Interactive Technologies Institute
LARSyS

arditi
agência regional para o desenvolvimento da investigação tecnologia e inovação

UNIVERSIDADE da MADEIRA

MADEIRA INTERNATIONAL WORKSHOP IN MACHINE LEARNING

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2022

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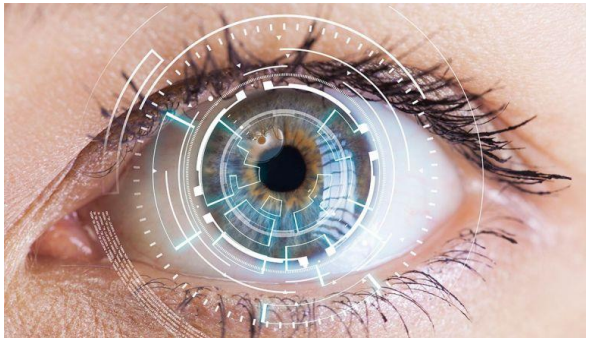
IMAGE CLASSIFICATION APPLICATIONS

Self driving cars



Biometric Recognition

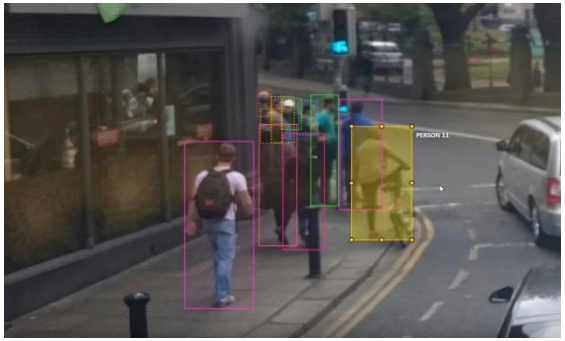
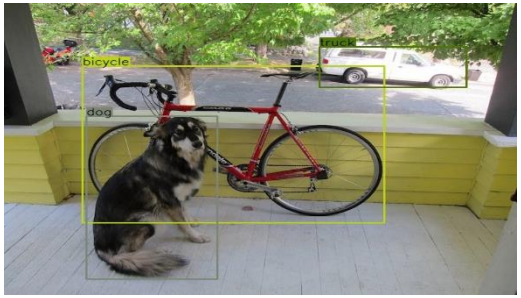
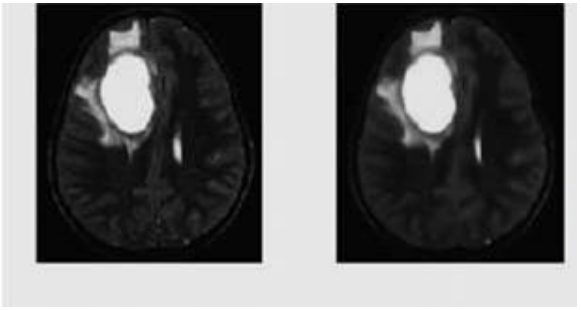


Image Annotation

Face Recognition



Object Detection



Tumour detection

DIGITAL IMAGE

A Digital image is a **2D matrix** made up of small box units called **pixel**.

The **numerical value** for each pixel depicts its **intensity.**

The intensity can range between **0-255**.

