipynb'
'Multi-label Text Classification with Keras_Multiple Output Layers'
 Multi_label_Text_Classification_with_Keras_Multiple_Output_Layers.ipynb
 Multi_label_Text_Classification_with_Keras_Multiple_Output_Layers.pdf
 Multi_label_Text_Classification_with_Keras_Multiple_Output_Layers.py
'Multi-label Text Classification with Keras_Single Output Layers'
 Multi_label_Text_Classification_with_Keras_Single_Output_Layers.ipynb
 Multi_label_Text_Classification_with_Keras_Single_Output_Layers.pdf
 Multi_label_Text_Classification_with_Keras_Single_Output_Layers.py
 toxic-comment-classification
 toxic-comment-classification.zip
 toxic_comments.csv
```

[4]
```
# 匯入模組
import re
import pydot
import pandas as pd
import numpy as np
from numpy import array
import matplotlib.pyplot as plt
from numpy import asarray
from numpy import zeros
from keras.preprocessing.text import one_hot
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers.core import Activation, Dropout, Dense
from keras.layers import Flatten, LSTM
from keras.layers import GlobalMaxPooling1D
from keras.models import Model
from keras.layers.embeddings import Embedding
from sklearn.model_selection import train_test_split
from keras.preprocessing.text import Tokenizer
from keras.layers import Input
from keras.layers.merge import Concatenate
from google.colab import drive, files
```

```
Using TensorFlow backend.
```

[5]
```
# 將csv讀入colab的授權前置作業
!pip install -U -q PyDrive
from pydrive.auth import GoogleAuth
from pydrive.drive import GoogleDrive
from google.colab import auth
from oauth2client.client import GoogleCredentials
# Authenticate and create the PyDrive client.
```

```
auth.authenticate_user()
gauth = GoogleAuth()
gauth.credentials = GoogleCredentials.get_application_default()
drive = GoogleDrive(gauth)
drive
```

```
<pydrive.drive.GoogleDrive at 0x7f020c05d4e0>
```

[6]
```
# 取得csv的共用連結'toxic_comments.csv'
link = 'https://drive.google.com/open?id=1w-NPyCW38I7CDVk4eDR6r6Cu6IL9UyfU'
# The shareable link
fluff, id = link.split('=')
print('id =',id)
```

```
id = 1w-NPyCW38I7CDVk4eDR6r6Cu6IL9UyfU
```

[7]
```
# csv匯入dataframe
downloaded = drive.CreateFile({'id':id})
downloaded.GetContentFile('toxic_comments.csv')
toxic_comments = pd.read_csv('toxic_comments.csv')
# 印出前5列
toxic_comments.head()
```

	id	comment_text	toxic	severe_toxic	obscene	threat	insult	identity_hate
0	0000997932d777bf	Explanation\nWhy the edits made under my usern...	0	0	0	0	0	0
1	000103f0d9cfb60f	D'aww! He matches this background colour I'm s...	0	0	0	0	0	0
2	000113f07ec002fd	Hey man, I'm really not trying to edit war. It...	0	0	0	0	0	0
3	0001b41b1c6bb37e	"\nMore\nI can't make any real suggestions on ...	0	0	0	0	0	0
4	0001d958c54c6e35	You, sir, are my hero. Any chance you remember...	0	0	0	0	0	0

[8]
```
# dataframe大小
toxic_comments.shape
```

```
(159571, 8)
```

[9]
```
# 刪除所有列包含空值或空字符串
filter = toxic_comments["comment_text"] != ""
toxic_comments = toxic_comments[filter]
toxic_comments = toxic_comments.dropna()
print('toxic_comments_filter Shape = ',toxic_comments.shape)
```

