

Detection of Cat faces using yolov5



Aleksander Vanberg Eriksen

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Introduction

This report will analyze the yolov5 object detection algorithm for how good precision it has compared to its learning rate. I will look at colored, blurred, and gray images of cats, and will train on detecting the cat's faces. I will see how the algorithm handles testcases, where the model has been trained using colored/blurred/gray images, of the images they were not trained on. This analysis was done using google collab.

Motivation

The reason I'm choosing this topic is because when we learned about it while working on assignment 2, I got interested in how good it was with different types of images. I learned how to manipulate images from assignment 1, which gave me the thought of combining the two assignments. This way I could learn more about how it works, how good the yolov5 object detection is today, and where it needs to improve.

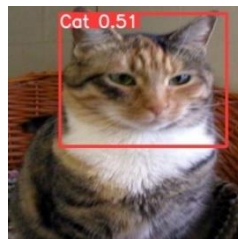
Description of data set

There are three datasets which consists of a train, valid and test folder. Both color and gray were created using the app <https://app.roboflow.com/>. Blurred dataset was created by using the *Blur.py* python file. The bounding boxes were manually created, and images were split up accordingly. There are 436 test images, 83 valid images and 355 train images in each dataset.

Analyze of results

There are a total of 442 cats. The precision computation considers for the missed predictions. A successful prediction covers the cats face.

This picture is considered a successful prediction:



This picture is considered gray area, but still accepted:



This picture is considered a missed prediction:



Accuracy for 10 Epochs, 2 hours training

Colored

Learning rate	Colored	Gray	Blurred
0.01 with 0.01	50.2 %	48.3 %	1.1 %
0.05 with 0.05	49.6 %	48 %	1.3 %
0.1 with 0.01	0 %	0 %	0 %

Gray

Learning rate	Gray	Colored	Blurred
0.01 with 0.01	39.4 %	33.7	0.2 %
0.05 with 0.05	39.4 %	33.4 %	0.4 %
0.1 with 0.01	0 %	0 %	0 %

Blur

Learning rate	Blur	Colored	Gray
0.01 with 0.01	10.4 %	7.7 %	5.3 %
0.05 with 0.05	9.1 %	7.3 %	5.5 %
0.1 with 0.01	43 %	36.6 %	39.1 %

Accuracy for 30 Epochs, 4.2 hours training

Colored

Learning rate	Colored	Gray	Blurred
0.01 with 0.01	53.5 %	53.5 %	0.67 %
0.02 with 0.02	65.2 %	59.2 %	1.8 %
0.05 with 0.05	40.7 %	42.47 %	0.2%
0.07 with 0.07	6.5 %	6.2 %	0 %
0.1 with 0.01	0 %	0 %	0 %

Gray

Learning rate	Gray	Colored	Blurred
0.01 with 0.01	63.3 %	57.6 %	0 %
0.02 with 0.02	60 %	50.1 %	0 %
0.05 with 0.05	56.5 %	46.8 %	0 %
0.07 with 0.07	40 %	40 %	0 %
0.1 with 0.01	0 %	0 %	0 %

Blur

Learning rate	Blur	Colored	Gray
0.01 with 0.01	37.4 %	12.2 %	11.4 %
0.02 with 0.02	42.3 %	17.3 %	17.24 %
0.05 with 0.05	24.9 %	12.3 %	12.8 %
0.07 with 0.07	2.4 %	1.3 %	1.3 %
0.1 with 0.01	0 %	0.2 %	0 %

Learning rate column consist of lr_0 and lrf .

- lr_0 is initial learning rate
- lrf is final OneCycleLR learning rate ($lr_0 * lrf$)

Conclusion

At 10 epochs Yolov5's best model was the one that trained for colored images, while the worst one was the one that trained on blurred images.

Both gray and images worked on each other, while blurred images were bad all around.

Surprisingly the blurred model did somewhat good with an initial learning rate of 0.1, while the others got an accuracy of 0 %.

At 30 epochs, the model that trained with gray images were the best, while the blurred one was the worst.

Both gray and the colored model were quite similar, which was expected.

The only thing that separated them was the color, so they both had a clear perception of what a cat's face is since they could work on the edges in the images.

The blurred model made it difficult for the model to see edges, so that is why it did so poorly on testing with gray and colored images.

Best initial learning rate is 0.02 with lrf at 0.02.

Every model increased their accuracy when increasing epochs, so the longer the model trains the better result it will get.

Resources

<https://www.kaggle.com/datasets/prasunroy/natural-images?resource=download>