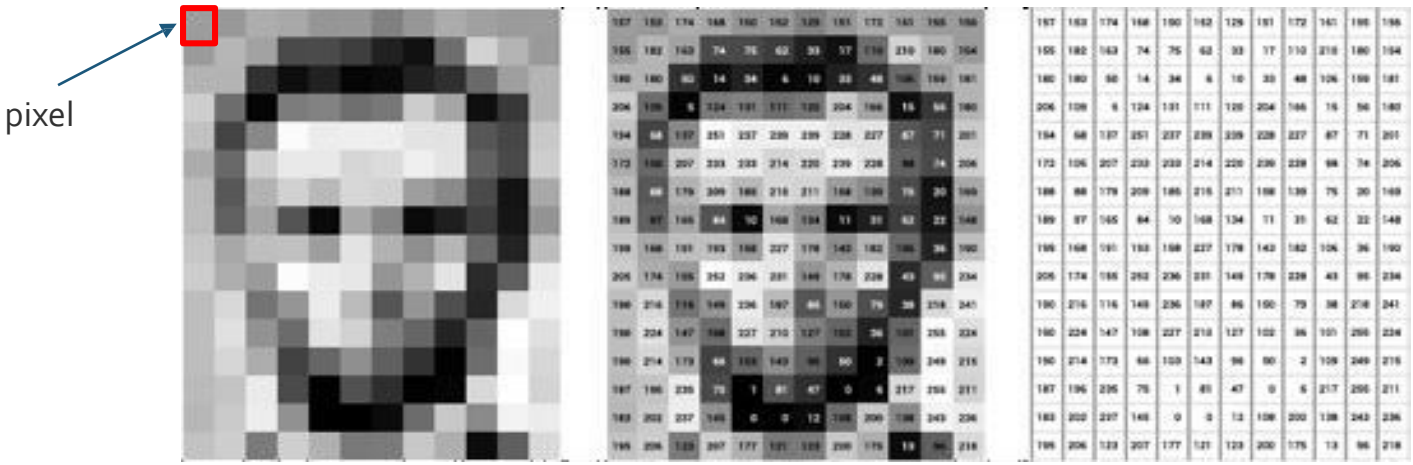


Fig 1. Digital Image (Black and white) Representation

*https://datascience.aero/computer-vision-seeing-interpreting-images/

COLOR IMAGES

Colored image consist of three channels: **Red, Green and Blue**.

Each channel intensity value may range between **0 and 255**.

Hence, each pixel is represented by **three values**. Different intensity values from these channels defines the object's color.

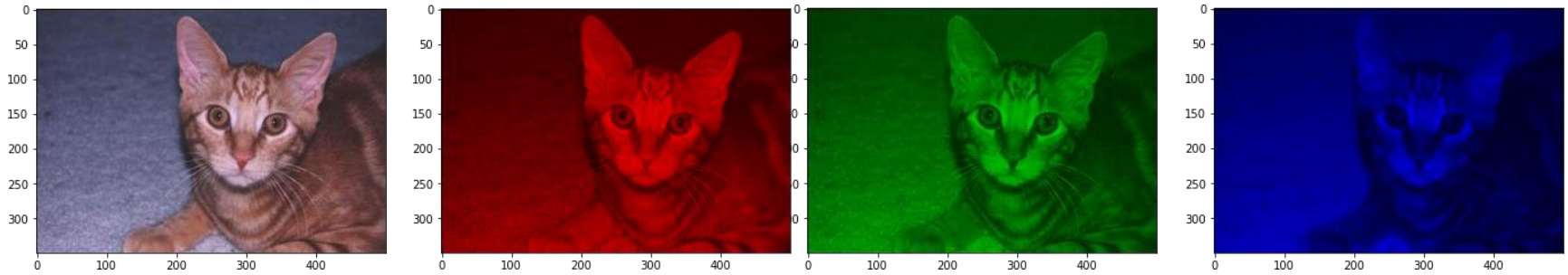


Fig. 2. Colored image and its R,G and B channels.