```
toxic_comments_filter Shape =  (159571, 8)
```

[10]
```
# 找其中一筆資料測試comment的詞語對應到的類別
print(toxic_comments["comment_text"][168])
print("Toxic:" + str(toxic_comments["toxic"][168]))
print("Severe_toxic:" + str(toxic_comments["severe_toxic"][168]))
print("Obscene:" + str(toxic_comments["obscene"][168]))
print("Threat:" + str(toxic_comments["threat"][168]))
print("Insult:" + str(toxic_comments["insult"][168]))
print("Identity_hate:" + str(toxic_comments["identity_hate"][168]))
```

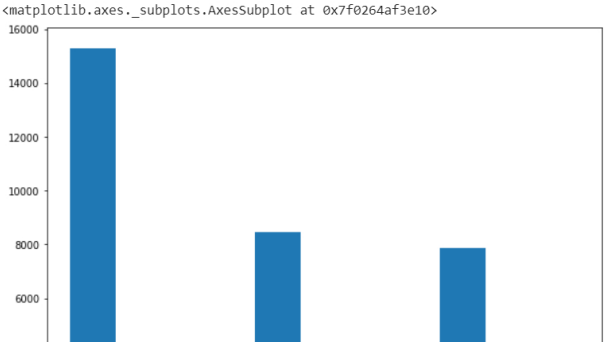
```
You should be fired, you're a moronic wimp who is too lazy to do research. It makes me sick that people like you exist in this world.
Toxic:1
Severe_toxic:0
Obscene:0
Threat:0
Insult:1
Identity_hate:0
```

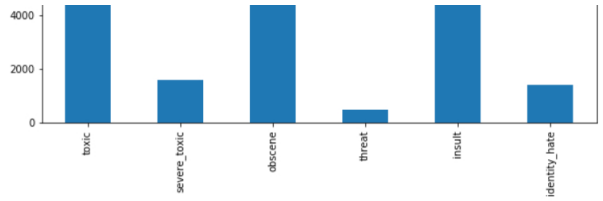
[11]
```
# 繪製每個標籤的評論數
toxic_comments_labels = toxic_comments[["toxic", "severe_toxic", "obscene", "threat", "insult", "identity_hate"]]
toxic_comments_labels.head()
```

	toxic	severe_toxic	obscene	threat	insult	identity_hate
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0

[12]
```
# 畫成長條圖
fig_size = plt.rcParams["figure.figsize"]
fig_size[0] = 10
fig_size[1] = 8
plt.rcParams["figure.figsize"] = fig_size

toxic_comments_labels.sum(axis=0).plot.bar()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0264af3e10>
```





Multi-lable Text Classification Model with Multiple Output Layers

```
[13] # 文本分類模型的第一步是創建一個函式負責清理文本
     def preprocess_text(sen):
         # Remove punctuations and numbers
         sentence = re.sub('[^a-zA-Z]', ' ', sen)

         # Single character removal
         sentence = re.sub(r"\s+[a-zA-Z]\s+", ' ', sentence)

         # Removing multiple spaces
         sentence = re.sub(r'\s+', ' ', sentence)

         return sentence
```

```
[14] # 清理完的文本儲存在X
     X = []
     sentences = list(toxic_comments["comment_text"])
     for sen in sentences:
         X.append(preprocess_text(sen))

     y = toxic_comments[["toxic", "severe_toxic", "obscene", "threat", "insult", "identity_hate"]]
```

```
[15] # 分割訓練集和測試集
     X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=42)
```

```
[16] # y變量包含6個標籤的組合輸出
     # First output
     y1_train = y_train[["toxic"]].values
     y1_test =  y_test[["toxic"]].values

     # Second output
     y2_train = y_train[["severe_toxic"]].values
     y2_test =  y_test[["severe_toxic"]].values

     # Third output
     y3_train = y_train[["obscene"]].values
     y3_test =  y_test[["obscene"]].values

     # Fourth output
     y4_train = y_train[["threat"]].values
     y4_test =  y_test[["threat"]].values

     # Fifth output
     y5_train = y_train[["insult"]].values
     y5_test =  y_test[["insult"]].values

     # Sixth output
     y6_train = y_train[["identity_hate"]].values
     y6_test =  y_test[["identity_hate"]].values
```

```
[17] # 將文本輸入轉換為嵌入向量
     tokenizer = Tokenizer(num_words=5000)
     tokenizer.fit_on_texts(X_train)

     X_train = tokenizer.texts_to_sequences(X_train)
     X_test = tokenizer.texts_to_sequences(X_test)

     vocab_size = len(tokenizer.word_index) + 1
     print('vocab_size = ',vocab_size)

     maxlen = 200

     X_train = pad_sequences(X_train, padding='post', maxlen=maxlen)
     X_test = pad_sequences(X_test, padding='post', maxlen=maxlen)
```

