MADEIRA INTERNATIONAL WORKSHOP IN MACHINE LEARNING

2021

IMAGE ANALYSIS USING FEED FORWARD DEEP NEURAL NETWORK

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.

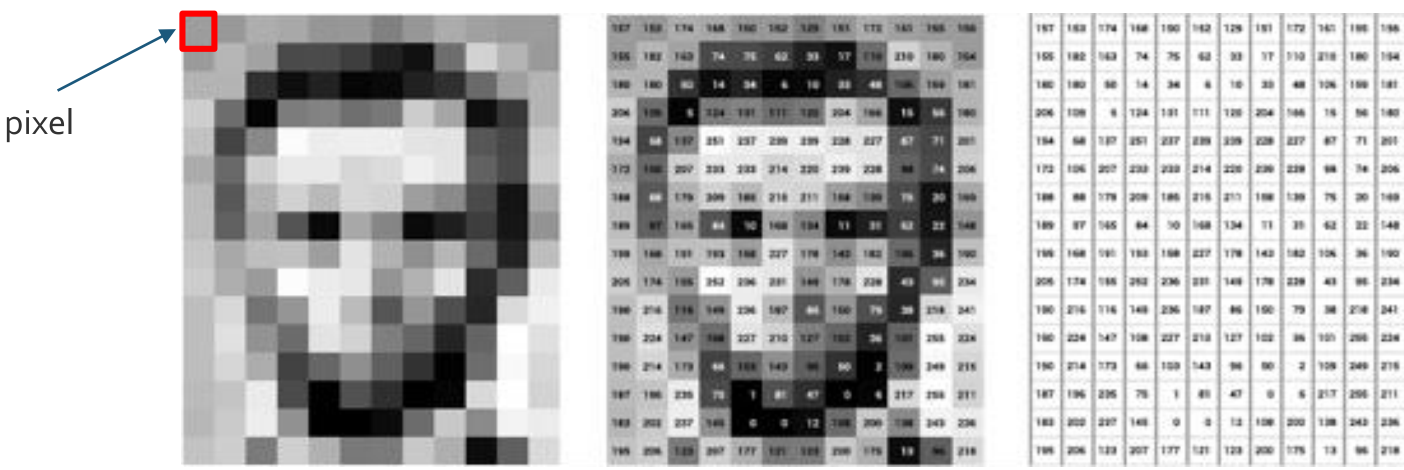


Fig 1. Digital Image (Black and white) Representation

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

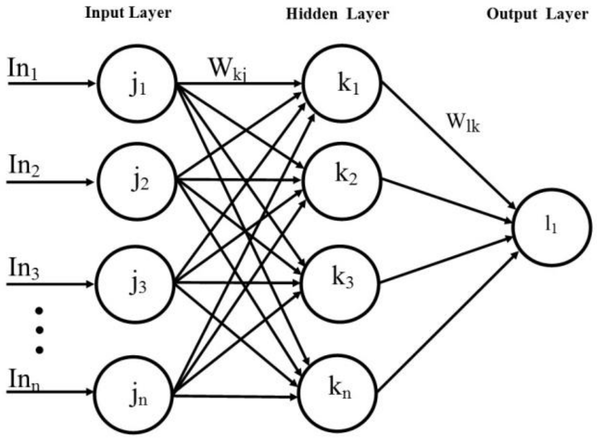
NEURAL NETWORKS

Artificial Neural Networks

One Input layer (dependent on the number of features).

One Hidden Layer (Multiple theories, hit and trial).

One Output Layer (Number of classes).



Deep Neural Networks

One Input layer (dependent on the number of features).

Multiple Hidden Layers (Hierarchical feature learning).

One Output Layer (Number of classes).

