toxic-comment-classification-12

April 2, 2024

[1]:

```
!pip install -U -q kaggle
!mkdir -p ~/.kaggle
```

[2]:

```
#copy kaggle json file
!cp /content/drive/MyDrive/kaggle.json ~/.kaggle/
```

[3]:

```
!kaggle -v
```

```
Kaggle API 1.5.4
```

[4]:

```
#download toxic dataset
!kaggle competitions download -c jigsaw-toxic-comment-classification-challenge
```

```
Warning: Looks like you're using an outdated API Version, please consider
updating (server 1.5.12 / client 1.5.4)
Downloading train.csv.zip to /content
 76% 20.0M/26.3M [00:00<00:00, 65.2MB/s]
100% 26.3M/26.3M [00:00<00:00, 103MB/s]
Downloading test.csv.zip to /content
 90% 21.0M/23.4M [00:00<00:00, 66.0MB/s]
100% 23.4M/23.4M [00:00<00:00, 115MB/s]
Downloading sample_submission.csv.zip to /content
  0% 0.00/1.39M [00:00<?, ?B/s]
100% 1.39M/1.39M [00:00<00:00, 94.9MB/s]
Downloading test_labels.csv.zip to /content
  0% 0.00/1.46M [00:00<?, ?B/s]
100% 1.46M/1.46M [00:00<00:00, 98.1MB/s]
```

[5]:

```
!unzip train.csv.zip
```

```
Archive:  train.csv.zip
  inflating: train.csv
```

[6]:

```
!head train.csv
```

```
"id","comment_text","toxic","severe_toxic","obscene","threat","insult","identity
_hate"
"0000997932d777bf","Explanation
```

```
Why the edits made under my username Hardcore Metallica Fan were reverted? They
weren't vandalisms, just closure on some GAs after I voted at New York Dolls
FAC. And please don't remove the template from the talk page since I'm retired
now.89.205.38.27",0,0,0,0,0,0
"000103f0d9cfb60f","D'aww! He matches this background colour I'm seemingly stuck
with. Thanks.  (talk) 21:51, January 11, 2016 (UTC)",0,0,0,0,0,0
"000113f07ec002fd","Hey man, I'm really not trying to edit war. It's just that
this guy is constantly removing relevant information and talking to me through
edits instead of my talk page. He seems to care more about the formatting than
the actual info.",0,0,0,0,0,0
"0001b41b1c6bb37e","""
More
I can't make any real suggestions on improvement - I wondered if the section
statistics should be later on, or a subsection of """"types of accidents""""  -I
think the references may need tidying so that they are all in the exact same
format ie date format etc. I can do that later on, if no-one else does first -
if you have any preferences for formatting style on references or want to do it
yourself please let me know.

There appears to be a backlog on articles for review so I guess there may be a
delay until a reviewer turns up. It's listed in the relevant form eg
Wikipedia:Good_article_nominations#Transport  """,0,0,0,0,0,0
```

[7]:

```python
from __future__ import print_function, division
from builtins import range
# Note: you may need to update your version of future
# sudo pip install -U future
```

[8]:

```python
import os
import sys
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.layers import Dense, Input, GlobalMaxPooling1D
from keras.layers import Conv1D, MaxPooling1D, Embedding
from keras.models import Model
from sklearn.metrics import roc_auc_score
```

[ ]:

```python
# Download the data:
# https://www.kaggle.com/c/jigsaw-toxic-comment-classification-challenge
# Download the word vectors:
# http://nlp.stanford.edu/data/glove.6B.zip
```

[9]:

```python
# some configuration
MAX_SEQUENCE_LENGTH = 100
```

```
MAX_VOCAB_SIZE = 20000
EMBEDDING_DIM = 100
VALIDATION_SPLIT = 0.2
BATCH_SIZE = 128
EPOCHS = 10
```

load in pre-trained word vectors

[10]:
```
print('Loading word vectors...')
word2vec = {}
#/content/drive/MyDrive/glove.6B.100d.txt
with open(os.path.join('/content/drive/MyDrive/glove.6B.%sd.txt' %␣
 ↪EMBEDDING_DIM)) as f:
  # is just a space-separated text file in the format:
  # word vec[0] vec[1] vec[2] ...
  for line in f:
    values = line.split()
    word = values[0]
    vec = np.asarray(values[1:], dtype='float32')
    word2vec[word] = vec
print('Found %s word vectors.' % len(word2vec))
```

```
Loading word vectors…
Found 400000 word vectors.
```

prepare text samples and their labels

[11]:
```
print('Loading in comments...')

train = pd.read_csv("../content/train.csv")
sentences = train["comment_text"].fillna("DUMMY_VALUE").values
possible_labels = ["toxic", "severe_toxic", "obscene", "threat", "insult",␣
 ↪"identity_hate"]
targets = train[possible_labels].values
```

```
Loading in comments…
```

