R05921063 陳定楷 HW3 討論對象：F04942066劉楚彤、R04942143吳兆倫

1. **Supervised learning: CNN**
   pseudo code

```
model = Convolution(32,3,3,'relu')+Convolution(32,3,3,'relu')
        + MaxPolling((2,2))+Dropout(0.25)
        + Convolution(64,3,3,'relu')+Convolution(64,3,3,'relu')
        + MaxPolling((2,2))+Dropout(0.25)
        + Flatten()+Dense(512,'relu')+Dropout(0.5)
        + Dense(10,'softmax')
model.optimizer = Adadelta(learningRate=0.3)
model.loss = 'cross_entropy'
model.fit(3-folds cross-validation of label data)

prediction = model.predict(test)
```

   Accuracy: Kaggle: 0.56, Cross-validation: 0.65

2. **Semi-supervised learning(1): Self-training**
   pseudo code

```
model = same model of supervised learning
sampleWeight = ones(5000)*10
for i < 4 and unlabel != 0, i++
        unlabelPD = model.predict(unlabel)
        addList = [new | for new in unlabelPD, max(new)>0.9]
        label += addList
        unlabel -= addList
        sampleWeight += ones(len(addList))
        model.fit(label)

prediction = model.predict(test)
```

   Accuracy: Kaggle: 0.57

3. **Semi-supervised learning(2): Autoencoder**
   pseudo code

```
encoded = Convolution(16,3,3,'relu')+MaxPooling((2,2))
                + Convolution(8,3,3,'relu')+MaxPooling((2,2))
                + Convolution(8,3,3,'relu')+MaxPooling((2,2))
decoded = Convolution(8,3,3,'relu')+UpSampling((2,2))
                + Convolution(8,3,3,'relu')+UpSampling((2,2))
                + Convolution(16,3,3,'relu')+UpSampling((2,2))
                + Convolution(3,3,3,'sigmoid')
```

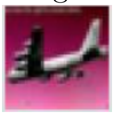
```
autoencoder = Model(encoded+decoded)
encoder = Model(encoded)
autoencoder.optimizer = Adadelta(learningRate = 1)
autoencoder.loss = "binary crossentropy"
autoencoder.fit((label+unlabel), (label+unlabel))

labelfeat, unlabelfeat = encoder.predict(label, unlabel)
Use KNN(labelfeat, unlabelfeat, K=15) to classify unlabel data
allData = label+classified_unlabel
model = same model of supervised learning
model.fit(3-folds cross-validation of allData)

prediction = model.predict(test)
```

Accuracy: Kaggle: 0.38

4. **Discussion**
在三種learning下都使用同一個CNN model，以Kaggle的accuracy比較：
self-training > supervised CNN > autoencoder
之所以autoencoder的準確度不高，可能是因為autoencoder training不完全看出來。 Loss在整個training的過程中大致在0.55到0.6，並沒有降到很低，代表output的圖片與input的一致性偏低:
image 3 input: output:



因此無法保證經過encoder取出的feature會接近同種類的feature，KNN可信度下降會導致unlabel data在分類時分錯，最後使accuracy降低。

參考資料：keras.io, The Keras Blog