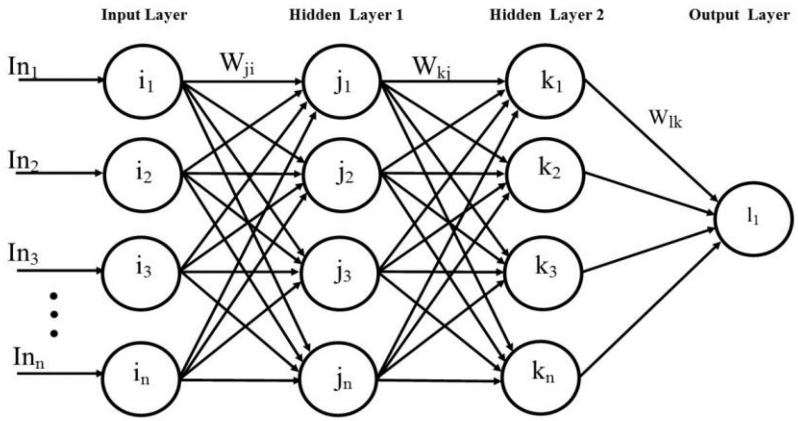


IMAGE CLASSIFICATION FRAMEWORK

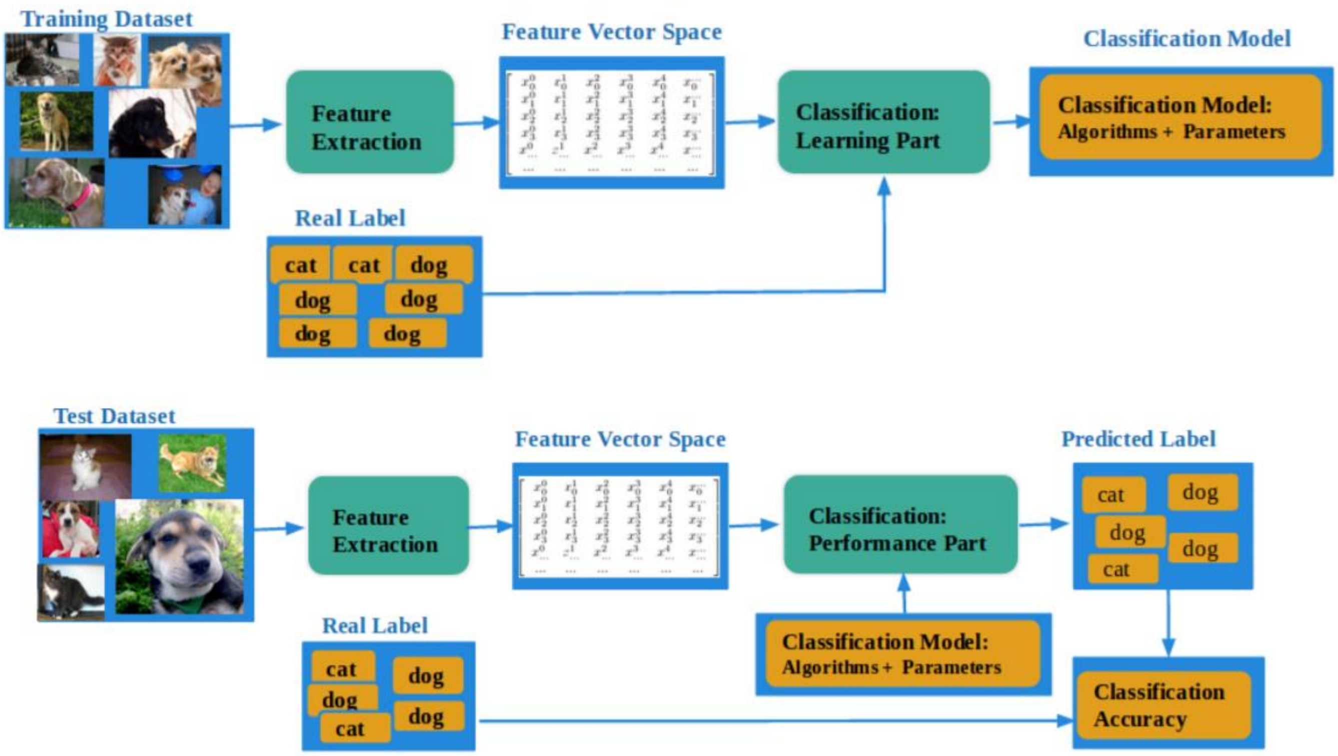


Fig 4. Image classification Framework (a) Training framework (b) testing framework.

PYTHON LIBRARIES

OpenCV- Open computer vision used for image processing and feature calculation.

Matplotlib-Plotting figures and display images

OS- accessing files and folders.

Numpy-Numerical Computations.

Tensorflow-Neural Network Implementations, feature normalization and one hot encoding.