[12]:
```
print(sentences.shape)
print(targets.shape)
```

```
(159571,)
(159571, 6)
```

[13]:
```
print("max sequence length:", max(len(s) for s in sentences))
print("min sequence length:", min(len(s) for s in sentences))
s = sorted(len(s) for s in sentences)
print("median sequence length:", s[len(s) // 2])
```

```
max sequence length: 5000
```

```
min sequence length: 6
median sequence length: 205
```

[14]:

```
# convert the sentences (strings) into integers
tokenizer = Tokenizer(num_words=MAX_VOCAB_SIZE)
tokenizer.fit_on_texts(sentences)
sequences = tokenizer.texts_to_sequences(sentences)
# print("sequences:", sequences); exit()


print("max sequence length:", max(len(s) for s in sequences))
print("min sequence length:", min(len(s) for s in sequences))
s = sorted(len(s) for s in sequences)
print("median sequence length:", s[len(s) // 2])

print("max word index:", max(max(seq) for seq in sequences if len(seq) > 0))
```

```
max sequence length: 1400
min sequence length: 0
median sequence length: 35
max word index: 19999
```

[15]:

```
# get word -> integer mapping
word2idx = tokenizer.word_index
print('Found %s unique tokens.' % len(word2idx))
```

```
Found 210337 unique tokens.
```

[16]:

```
# pad sequences so that we get a N x T matrix
data = pad_sequences(sequences, maxlen=MAX_SEQUENCE_LENGTH)
print('Shape of data tensor:', data.shape)
```

```
Shape of data tensor: (159571, 100)
```

[17]:

```
# prepare embedding matrix
print('Filling pre-trained embeddings...')
num_words = min(MAX_VOCAB_SIZE, len(word2idx) + 1)
embedding_matrix = np.zeros((num_words, EMBEDDING_DIM))
for word, i in word2idx.items():
  if i < MAX_VOCAB_SIZE:
    embedding_vector = word2vec.get(word)
    if embedding_vector is not None:
      # words not found in embedding index will be all zeros.
      embedding_matrix[i] = embedding_vector
```

```
Filling pre-trained embeddings…
```

[18]:

```
embedding_layer = Embedding(
  num_words,
  EMBEDDING_DIM,
  weights=[embedding_matrix],
  input_length=MAX_SEQUENCE_LENGTH,
  trainable=False
)
```

[19]:

```
print('Building model...')

# train a 1D convnet with global maxpooling
input_ = Input(shape=(MAX_SEQUENCE_LENGTH,))
x = embedding_layer(input_)
x = Conv1D(128, 3, activation='relu')(x)
x = MaxPooling1D(3)(x)
x = Conv1D(128, 3, activation='relu')(x)
x = MaxPooling1D(3)(x)
x = Conv1D(128, 3, activation='relu')(x)
x = GlobalMaxPooling1D()(x)
x = Dense(128, activation='relu')(x)
output = Dense(len(possible_labels), activation='sigmoid')(x)

model = Model(input_, output)
model.compile(
  loss='binary_crossentropy',
  optimizer='rmsprop',
  metrics=['accuracy']
)

print('Training model...')
r = model.fit(
  data,
  targets,
  batch_size=BATCH_SIZE,
  epochs=EPOCHS,
  validation_split=VALIDATION_SPLIT
)
```

```
Building model…
Training model…
Epoch 1/10
998/998 [==============================] - 28s 14ms/step - loss: 0.0839 -
accuracy: 0.9758 - val_loss: 0.0771 - val_accuracy: 0.9941
Epoch 2/10
998/998 [==============================] - 13s 13ms/step - loss: 0.0676 -
accuracy: 0.9927 - val_loss: 0.0892 - val_accuracy: 0.9941
Epoch 3/10
```

