**Team5 CNN Report**

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# Create Model

## 1.1 Processing the data

文本

描述已自动生成

**Output:**

表格

描述已自动生成

## Model network structure

文本

描述已自动生成

**Output:**

苹果与水果

描述已自动生成

# Evaluate model

## 2.1 Parameter:

表格

描述已自动生成

图形用户界面, 文本, 应用程序, 聊天或短信

描述已自动生成

## 2.2 Accurate and Lost Curve

图表, 折线图

描述已自动生成图表, 折线图

描述已自动生成

### 2.2.1 Result display



## 2.3 Predicting images

### 2.3.1 Successful Examples :

图片包含 图形用户界面

描述已自动生成 图表

描述已自动生成

图表, 气泡图

中度可信度描述已自动生成 图表, 气泡图

描述已自动生成

### 2.3.2 Failed Examples :

桌子上有许多香蕉

中度可信度描述已自动生成 图表

中度可信度描述已自动生成

图表, 气泡图

描述已自动生成

### 2.3.3 Experimental Results:

1. There are incorrect results in the prediction results, which are caused by the color characteristics of the image.

2. Some overfitting was found in the experiment.

3. Some classes have insufficient sample size, resulting in less than ideal prediction results.

4. There are some incorrect images in the training.

# Improve the model

## 3.1 Improve the training set

In response to the above situation, we start with the training set and perform a series of operations such as image enhancement and so on.

1. **Balance out the number of samples in each class**

Add images to “mixed” training sets and all classes have 400 images.

文本, 表格

描述已自动生成

1. **Correct any mis-labelling in any of the 4 classes**

Delete mis-labelling training sets.

1. **Determining the image-sizes to be used for training**

Modify image size to (200,200).

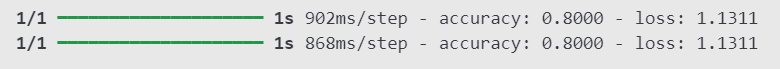
1. **Image Augmentation to generate more data**

Enhance images, such as reversing, adjusting brightness, etc., to increase training capacity.

文本

描述已自动生成

### 3.1.1 Result



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

This model



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

Last model and accuracy

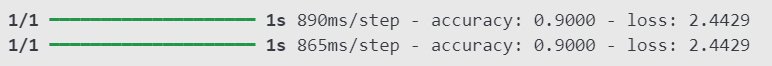
### 3.1.2 conclusion

It can be seen that the accuracy has decreased, loss is high, and as the training set capacity increases, the quantity also increases. Therefore, the training process should be extended.

## Increase the epochs and batch size.

### 3.2.1 Result

文本

描述已自动生成

图表, 折线图, 直方图

描述已自动生成图表, 折线图, 箱线图

描述已自动生成

(epochs=50 ; batch size=200 )



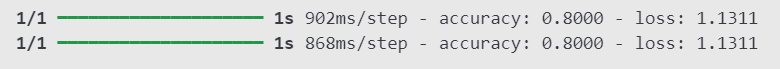
图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

(epochs=50 ; batch size=200 ; image size=(300,300))

This model



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

Last model and accuracy

### conclusion

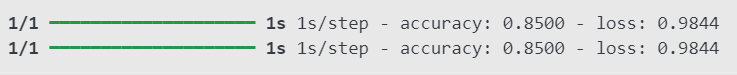
It can be seen that increasing the training process can improve accuracy, but the feedback effect that the value dropped from very high to very low, it affected the average value, but the trend of the value change is very ideal, so we tried changing the optimizer rmsprop.

## Use Rmsprop Optimizer

### 3.3.1 Result

图片包含 图形用户界面

描述已自动生成



图表, 折线图, 直方图

描述已自动生成图表, 折线图

描述已自动生成

Rmsprop Optimizer



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

Adam optimizer

### conclusion

We can see that rmsprop automatically adjusts the learning rate for each parameter based on its historical gradients. It maintains a moving average of the squared gradients and uses it to normalize the current gradient. This allows the optimizer to adapt the learning rate for each parameter independently, which can lead to faster convergence and better performance.

Adam also maintains a moving average of the squared gradients, but difference is that it can accelerate convergence and reduce oscillations. And Adam can train quickly, stably, and effectively in the early stages.

Overall, in this fruit classification model, Adam has the advantages of rmsprop and smoother learning.

## Add new layers

### 3.4.1 Result

文本

描述已自动生成



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

(add layers)

### Conclusion

In theory, adding a layer can learn more features, but overfitting should also be considered. Therefore, it is necessary to combine one's own model situation to make choices and learn multiple times, and see the experimental results

## 3.5 Add dropout layer

### 3.5.1 Result

文本

低可信度描述已自动生成



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

This model



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

Last model

### 3.5.2 Conclusion

It can be clearly seen that after adding dropout at each layer, the test loss decreases, indicating an improvement in the model's versatility.

## 3.6 Add Early Stopping

### 3.6.1 Result

文本

描述已自动生成



图表

描述已自动生成 图表, 折线图

描述已自动生成

This model



图表, 折线图

描述已自动生成 图表, 折线图

描述已自动生成

Last model

### 3.6.2 conclusion

After adding early learning, it will be possible to stop learning when verifying the loss continuously, which can ensure the accuracy of the model and not be affected by incorrect learning.

# Summary

Overall, adding different improvement methods to the basic model, can improve our model’s accuracy. Such as, improve the training sets, increase the epochs and batch size, use different optimizer, add new layers, add drop out layers, add early stopping and other methods.

Each method needs to be adjusted according to the actual situation and the model we want to design. After trying different combinations of methods, we also obtained diverse results. In this way, we learned about the advantages, disadvantages, and characteristics of many CNN models.

# Hypothesis(additional)

## 5.1 hypothesis

In the process of searching for the training set, we found many examples of red bananas(not yellow). So can our model identify it?

图形用户界面

描述已自动生成

Answer is NO. The red banana was identified by us as an apple.

## Hypothetical solution

### solution1

Based on the features of the CNN model, we only need to add images of red bananas for training to identify red banana classes.

### solution2

文本

描述已自动生成



Change the input image channel to 1 to obtain a grayscale model as the shape model.

文本

描述已自动生成

By adjusting the weights parameter, it is possible to control the proportion of weights of different model predictions in the combination. This method can utilize the prediction results of multiple models to improve the accuracy and robustness of the final prediction.

Combine shape model and color model separately to adjust the proportion of the model in the prediction and predict the image. For example, faced with a red banana, we let the shape weight a little more and the color weight a little less, eventually predicting that it is a red banana.

But this method doesn't work well in the end, so it may be possible to consider models other than CNN model, such as Random Forests model.