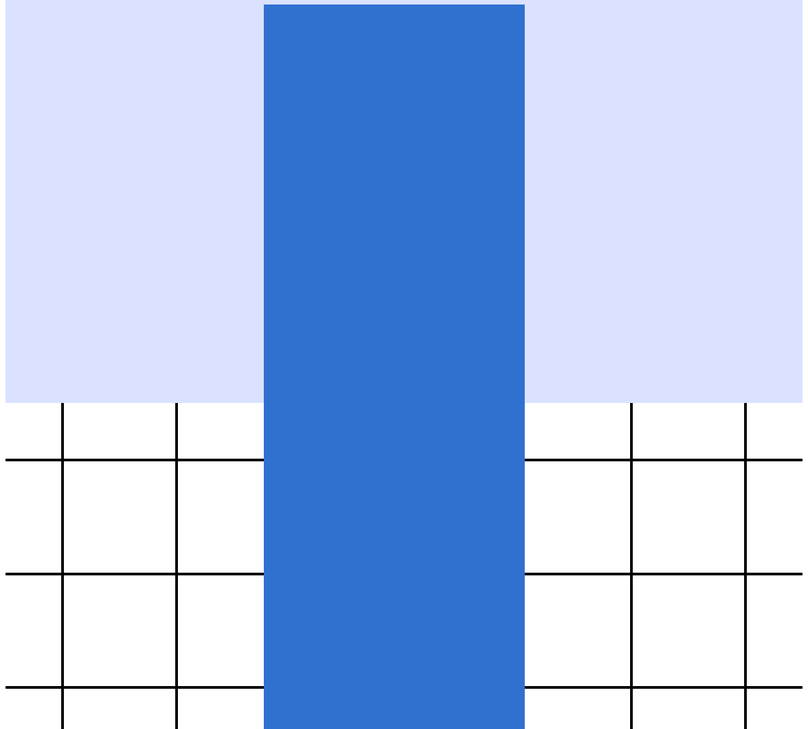
DATA AUGMENTATION AND PERFORMANCE

– Matee Vadrukchid –



Part 1: Data Augmentation

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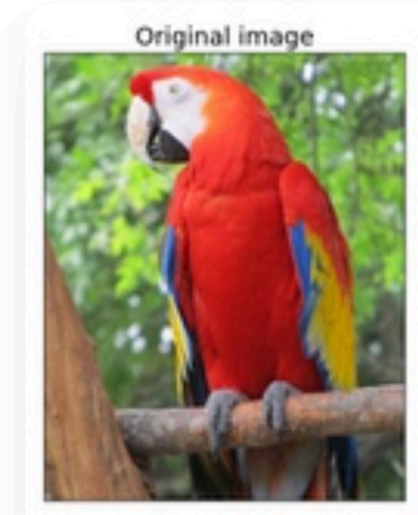
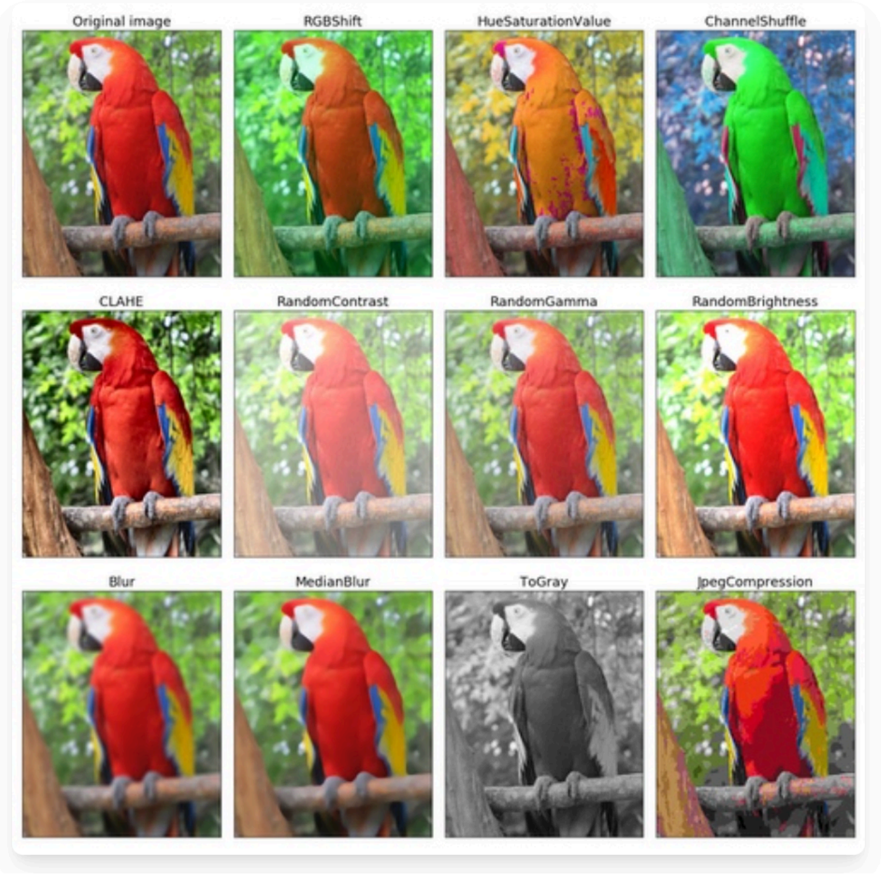
Do more with less data ?

