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1. 請比較有無normalize的差別。並說明如何normalize.

RMSE	Without Normalize	With Normalize
public/private	0.86314/0.85786	0.87800/0.87395

Normalize的方法是將Rating分數做標準化（減去平均除以標準差）再做training，而後在test的部分將預測出來的分數乘以原本的標準差和加上平均值做還原，但發現結果並沒有做改善。

2. 比較不同的embedding dimension的結果。

Dimension	RMSE public	RMSE private
64	0.86314	0.85786
128	0.86445	0.85795
256	0.86637	0.86061
512	0.87169	0.86687

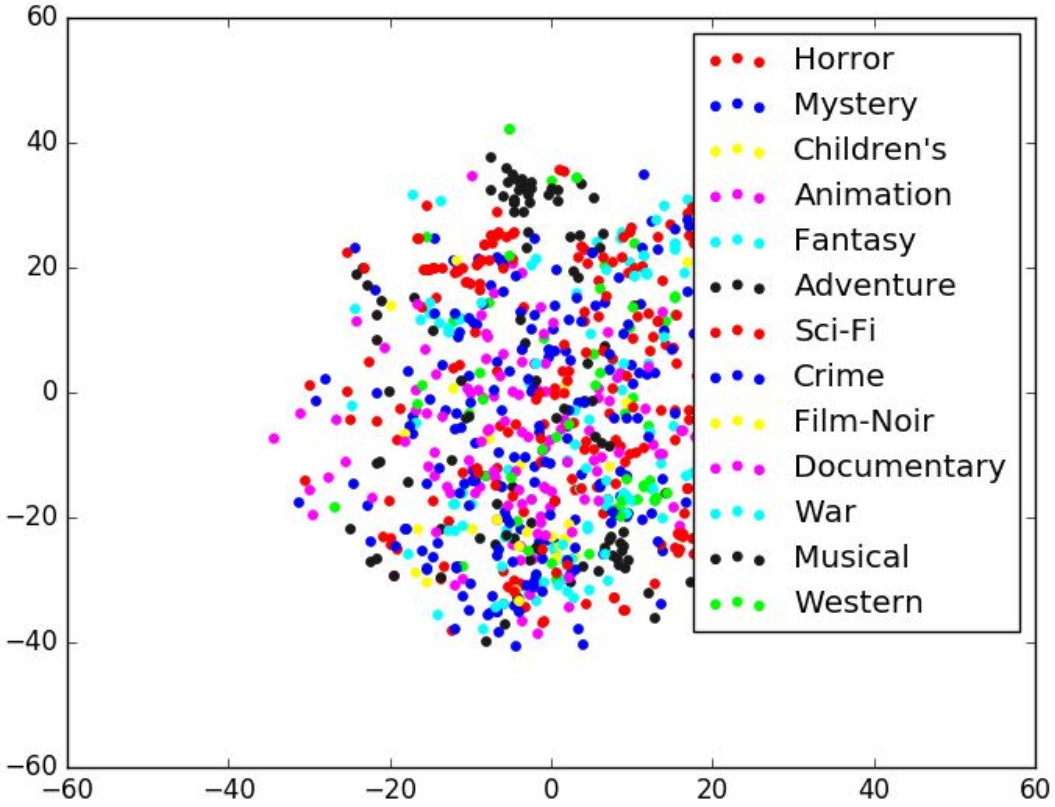
可以發現，結果在64-dim的時候效果最好，若dim多了，則可能因為feature變多而比較難train和over-fitting。

3. 比較有無bias的結果。

RMSE	With bias	Without bias
public/private	0.86314/0.85786	0.86412/0.85823

加入bias後，performance有比較好，因為可以多考慮到如使用者本身的偏好和電影的特性使預測更準確。

4. 請試著將movie的embedding用tsne降維後，將movie category當作label來作圖。
(Collaborators:b03901109陳緯哲)



5. 試著使用除了rating以外的feature, 並說明你的作法和結果，結果好壞不會影響評分。
(Collaborators:b03901109陳緯哲)

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____________________________________________________________________________________________________
Layer (type)                     Output Shape          Param #     Connected to
====================================================================================================
input_1 (InputLayer)             (None, 1)             0
____________________________________________________________________________________________________
input_2 (InputLayer)             (None, 1)             0
____________________________________________________________________________________________________
embedding_1 (Embedding)          (None, 1, 64)         386560      input_1[0][0]
____________________________________________________________________________________________________
embedding_2 (Embedding)          (None, 1, 64)         252928      input_2[0][0]
____________________________________________________________________________________________________
input_3 (InputLayer)             (None, 18)            0
____________________________________________________________________________________________________
flatten_1 (Flatten)              (None, 64)            0           embedding_1[0][0]
____________________________________________________________________________________________________
flatten_2 (Flatten)              (None, 64)            0           embedding_2[0][0]
____________________________________________________________________________________________________
embedding_4 (Embedding)          (None, 1, 1)          3952        input_2[0][0]
____________________________________________________________________________________________________
embedding_3 (Embedding)          (None, 1, 1)          6040        input_1[0][0]
____________________________________________________________________________________________________
dense_1 (Dense)                  (None, 64)            1216        input_3[0][0]
____________________________________________________________________________________________________
dot_1 (Dot)                      (None, 1)             0           flatten_1[0][0]
                                                                   flatten_2[0][0]
____________________________________________________________________________________________________
flatten_4 (Flatten)              (None, 1)             0           embedding_4[0][0]
____________________________________________________________________________________________________
flatten_3 (Flatten)              (None, 1)             0           embedding_3[0][0]
____________________________________________________________________________________________________
dot_2 (Dot)                      (None, 1)             0           flatten_1[0][0]
                                                                   dense_1[0][0]
____________________________________________________________________________________________________
add_1 (Add)                      (None, 1)             0           dot_1[0][0]
                                                                   flatten_4[0][0]
                                                                   flatten_3[0][0]
                                                                   dot_2[0][0]
____________________________________________________________________________________________________
dense_2 (Dense)                  (None, 1)             2           add_1[0][0]
====================================================================================================
Total params: 650,698
Trainable params: 650,698
Non-trainable params: 0
____________________________________________________________________________________________________
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透過將movie.csv裡頭透露的資訊，將電影特色的18-dim轉為one-hot-encoding後再接上dense，最後輸出64-dim再add起來，其他結構和原本不變，但結果並無原本使用rating來得好。

RMSE	Rating	Genre
public/private	0.86314/0.85786	0.93950/0.93683