

高效能運算與深度學習 期末報告
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Invasive Species Monitoring

Introduction

MNist上的實驗已經做過很多，之前修過的李宏毅教授的ML課也碰過，我決定在別的dataset上驗證課程所學到的技巧。我找到了在Kaggle上的Invasive Species Monitoring。

Kaggle: <https://www.kaggle.com/c/invasive-species-monitoring>

該題目提供了植株的影像以及個別的label(據攻擊性與否)，希望能用機器學習決定出植株是否具invasive(攻擊性)。

Data Description

Training data:

Images 2295張彩色相片 (2295, 866, 1154, 3)

Labels 0 或 1的Label (2295,)

Testing data:

Images 1531張彩色相片 (1531, 866, 1154, 3)

Not Invasive



Invasive



Github

<https://github.com/b02901072/InvasiveSpeciesMonitoring.git>

1. bash download.sh
2. python3 resize.py #做前處理將圖片resize成150x200的固定大小
3. python3 [CNN.py DNN.py vgg16.py]

Method

(1)Input 彩色照片

(2)Output Binary Classification (0-1)

1. Only DNN

Input-500(drop 0.25)-500(drop 0.25)-500(drop 0.25)-250(drop 0.25)-Output

除了最後binary classification用sigmoid之外，其餘都用relu

(1)我一開始optimizer用adam是train不起來，全部output成1.0

(2)改為SGD並調整lr之後，才train的起來

Kaggle Best: 0.83172

2. Only CNN

Input-Conv2D(32)-Max(2,2)-Conv2D(32)-Max(2,2)-Conv2D(64)-Max(2,2)-Conv2D(64)-

Max(2,2)-Conv2D(128)-Max(2,2)-Conv2D(128)-Max(2,2)-Dense(256, drop 0.5)-Output

Kaggle Best 0.96386

3. Transfer Learning: Pre-trained Model (VGG16)

VGG16是ILSVRC-2014，由VGG team開發的16-layer CNN model，在圖形辨識上有良好的表現。

其構造為以下

Input-Conv2D(64)^2-Max(2,2)-Conv2D(128)^2-Max(2,2)-Conv2D(256)^3-Max(2,2)-

Conv2D(512)^3-Max(2,2)-Conv2D(512)^3-Max(2,2)-Dense(4096)-Dense(1000)-Output

可在這基礎之上接上Output層，已滿足我們需要的binary classification

Kaggle Best: 0.96933

4. Data Augmentation

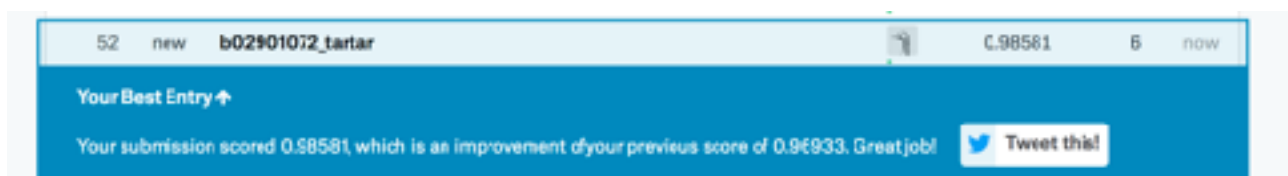
```
rotation_range = 30
width_shift_range = 0.1
height_shift_range = 0.1
horizontal_flip = True
```