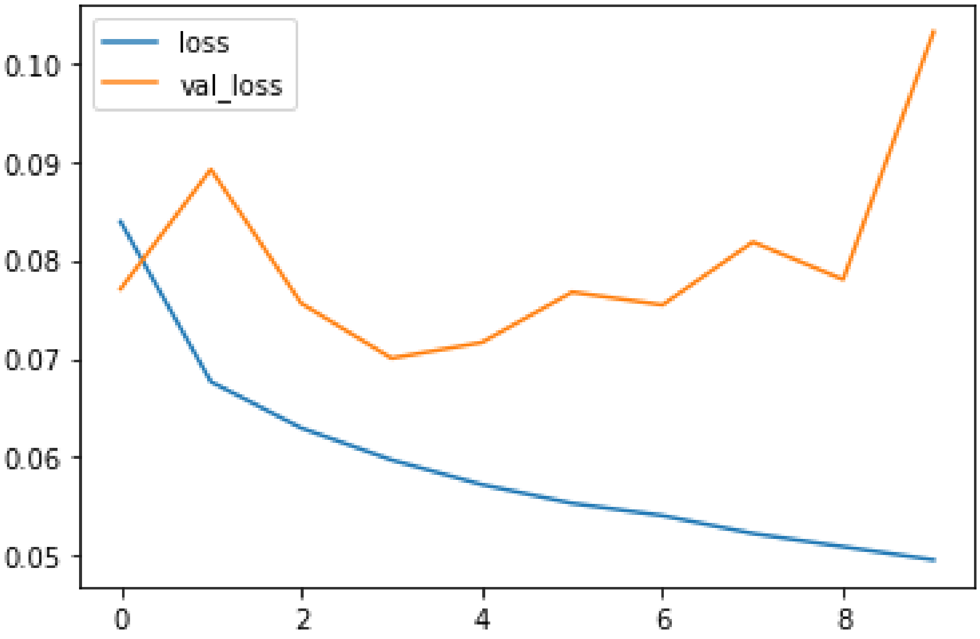
```
998/998 [==============================] - 14s 14ms/step - loss: 0.0629 -
accuracy: 0.9924 - val_loss: 0.0756 - val_accuracy: 0.9941
Epoch 4/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0597 -
accuracy: 0.9930 - val_loss: 0.0700 - val_accuracy: 0.9848
Epoch 5/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0572 -
accuracy: 0.9935 - val_loss: 0.0716 - val_accuracy: 0.9938
Epoch 6/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0553 -
accuracy: 0.9937 - val_loss: 0.0767 - val_accuracy: 0.9937
Epoch 7/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0540 -
accuracy: 0.9937 - val_loss: 0.0754 - val_accuracy: 0.9938
Epoch 8/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0522 -
accuracy: 0.9935 - val_loss: 0.0818 - val_accuracy: 0.9936
Epoch 9/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0509 -
accuracy: 0.9933 - val_loss: 0.0780 - val_accuracy: 0.9941
Epoch 10/10
998/998 [==============================] - 14s 14ms/step - loss: 0.0495 -
accuracy: 0.9931 - val_loss: 0.1032 - val_accuracy: 0.9918
```

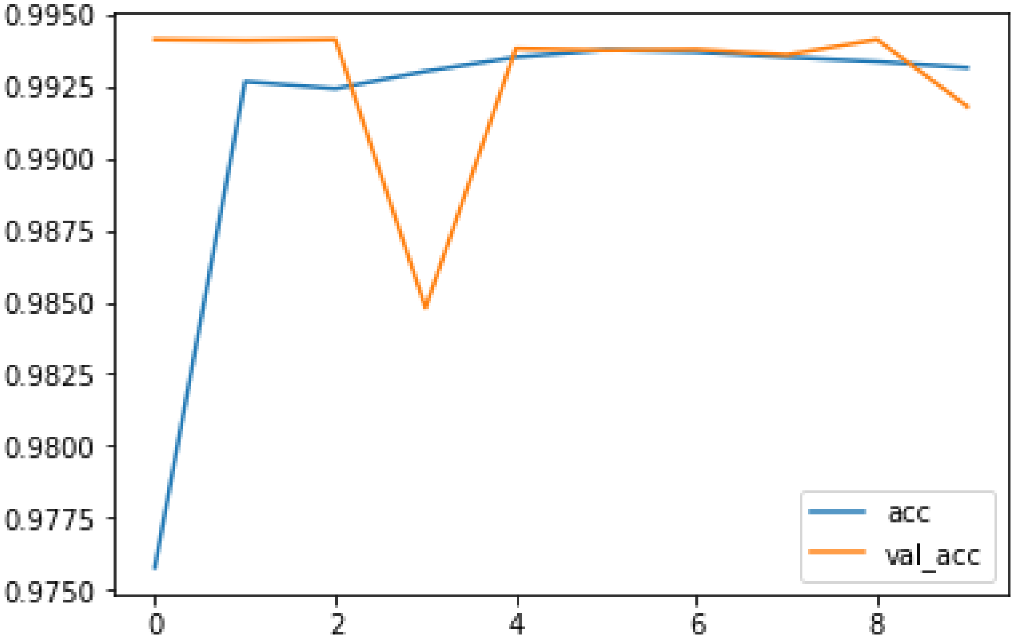
[20]:

```
# plot some data
plt.plot(r.history['loss'], label='loss')
plt.plot(r.history['val_loss'], label='val_loss')
plt.legend()
plt.show()

# accuracies
plt.plot(r.history['accuracy'], label='acc')
plt.plot(r.history['val_accuracy'], label='val_acc')
plt.legend()
plt.show()

# plot the mean AUC over each label
p = model.predict(data)
aucs = []
for j in range(6):
    auc = roc_auc_score(targets[:,j], p[:,j])
    aucs.append(auc)
print(np.mean(aucs))
```





```
0.975805863700396
```