IMAGE CLASSIFICATION FRAMEWORK

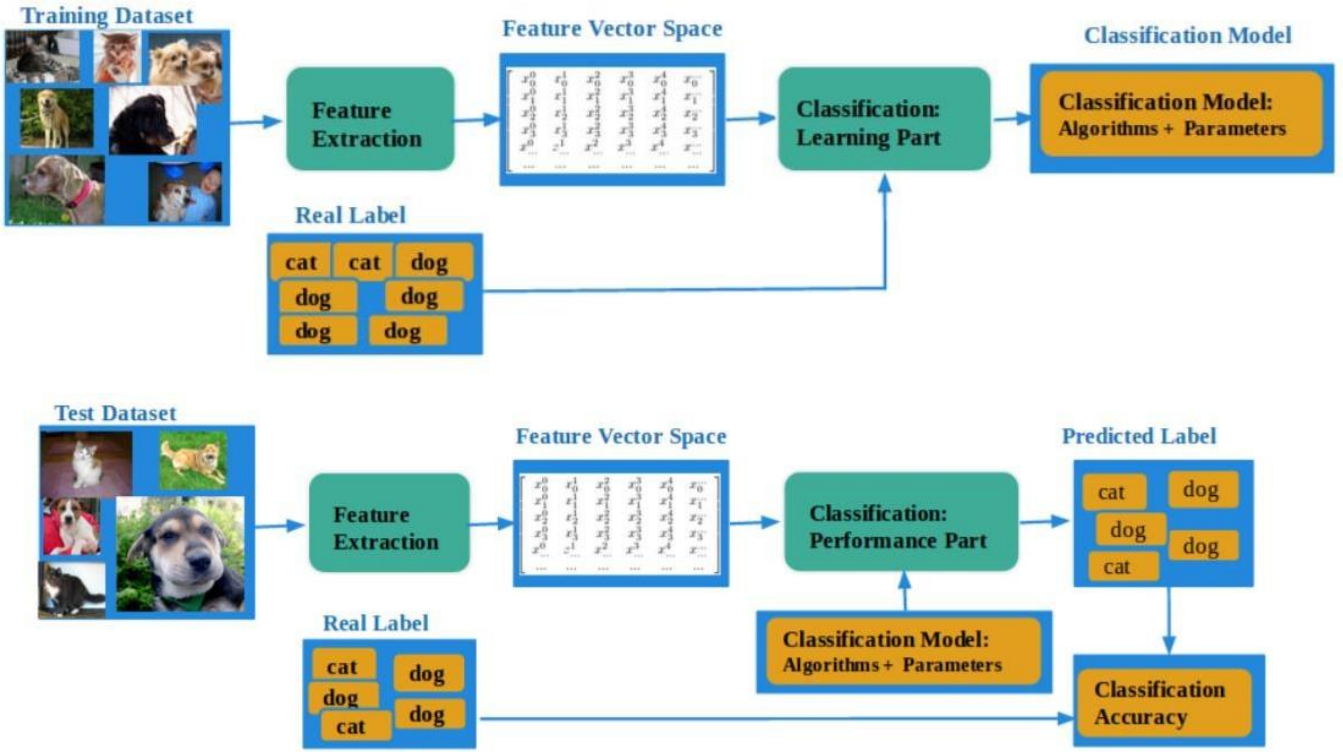


Fig 4. Image classification Framework (a) Training framework (b) testing framework.

Challenges

- Limited data availability due to data cleaning.
- Limited labelled training samples (Supervised Learning).
- Limited Data diversifications.
- Difficulty in creating Generalised deep learning models.

Solution

Data Augmentation

Data Augmentation

- It is a technique to **create a diverse training dataset** for robust models.
- It deals with applying **image transformations** such as image restoration, flipping, resizing etc.
- It should be applied to **training data only**.