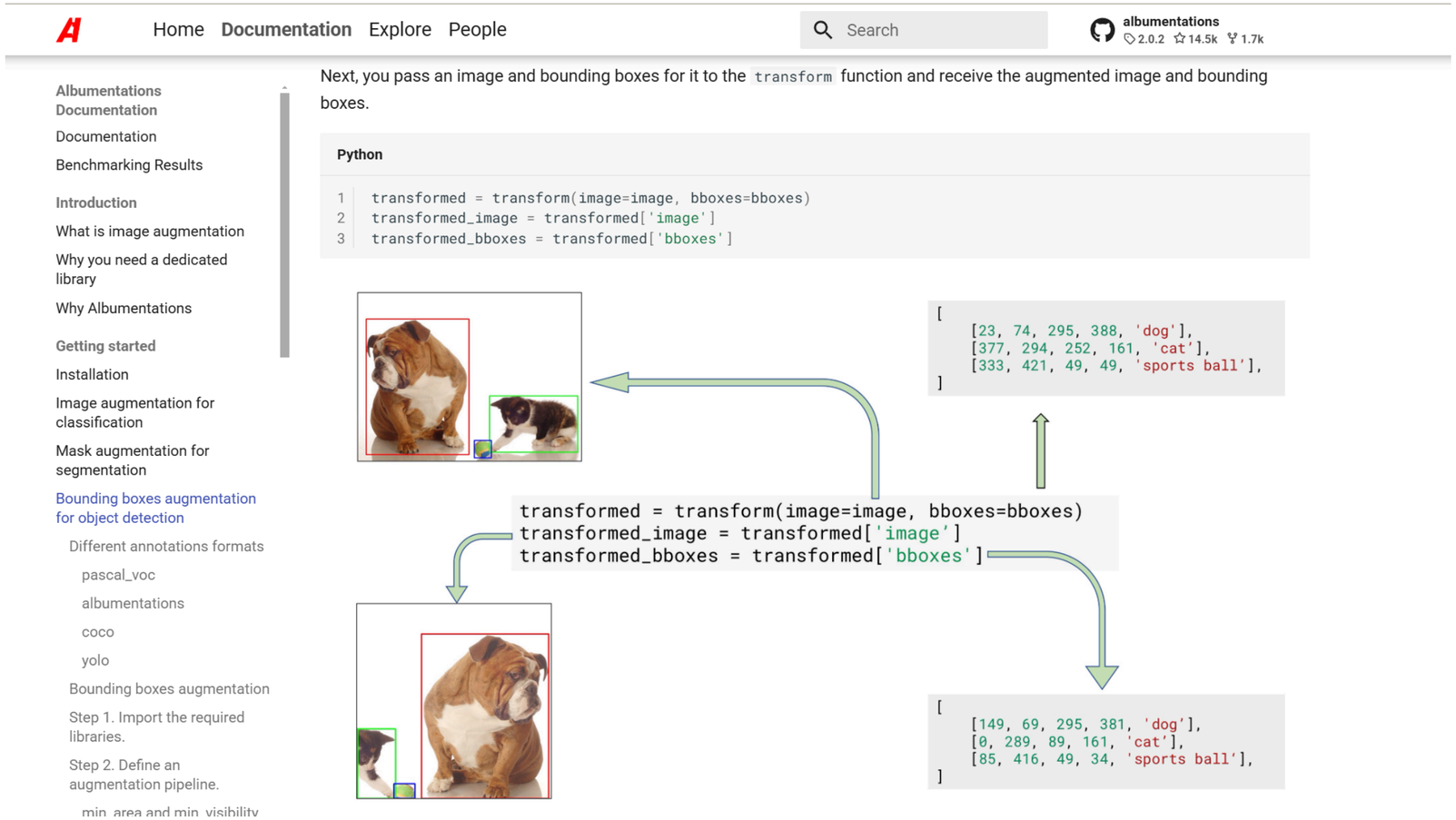
Albumentations is a computer vision tool that boosts the performance of deep convolutional neural networks.