###embedding layer without pretrained word embedding

[23]:

```
embedding_layer = Embedding(
  num_words,
  EMBEDDING_DIM,
  #weights=[embedding_matrix],
  input_length=MAX_SEQUENCE_LENGTH,
  #trainable=False
)
```

[24]:

```
print('Building model without pretrained word embeddings')

# train a 1D convnet with global maxpooling
input_ = Input(shape=(MAX_SEQUENCE_LENGTH,))
x = embedding_layer(input_)
x = Conv1D(128, 3, activation='relu')(x)
x = MaxPooling1D(3)(x)
x = Conv1D(128, 3, activation='relu')(x)
x = MaxPooling1D(3)(x)
x = Conv1D(128, 3, activation='relu')(x)
x = GlobalMaxPooling1D()(x)
x = Dense(128, activation='relu')(x)
output = Dense(len(possible_labels), activation='sigmoid')(x)

model = Model(input_, output)
model.compile(
  loss='binary_crossentropy',
  optimizer='rmsprop',
  metrics=['accuracy']
)

print('Training model...')
r = model.fit(
  data,
  targets,
  batch_size=BATCH_SIZE,
  epochs=EPOCHS,
  validation_split=VALIDATION_SPLIT
)
```

```
Building model without pretrained word embeddings
Training model…
Epoch 1/10
998/998 [==============================] - 18s 17ms/step - loss: 0.0826 -
accuracy: 0.9852 - val_loss: 0.0738 - val_accuracy: 0.9941
Epoch 2/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0625 -
accuracy: 0.9936 - val_loss: 0.1003 - val_accuracy: 0.9940
Epoch 3/10
```