Data Augmentation

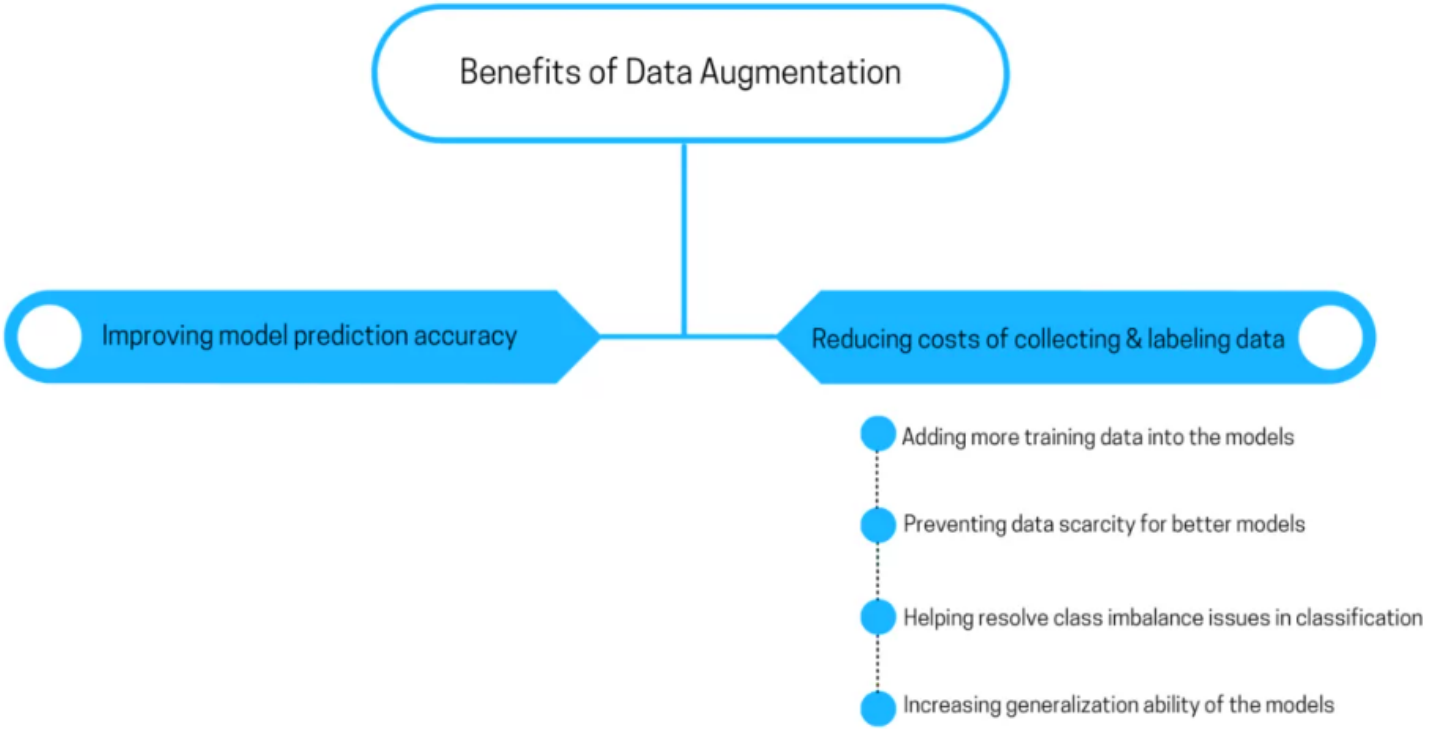