```
vocab_size =  148243
```

```
[18] # 使用GloVe詞嵌入
     embeddings_dictionary = dict()
     glove_file = open('/content/drive/My Drive/04 中興資管所/5 上課資料/電腦視覺與人機互動/final_project/final_project/glove.6B/glove.6B.100d.txt', encoding="utf8")

     for line in glove_file:
         records = line.split()
         word = records[0]
         vector_dimensions = asarray(records[1:], dtype='float32')
         embeddings_dictionary[word] = vector_dimensions
     glove_file.close()

     embedding_matrix = zeros((vocab_size, 100))
     for word, index in tokenizer.word_index.items():
         embedding_vector = embeddings_dictionary.get(word)
         if embedding_vector is not None:
             embedding_matrix[index] = embedding_vector
```

```
[19] # 建立LSTM模型
     input_1 = Input(shape=(maxlen,))
     embedding_layer = Embedding(vocab_size, 100, weights=[embedding_matrix], trainable=False)(input_1)
     LSTM_Layer1 = LSTM(128)(embedding_layer)

     output1 = Dense(1, activation='sigmoid')(LSTM_Layer1)
```

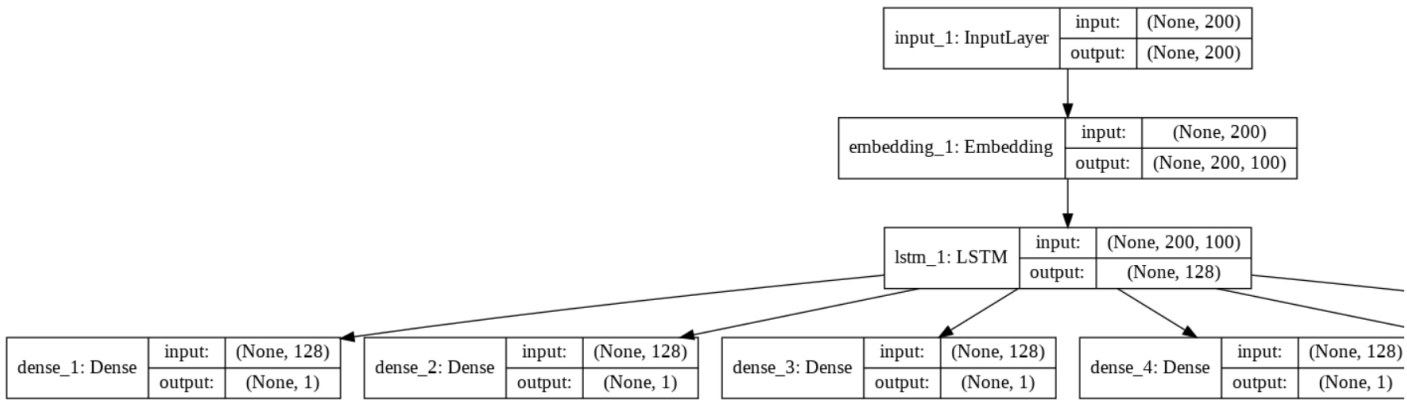
```
output2 = Dense(1, activation='sigmoid')(LSTM_Layer1)
output3 = Dense(1, activation='sigmoid')(LSTM_Layer1)
output4 = Dense(1, activation='sigmoid')(LSTM_Layer1)
output5 = Dense(1, activation='sigmoid')(LSTM_Layer1)
output6 = Dense(1, activation='sigmoid')(LSTM_Layer1)

model = Model(inputs=input_1, outputs=[output1, output2, output3, output4, output5, output6])
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['acc'])
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:66: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:541: The name tf.placeholder is deprecated. Please use tf.compat.v1.placeholder inste

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:4432: The name tf.random_uniform is deprecated. Please use tf.random.uniform instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:190: The name tf.get_default_session is deprecated. Please use tf.compat.v1.get_defau

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:197: The name tf.ConfigProto is deprecated. Please use tf.compat.v1.ConfigProto inste

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:203: The name tf.Session is deprecated. Please use tf.compat.v1.Session instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:207: The name tf.global_variables is deprecated. Please use tf.compat.v1.global_varia

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:216: The name tf.is_variable_initialized is deprecated. Please use tf.compat.v1.is_va