CNN + data_aug

Kaggle Best: 0.96070

VGG16 + data_aug

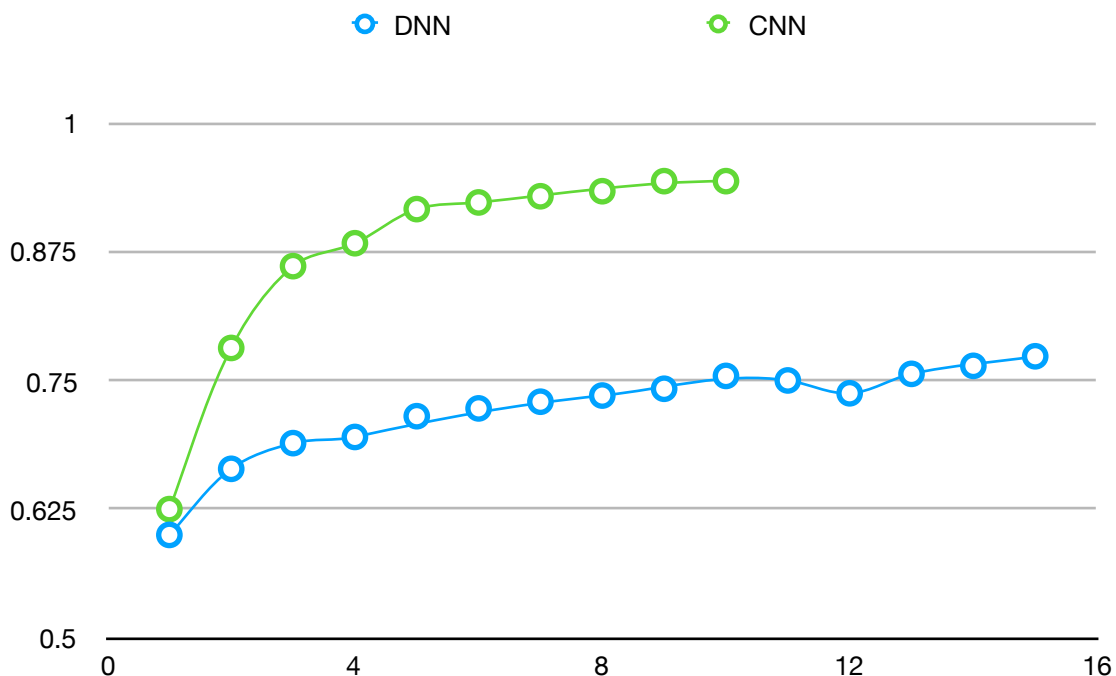
Kaggle Best: 0.98581



Discussion

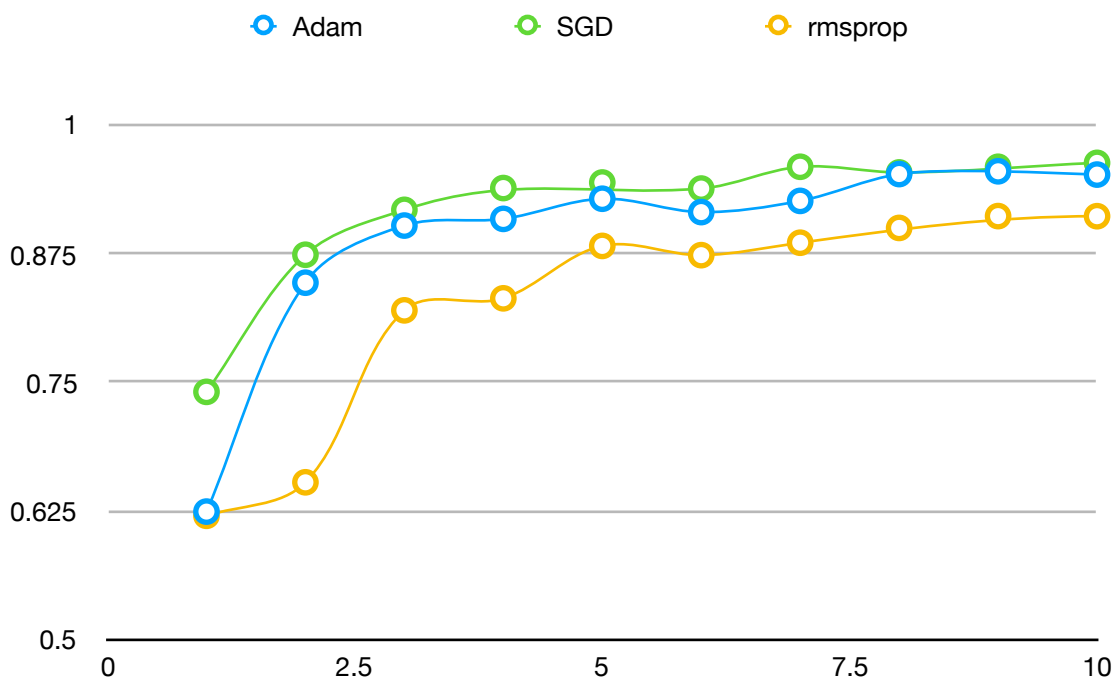
1. DNN vs CNN

在影像辨識的領域上，DNN和CNN有著巨大的鴻溝。



2. Optimizer

下圖我在CNN.py實驗的結果



Reference

Building powerful image classification models using very little data

<https://blog.keras.io/building-powerful-image-classification-models-using-very-little-data.html>