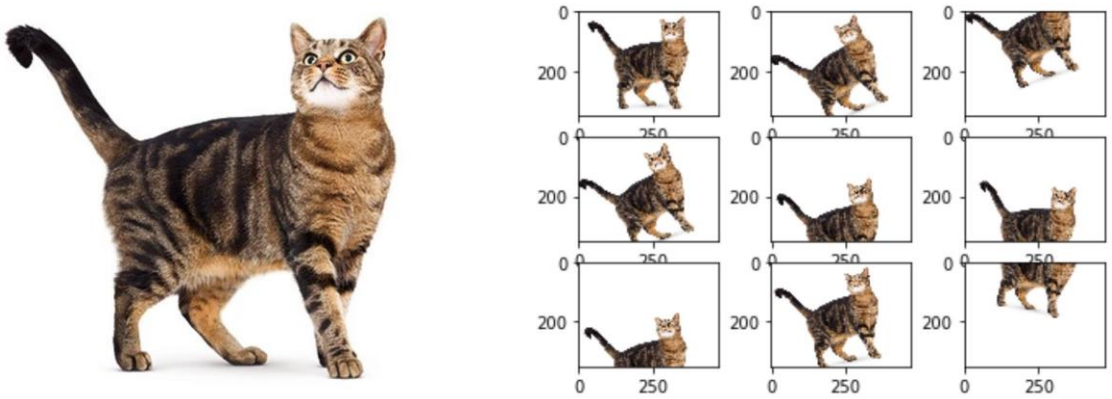
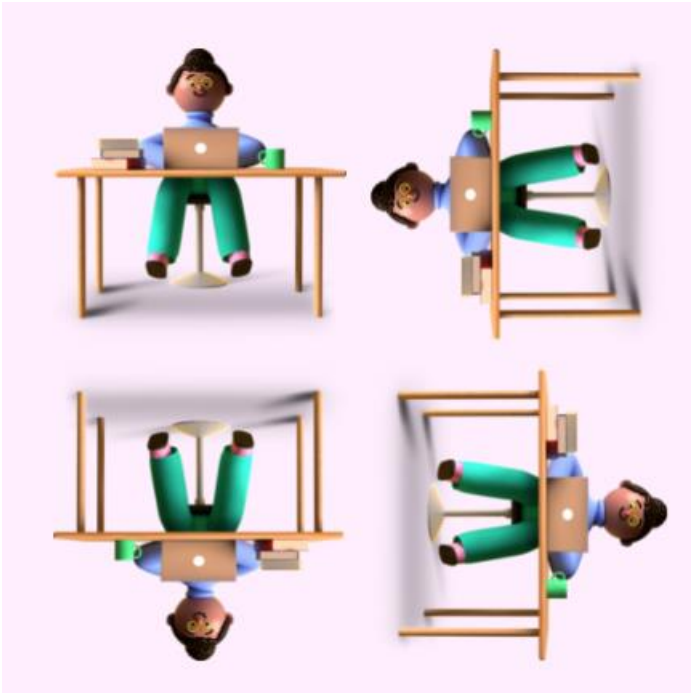