Part 1: Data Augmentation

Link: https://albumentations.ai/docs/getting_started/bounding_boxes_augmentation/



Part 2: Performance

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METRICS FOR MULTI-CLASS CLASSIFICATION: AN OVERVIEW

A WHITE PAPER

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ABSTRACT

Classification tasks in machine learning involving more than two classes are known by the name of "multi-class classification". Performance indicators are very useful when the aim is to evaluate and compare different classification models or machine learning techniques. Many metrics come in handy to test the ability of a multi-class classifier. Those metrics turn out to be useful at different stage of the development process, e.g. comparing the performance of two different models or analysing the behaviour of the same model by tuning different parameters. In this white paper we review a list of the most promising multi-class metrics, we highlight their advantages and disadvantages and show their possible usages during the development of a classification model.

Link : https://arxiv.org/pdf/2008.05756

Part 2: Performance

Measuring Performance Terminology

- True Positive(TP): Data items that are correctly predicted
- True Negative(TN): Data items that are correctly predicted as a negative label
- False Positive(FP): Data items that are incorrectly predicted as a positive label
- False Negative(FN): Data items that are predicted as a negative label even though it is positive

Measuring Performance

- Accuracy

$$accuracy = \frac{\#correct}{\#total}$$

- Precision

$$precision = \frac{TP}{TP + FP}$$

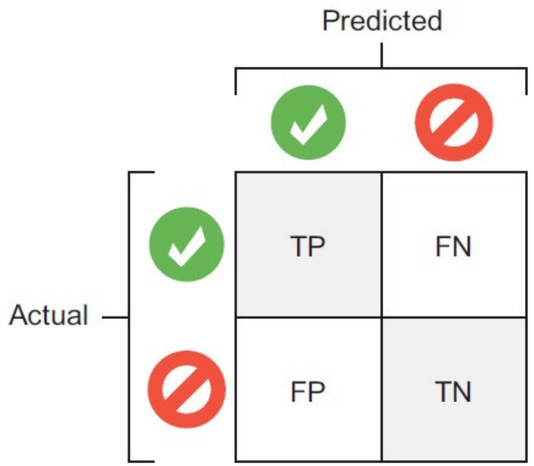
- Recall

$$recall = \frac{TP}{TP + FN}$$

Part 2: Performance

Confusion Matrix

- Confusion Matrix is a detailed report of machine learning performance



Part 2: Performance

Example for Cat Prediction

Confusion matrix		Predicted	
		Cat	Dog
Actual	Cat	30	20
	Dog	10	40

- Accuracy = 70/100
- Precision = 30/40
- Recall = 30/50

Part 2: Performance

If you have tomake 100% recall for cat prediction, what will you do?

100% recall => don’t miss any cat image

Always predict everything as a cat

=> it will create a lot of false positive

Part 2: Performance

Precision and recall

- Example :

	ω_1	ω_2	ω_3	ω_4
ω_1	97	0	2	1
ω_2	0	89	10	1
ω_3	0	0	100	0
ω_4	0	3	5	92

$$P = \frac{tp}{tp + fp}$$

$$R = \frac{tp}{tp + fn}$$

$$P_1 = 97/(97 + 0 + 0 + 0) = 100\%$$
$$P_2 = 89/(0 + 89 + 0 + 3) = 96.74\%$$
$$P_3 = 100/(2 + 10 + 100 + 5) = 85.47\%$$
$$P_4 = 92/(1 + 1 + 0 + 92) = 97.87\%$$
$$R_1 = 97/(97 + 0 + 2 + 1) = 97\%$$
$$R_2 = 89/(0 + 89 + 10 + 1) = 89\%$$
$$R_3 = 100/(0 + 0 + 100 + 0) = 100\%$$
$$R_4 = 92/(0 + 3 + 5 + 92) = 92\%$$

Precision and recall

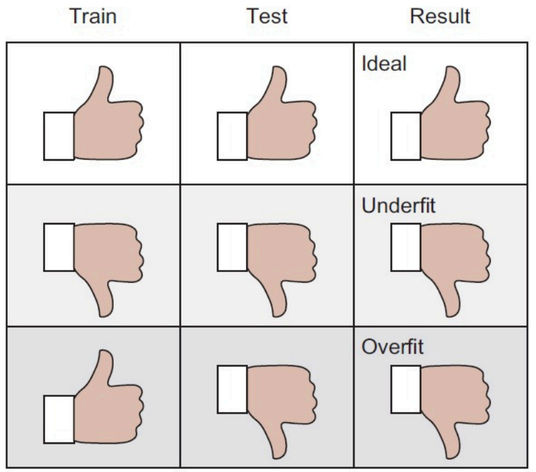
- F1: a more compact representation of the precision and recall properties of a system.