VGG16

<https://gist.github.com/baraldilorenzo/07d7802847aaad0a35d3>

Appendix 部分實驗截圖

GPU: M60 12GB

(a) DNN

```
validation_split=0.2)
Train on 1836 samples, validate on 459 samples
Epoch 1/50
1836/1836 [=====] - 2s - loss: 0.6553 - acc: 0.6002 - val_loss: 0.6267 - val_acc: 0.6536
Epoch 2/50
1836/1836 [=====] - 1s - loss: 0.6381 - acc: 0.6645 - val_loss: 0.6188 - val_acc: 0.6797
Epoch 3/50
1836/1836 [=====] - 1s - loss: 0.6025 - acc: 0.6896 - val_loss: 0.5856 - val_acc: 0.6950
Epoch 4/50
1836/1836 [=====] - 1s - loss: 0.5974 - acc: 0.6956 - val_loss: 0.5881 - val_acc: 0.7015
Epoch 5/50
1836/1836 [=====] - 1s - loss: 0.5824 - acc: 0.7157 - val_loss: 0.5884 - val_acc: 0.7124
Epoch 6/50
1836/1836 [=====] - 1s - loss: 0.5631 - acc: 0.7233 - val_loss: 0.5626 - val_acc: 0.7146
Epoch 7/50
1836/1836 [=====] - 1s - loss: 0.5581 - acc: 0.7298 - val_loss: 0.5674 - val_acc: 0.7146
Epoch 8/50
1836/1836 [=====] - 1s - loss: 0.5478 - acc: 0.7358 - val_loss: 0.5806 - val_acc: 0.6972
Epoch 9/50
1836/1836 [=====] - 1s - loss: 0.5297 - acc: 0.7424 - val_loss: 0.5567 - val_acc: 0.7146
Epoch 10/50
1836/1836 [=====] - 1s - loss: 0.5281 - acc: 0.7549 - val_loss: 0.5589 - val_acc: 0.7146
Epoch 11/50
1836/1836 [=====] - 1s - loss: 0.5128 - acc: 0.7586 - val_loss: 0.5611 - val_acc: 0.7277
Epoch 12/50
1836/1836 [=====] - 1s - loss: 0.5192 - acc: 0.7380 - val_loss: 0.5684 - val_acc: 0.7168
Epoch 13/50
1836/1836 [=====] - 1s - loss: 0.5182 - acc: 0.7560 - val_loss: 0.5839 - val_acc: 0.7233
Epoch 14/50
1836/1836 [=====] - 1s - loss: 0.4956 - acc: 0.7647 - val_loss: 0.5727 - val_acc: 0.7233
Epoch 15/50
1836/1836 [=====] - 1s - loss: 0.4818 - acc: 0.7740 - val_loss: 0.5445 - val_acc: 0.7190
Epoch 16/50
1836/1836 [=====] - 1s - loss: 0.4651 - acc: 0.7859 - val_loss: 0.5884 - val_acc: 0.7211
Epoch 17/50
1836/1836 [=====] - 1s - loss: 0.4686 - acc: 0.7903 - val_loss: 0.5782 - val_acc: 0.7168
Epoch 18/50
1836/1836 [=====] - 1s - loss: 0.4526 - acc: 0.8023 - val_loss: 0.5554 - val_acc: 0.7233
Epoch 19/50
1836/1836 [=====] - 1s - loss: 0.4398 - acc: 0.8077 - val_loss: 0.5583 - val_acc: 0.7124
Epoch 20/50
1836/1836 [=====] - 1s - loss: 0.4382 - acc: 0.7936 - val_loss: 0.5566 - val_acc: 0.7211
Epoch 21/50
1836/1836 [=====] - 1s - loss: 0.4186 - acc: 0.8110 - val_loss: 0.5757 - val_acc: 0.7298
```