IMAGE AUGMENTATION



a. Image rotation and width-height shift

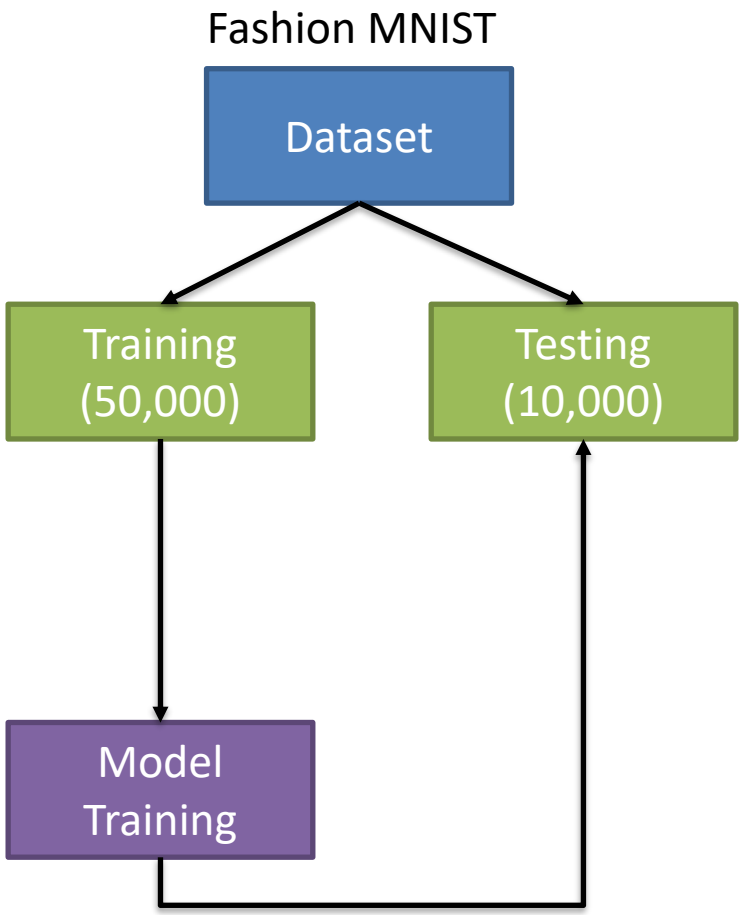
b. Image resizing

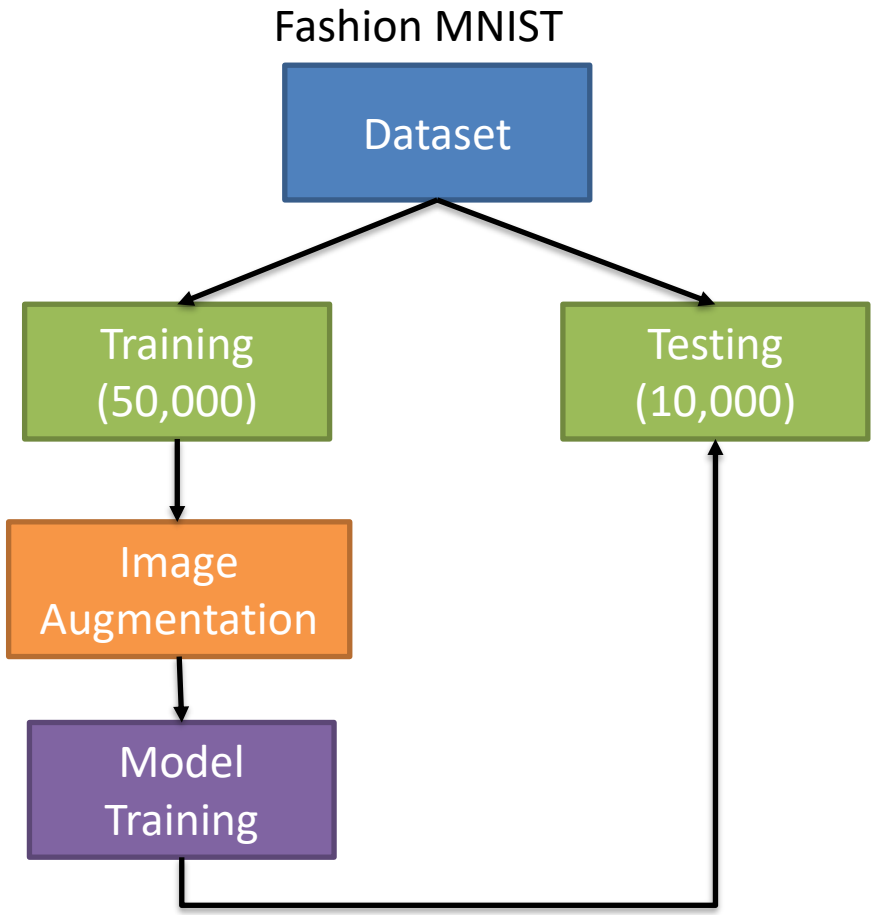


c. Horizontal and vertical flip

Data Augmentation in Practice

Data Augmentation





DATASET INFORMATION

Inputs: **Grayscale Images** (60,000 training, 10,000 testing)

Classes: **10** (Needs to be converted to one-hot encoding format)

In this type of encoding ,the sample belonging to particular class is assigned a value 1 and, 0 for other classes. For instance, imagine following are the labels for dog-cat classification.

Categories	Cat	Dog
Cat	1,	0
Dog →	0,	1
Cat	1,	0
Dog	0,	1
Cat	1,	0

Image Augmentation Used

- **Pixel normalization: by dividing each pixel value by 255.**
- datagen = ImageDataGenerator(
  featurewise_center=False,
  samplewise_center=False,
  featurewise_std_normalization=False,
  samplewise_std_normalization=False,
  zca_whitening=False,
  rotation_range=60,
  width_shift_range=0.03,
  height_shift_range=0.03,
  horizontal_flip=True,
  vertical_flip=True)

Results

Metrics	W/O Augmentation	W/ augmentation
Training Loss	0.34	0.28 (-0.6)
Testing Loss	0.33	0.31 (-0.2)
Training Accuracy	0.87	0.90 (+3%)
Testing Accuracy	0.88	0.89 (+1%)

Thank You