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:223: The name tf.variables_initializer is deprecated. Please use tf.compat.v1.variabl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/optimizers.py:793: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:3657: The name tf.log is deprecated. Please use tf.math.log instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow_core/python/ops/nn_impl.py:183: where (from tensorflow.python.ops.array_ops) is deprecated and will be removed
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
```

[20]
```
model.summary()
```

```
Model: "model_1"
_________________________________________________________________________________________________
Layer (type)                 Output Shape              Param #     Connected to
=================================================================================================
input_1 (InputLayer)         (None, 200)               0
_________________________________________________________________________________________________
embedding_1 (Embedding)      (None, 200, 100)          14824300    input_1[0][0]
_________________________________________________________________________________________________
lstm_1 (LSTM)                (None, 128)               117248      embedding_1[0][0]
_________________________________________________________________________________________________
dense_1 (Dense)              (None, 1)                 129         lstm_1[0][0]
_________________________________________________________________________________________________
dense_2 (Dense)              (None, 1)                 129         lstm_1[0][0]
_________________________________________________________________________________________________
dense_3 (Dense)              (None, 1)                 129         lstm_1[0][0]
_________________________________________________________________________________________________
dense_4 (Dense)              (None, 1)                 129         lstm_1[0][0]
_________________________________________________________________________________________________
dense_5 (Dense)              (None, 1)                 129         lstm_1[0][0]
_________________________________________________________________________________________________
dense_6 (Dense)              (None, 1)                 129         lstm_1[0][0]
=================================================================================================
Total params: 14,942,322
Trainable params: 118,022
Non-trainable params: 14,824,300
_________________________________________________________________________________________________
```

[21]
```
from keras.utils import plot_model
plot_model(model, to_file='model_plot4b.png', show_shapes=True, show_layer_names=True)
```



[22]
```
history = model.fit(x=X_train, y=[y1_train, y2_train, y3_train, y4_train, y5_train, y6_train], batch_size=8192, epochs=5, verbose=1, validation_split=0.2)
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:1033: The name tf.assign_add is deprecated. Please use tf.compat.v1.assign_add instea

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_backend.py:1020: The name tf.assign is deprecated. Please use tf.compat.v1.assign instead.

Train on 102124 samples, validate on 25532 samples
Epoch 1/5
102124/102124 [==============================] - 85s 835us/step - loss: 3.5806 - dense_1_loss: 0.6208 - dense_2_loss: 0.5916 - dense_3_loss: 0.5932 - dense_4_loss: 0.5811 - dense_5_los
Epoch 2/5
102124/102124 [==============================] - 79s 777us/step - loss: 0.9019 - dense_1_loss: 0.3175 - dense_2_loss: 0.0744 - dense_3_loss: 0.2183 - dense_4_loss: 0.0341 - dense_5_los
Epoch 3/5
102124/102124 [==============================] - 79s 776us/step - loss: 0.8482 - dense_1_loss: 0.3151 - dense_2_loss: 0.0571 - dense_3_loss: 0.2079 - dense_4_loss: 0.0217 - dense_5_los
Epoch 4/5
102124/102124 [==============================] - 78s 768us/step - loss: 0.8442 - dense_1_loss: 0.3146 - dense_2_loss: 0.0574 - dense_3_loss: 0.2062 - dense_4_loss: 0.0214 - dense_5_los
Epoch 5/5
102124/102124 [==============================] - 78s 769us/step - loss: 0.8411 - dense_1_loss: 0.3144 - dense_2_loss: 0.0562 - dense_3_loss: 0.2054 - dense_4_loss: 0.0214 - dense_5_los
```

```
[23] # 評估模型準確率
     score = model.evaluate(x=X_test, y=[y1_test, y2_test, y3_test, y4_test, y5_test, y6_test], verbose=1)

     print("Test Score:", score[0])
     print("Test Accuracy:", score[1])
```

```
31915/31915 [==============================] - 37s 1ms/step
Test Score: 0.8477085876330376
Test Accuracy: 0.31438121781647255
```

```
# 畫成圖
plt.plot(history.history['dense_1_acc'])
plt.plot(history.history['val_dense_1_acc'])

plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train','test'], loc='upper left')
plt.show()

plt.plot(history.history['dense_1_loss'])
plt.plot(history.history['val_dense_1_loss'])

plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train','test'], loc='upper left')
plt.show()
```