$$F1 = 2 \times \frac{precision \times recall}{precision + recall}$$

Part 2: Performance

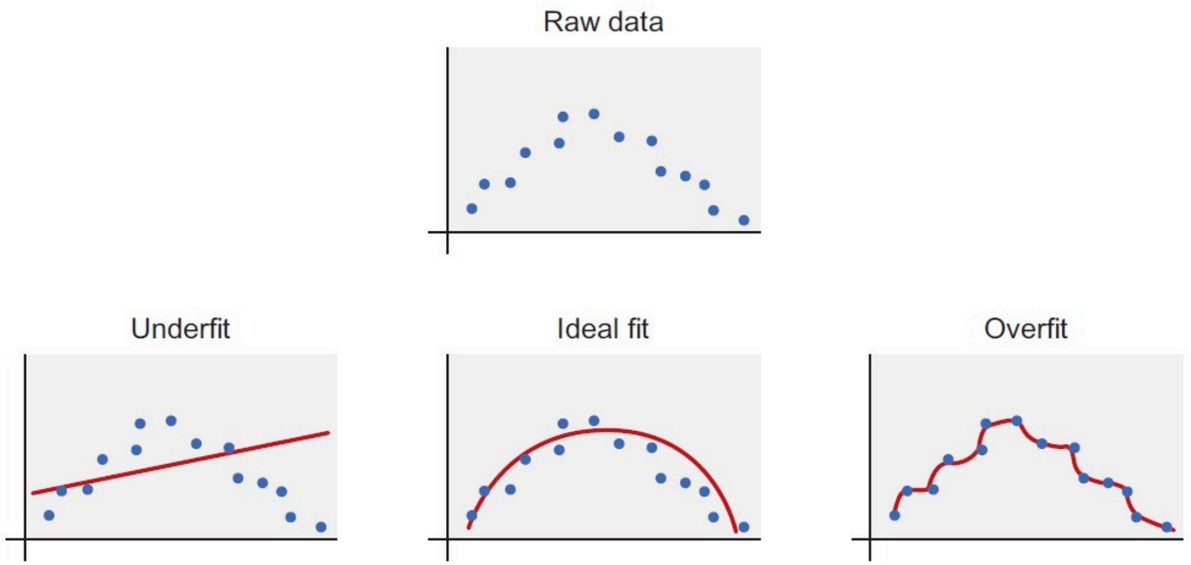
Overfitting/Underfitting

- With the machine learning, there are three scenarios that can happen



Part 2: Performance

Regression Model



Part 2: Performance

Ranked accuracy

Class Label	Probability
Airplane	0.0%
Automobile	0.0%
Bird	2.1%
Cat	0.03%
Deer	0.01%
Dog	0.56%
Frog	**97.3%**
Horse	0.0%
Ship	0.0%
Truck	0.0%

Class Label	Probability
Airplane	**1.1%**
Automobile	**38.7%**
Bird	0.0%
Cat	0.5%
Deer	0.0%
Dog	0.4%
Frog	0.11%
Horse	**1.4%**
Ship	**2.39%**
Truck	**55.4%**

Part 2: Performance

Rank-5 accuracy

- Step 1: Compute the class label probability for each input image
- Step 2: Sort the predicted class label probabilities in descending order with higher probability are placed at the front of the list
- Step 3: Determine if the ground-truth label exists in the top-5 predicted labels

Part 2: Performance

Rank-1 and Rank-5 Accuracy

Siberian husky

Eskimo dog

Two different classes in ImageNet from 1,000 classes

Part 2: Performance

Why Rank-5 Accuracy?

- With large classes, it is not easy to get high accuracy of rank-1
- Rank-5 can help see the performance even though we see less improvement in rank-1
- Some class are very similar

Assignment

You have a dataset of 155 images, each labeled as **Cat**, **Dog**, or **Person**. Your model tries to classify each image into one of these three classes. After prediction, you create this 3×3 confusion matrix:

	Predicted: Cat	Predicted: Dog	Predicted: Person	(Sum per true label)
True Cat	50	3	2	55
True Dog	2	45	3	50
True Person	4	6	40	50
(Sum per prediction)	56	54	45	155

Precision for one class (“Cat”)? Recall for one class (“Cat”)?

F1 Score for “Cat” ?