

Report

David Saunders (910995)

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Abstract

Write abstract here. 4 page report!

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1 Introduction

Contextualise the machine-learning problem and introduce the task and the hypothesis. Make sure to include a few references to previous work. You should demonstrate an awareness of the research-area.

Write section 1 here [**torsney2011tuner**] and talk about figure 1.

Image detection is a classic machine learning problem, with hundreds of papers on the topic. History of image detection is relatively recent. Maybe started with the MNIST handwritten digit classification problem. Is regarded by many as the 'Hello world' of machine learning/CNNs [**tensorflow'2020**]. One guy on kaggle used a cnn for the first time to great effect. Other more advanced problems such as image recognition, gesture , emotion detection now possible thanks to deeper networks, and convolution's layers.

Maybe touch on the problem some people have of using too advanced method for the task? Especially with stuff like pretrained CNN specialised for facial recognition used to detect a black or white dot for example.

2 Methodology

The model(s) you trained to undertake the task. Any decisions on hyperparameters must be stated here, including motivation for your choices where applicable.



Figure 1: This will be a figure showcasing some of my work

If the basis of your decision is experimentation with a number of parameters, then state this.

Decide to look, rotate by $\pi/6$ if nothing is found.

Decided to use a Convolutional Neural Network, due to their tried and trusted effectiveness at image detection. Detecting the red sphere is a trivial use of the technology so accuracy is expected to be very high. Problem will be with the training data not relating to the real life data where the spheres will be obscured and different sizes from the training. Problem of training/archived data not matching production is a well known issue (with prediction and stuff) TODO: ref.

All of the architecture of the CNN will be explained in this paragraph and all of the hyperparameter's explained. Why ADAM, why crossspectromity, LOOK AT LAST YEARS. (Maybe picture of model summary?, or look at a tool online to visualise)

First layer is `layers.Conv2D(32, (3, 3), input_shape = (51, 51, 3))` which inputs the training image and uses a kernel size of 32 pixel. Activation of each internal layers use relu as that is default for whatever reason. Alternative is to use something like sigmoid, but relu is now generally used because xyz.

Followed by a maxpooling layer to do what they do. Why MAXpooling is used and not min pooling, or average pooling. Pooling size is 2, 2 WHY and what exactly does it mean?

Second layer is the same but with a different input shape for obvious reasons. Followed by another activation and pooling.

Third layer is the same but with an initial kernel size of 64. Bigger kernel size is choice as the hope is that the lower levels will get smaller or more localised features but with a larger kernel we will hope it pieces the smaller features together. However as image recognition problems go this one is straightforward so it really shouldnt need to piece together layers of features. Regardless when a shallower network was tried it didn't work so here we are.

Then we flatten the layers so that we can feed the outputs from the convolutional layers into a more traditional dense network of nodes. This is fed into 64 neurons, which are then fed into a single neuron which will fire if a sphere is detected. Between the layers there is a dropout of 50% in an attempt to avoid overfitting TODO: reference WHY.

Loss function is chosen to be *binary_crossentropy* as it is the best choice for binary classification. Why did I choose rmsprop as an optimizer?

The model is then saved to disk. This is so the network doesn't have to be retrained all the time and to help reproducibility. (Get reference to why you should always save a model) Since networks are non-deterministic they may not always have the same result (ref).

3 Results

Describe, compare and contrast the results you obtained on your model(s). Any relationships in the data should be outlined and pointed out here. Only the most important conclusions should be mentioned in the text. By using tables and confusion-matrices to support the section, you can avoid describing the results fully.

Confusion matrix of CNN: (Only text or with a nice graph)

Confusion matrix of dummy: (Only text or with a nice graph)

4 Discussion and Conclusion

Restate the task and hypothesis/-ses concisely. Reiterate the methods used. Describe the outcome of the experiment and the conclusion that you can draw from these results in respect of the hypothesis/-ses.