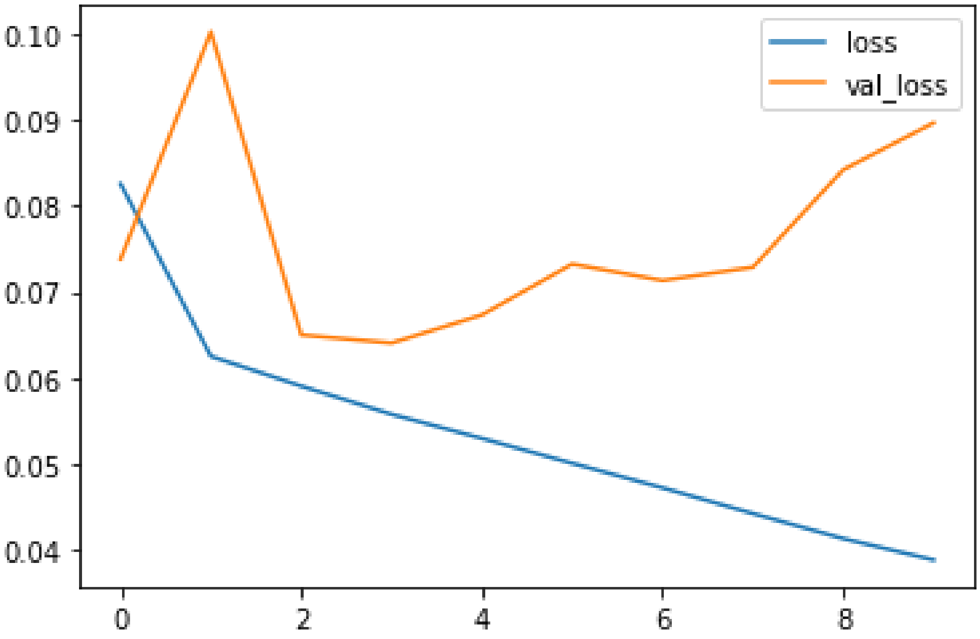
```
998/998 [==============================] - 17s 17ms/step - loss: 0.0590 -
accuracy: 0.9933 - val_loss: 0.0650 - val_accuracy: 0.9934
Epoch 4/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0558 -
accuracy: 0.9931 - val_loss: 0.0640 - val_accuracy: 0.9922
Epoch 5/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0529 -
accuracy: 0.9929 - val_loss: 0.0673 - val_accuracy: 0.9924
Epoch 6/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0500 -
accuracy: 0.9931 - val_loss: 0.0732 - val_accuracy: 0.9938
Epoch 7/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0472 -
accuracy: 0.9912 - val_loss: 0.0713 - val_accuracy: 0.9926
Epoch 8/10
998/998 [==============================] - 16s 16ms/step - loss: 0.0442 -
accuracy: 0.9903 - val_loss: 0.0729 - val_accuracy: 0.9930
Epoch 9/10
998/998 [==============================] - 16s 16ms/step - loss: 0.0413 -
accuracy: 0.9911 - val_loss: 0.0842 - val_accuracy: 0.9931
Epoch 10/10
998/998 [==============================] - 17s 17ms/step - loss: 0.0388 -
accuracy: 0.9887 - val_loss: 0.0897 - val_accuracy: 0.9886
```

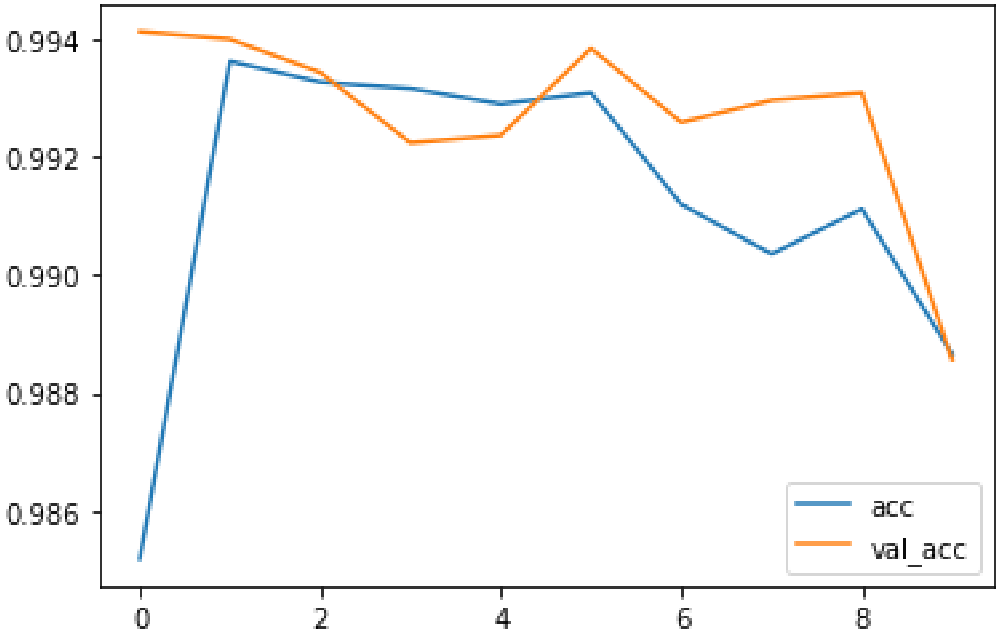
[25]:

```python
# plot some data
plt.plot(r.history['loss'], label='loss')
plt.plot(r.history['val_loss'], label='val_loss')
plt.legend()
plt.show()

# accuracies
plt.plot(r.history['accuracy'], label='acc')
plt.plot(r.history['val_accuracy'], label='val_acc')
plt.legend()
plt.show()

# plot the mean AUC over each label
p = model.predict(data)
aucs = []
for j in range(6):
    auc = roc_auc_score(targets[:,j], p[:,j])
    aucs.append(auc)
print(np.mean(aucs))
```





```
0.9791297567686225
```