(b) CNN

```
1836/1836 [=====] - 7s - loss: 0.6409 - acc: 0.6253 - val_loss: 0.5402 - val_acc: 0.6296
Epoch 2/10
1836/1836 [=====] - 4s - loss: 0.4430 - acc: 0.7821 - val_loss: 0.3297 - val_acc: 0.8627
Epoch 3/10
1836/1836 [=====] - 4s - loss: 0.3295 - acc: 0.8617 - val_loss: 0.2988 - val_acc: 0.8571
Epoch 4/10
1836/1836 [=====] - 4s - loss: 0.2800 - acc: 0.8840 - val_loss: 0.2491 - val_acc: 0.8998
Epoch 5/10
1836/1836 [=====] - 4s - loss: 0.2233 - acc: 0.9172 - val_loss: 0.2552 - val_acc: 0.8824
Epoch 6/10
1836/1836 [=====] - 4s - loss: 0.1958 - acc: 0.9237 - val_loss: 0.2897 - val_acc: 0.8758
Epoch 7/10
1836/1836 [=====] - 4s - loss: 0.1950 - acc: 0.9297 - val_loss: 0.3159 - val_acc: 0.8736
Epoch 8/10
1836/1836 [=====] - 4s - loss: 0.1812 - acc: 0.9346 - val_loss: 0.1696 - val_acc: 0.9325
Epoch 9/10
1836/1836 [=====] - 4s - loss: 0.1487 - acc: 0.9444 - val_loss: 0.2613 - val_acc: 0.9085
Epoch 10/10
1836/1836 [=====] - 4s - loss: 0.1331 - acc: 0.9444 - val_loss: 0.3498 - val_acc: 0.8976
1531/1531 [=====] - 1s
```

(c) vgg16

```
Train on 1000 samples, validate on 499 samples
Epoch 1/10
1836/1836 [=====] - 49s - loss: 1.2081 - acc: 0.6242 - val_loss: 0.4144 - val_acc: 0.8344
Epoch 2/10
1836/1836 [=====] - 42s - loss: 0.3529 - acc: 0.8469 - val_loss: 0.3147 - val_acc: 0.8584
Epoch 3/10
1836/1836 [=====] - 42s - loss: 0.2493 - acc: 0.9025 - val_loss: 0.3393 - val_acc: 0.8519
Epoch 4/10
1836/1836 [=====] - 42s - loss: 0.2532 - acc: 0.9090 - val_loss: 0.2454 - val_acc: 0.9641
Epoch 5/10
1836/1836 [=====] - 42s - loss: 0.1857 - acc: 0.9206 - val_loss: 0.1917 - val_acc: 0.9216
Epoch 6/10
1836/1836 [=====] - 42s - loss: 0.2176 - acc: 0.9156 - val_loss: 0.2081 - val_acc: 0.9085
Epoch 7/10
1836/1836 [=====] - 42s - loss: 0.1989 - acc: 0.9265 - val_loss: 0.1933 - val_acc: 0.9259
Epoch 8/10
1836/1836 [=====] - 43s - loss: 0.1408 - acc: 0.9526 - val_loss: 0.1583 - val_acc: 0.9398
Epoch 9/10
1836/1836 [=====] - 43s - loss: 0.1428 - acc: 0.9553 - val_loss: 0.4335 - val_acc: 0.8519
Epoch 10/10
1836/1836 [=====] - 43s - loss: 0.1355 - acc: 0.9521 - val_loss: 0.2132 - val_acc: 0.9194
1531/1531 [=====] - 16s
```


(d) CNN + data_augmentation

```
Epoch 1/20
57/57 [=====] - 8s - loss: 0.5905 - acc: 0.6601 - val_loss: 0.5627 - val_acc: 0.6819
Epoch 2/20
57/57 [=====] - 7s - loss: 0.4320 - acc: 0.8109 - val_loss: 0.3534 - val_acc: 0.8475
Epoch 3/20
57/57 [=====] - 7s - loss: 0.3354 - acc: 0.8595 - val_loss: 0.3144 - val_acc: 0.8671
Epoch 4/20
57/57 [=====] - 7s - loss: 0.3349 - acc: 0.8574 - val_loss: 0.2857 - val_acc: 0.8802
Epoch 5/20
57/57 [=====] - 7s - loss: 0.2563 - acc: 0.9009 - val_loss: 0.2742 - val_acc: 0.8976
Epoch 6/20
57/57 [=====] - 7s - loss: 0.2474 - acc: 0.9004 - val_loss: 0.2732 - val_acc: 0.8954
Epoch 7/20
57/57 [=====] - 7s - loss: 0.2595 - acc: 0.8944 - val_loss: 0.2561 - val_acc: 0.8932
Epoch 8/20
57/57 [=====] - 7s - loss: 0.2298 - acc: 0.9136 - val_loss: 0.2556 - val_acc: 0.8932
Epoch 9/20
57/57 [=====] - 7s - loss: 0.2080 - acc: 0.9216 - val_loss: 0.2602 - val_acc: 0.8824
Epoch 10/20
57/57 [=====] - 7s - loss: 0.2010 - acc: 0.9211 - val_loss: 0.2823 - val_acc: 0.9216
Epoch 11/20
57/57 [=====] - 7s - loss: 0.2094 - acc: 0.9136 - val_loss: 0.1902 - val_acc: 0.9237
Epoch 12/20
57/57 [=====] - 7s - loss: 0.1788 - acc: 0.9360 - val_loss: 0.1984 - val_acc: 0.9303
Epoch 13/20
57/57 [=====] - 7s - loss: 0.1889 - acc: 0.9258 - val_loss: 0.1749 - val_acc: 0.9281
Epoch 14/20
57/57 [=====] - 7s - loss: 0.1773 - acc: 0.9344 - val_loss: 0.1757 - val_acc: 0.9303
Epoch 15/20
57/57 [=====] - 7s - loss: 0.1679 - acc: 0.9300 - val_loss: 0.2684 - val_acc: 0.8932
Epoch 16/20
57/57 [=====] - 7s - loss: 0.1651 - acc: 0.9375 - val_loss: 0.1888 - val_acc: 0.9216
Epoch 17/20
57/57 [=====] - 7s - loss: 0.1593 - acc: 0.9421 - val_loss: 0.1955 - val_acc: 0.9281
Epoch 18/20
57/57 [=====] - 7s - loss: 0.1581 - acc: 0.9474 - val_loss: 0.1677 - val_acc: 0.9390
Epoch 19/20
57/57 [=====] - 7s - loss: 0.1734 - acc: 0.9344 - val_loss: 0.2096 - val_acc: 0.9172
Epoch 20/20
57/57 [=====] - 7s - loss: 0.1420 - acc: 0.9480 - val_loss: 0.2025 - val_acc: 0.9216
1531/1531 [=====] - 2s
```

(e) vgg16 + data_augmentation

```
In [4]: run vgg16.py
Training Data: (2295, 150, 200, 3)
Testing Data: (1531, 150, 200, 3)
Compiling model...
Fitting model...
Epoch 1/20
57/57 [=====] - 49s - loss: 0.6247 - acc: 0.6535 - val_loss: 0.4077 - val_acc: 0.8257
Epoch 2/20
57/57 [=====] - 49s - loss: 0.3581 - acc: 0.8443 - val_loss: 0.2645 - val_acc: 0.8802
Epoch 3/20
57/57 [=====] - 44s - loss: 0.2765 - acc: 0.8841 - val_loss: 0.3501 - val_acc: 0.8279
Epoch 4/20
57/57 [=====] - 46s - loss: 0.2336 - acc: 0.9068 - val_loss: 0.2204 - val_acc: 0.8889
Epoch 5/20
57/57 [=====] - 47s - loss: 0.1954 - acc: 0.9238 - val_loss: 0.1896 - val_acc: 0.9281
Epoch 6/20
57/57 [=====] - 44s - loss: 0.2115 - acc: 0.9179 - val_loss: 0.1823 - val_acc: 0.9216
Epoch 7/20
57/57 [=====] - 47s - loss: 0.1643 - acc: 0.9302 - val_loss: 0.1703 - val_acc: 0.9346
Epoch 8/20
57/57 [=====] - 44s - loss: 0.1775 - acc: 0.9347 - val_loss: 0.1921 - val_acc: 0.9172
Epoch 9/20
57/57 [=====] - 47s - loss: 0.1520 - acc: 0.9463 - val_loss: 0.1541 - val_acc: 0.9455
Epoch 10/20
57/57 [=====] - 45s - loss: 0.1498 - acc: 0.9498 - val_loss: 0.1599 - val_acc: 0.9325
Epoch 11/20
57/57 [=====] - 44s - loss: 0.1420 - acc: 0.9501 - val_loss: 0.1656 - val_acc: 0.9412
Epoch 12/20
57/57 [=====] - 44s - loss: 0.1381 - acc: 0.9479 - val_loss: 0.1816 - val_acc: 0.9346
Epoch 13/20
57/57 [=====] - 45s - loss: 0.1243 - acc: 0.9547 - val_loss: 0.1446 - val_acc: 0.9499
Epoch 14/20
57/57 [=====] - 45s - loss: 0.1576 - acc: 0.9454 - val_loss: 0.1732 - val_acc: 0.9237
Epoch 15/20
57/57 [=====] - 45s - loss: 0.1129 - acc: 0.9622 - val_loss: 0.1530 - val_acc: 0.9237
```