Scikit-Learn-Splitting the data into training and testing datasets.

https://colab.research.google.com/drive/1DCoYR7DI7aKDDnh1rfWWOedzRdAg0Z51#scrollTo=3iy5Ln-d0PFI

DATASET PREPARATION

Data set preparation or image preprocessing consist of three steps:

1. Reading the images.
2. Resizing the images.
3. Transforming images to the features and assigning (one hot)labels.
4. Dividing the data to training and testing data set.

FEATURE CALCULATION

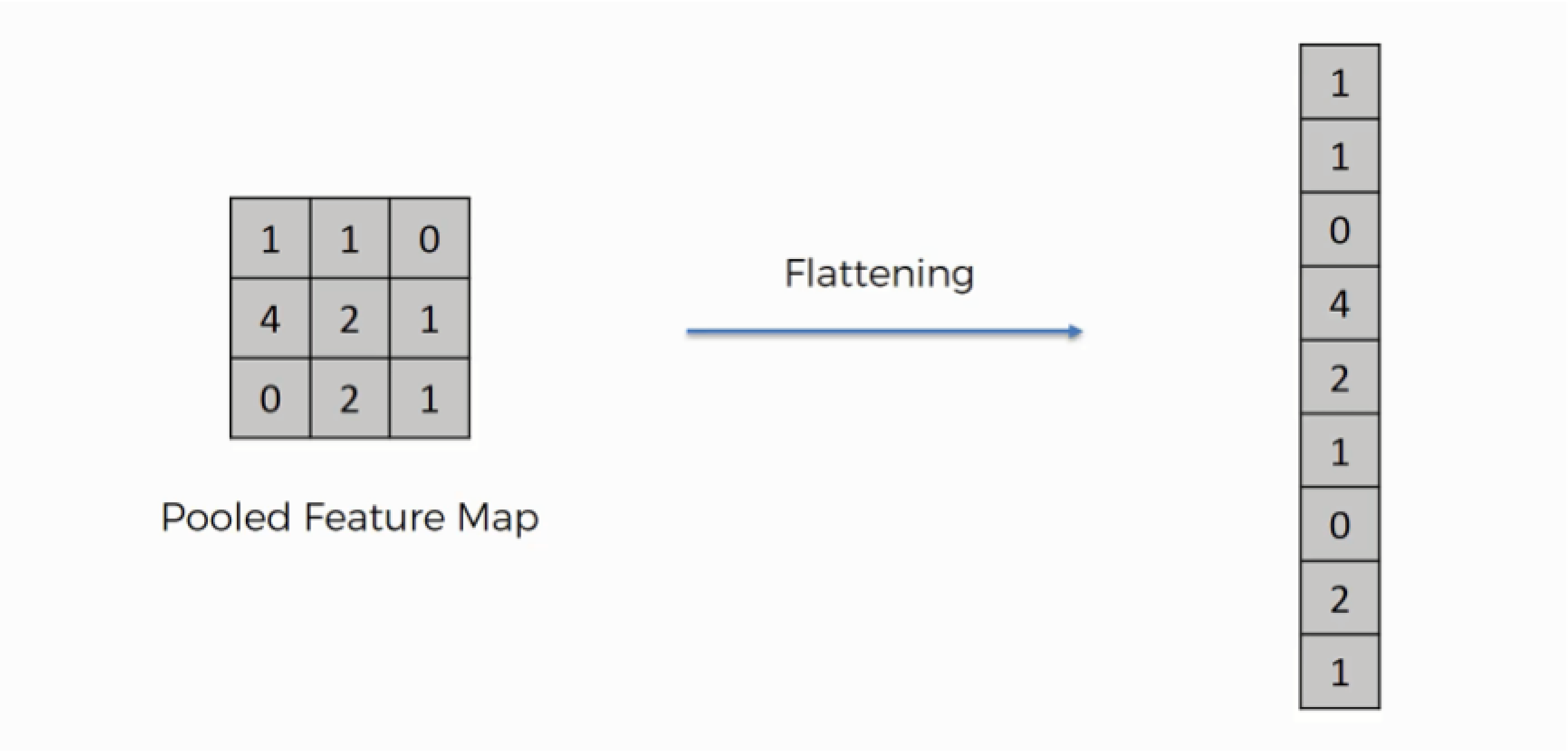
1. Gray-scale image pixel intensity values.

2. Object of interest selection gray-scale image pixel intensity values.

3.Scale invariant feature transform (SIFT) Features calculation.

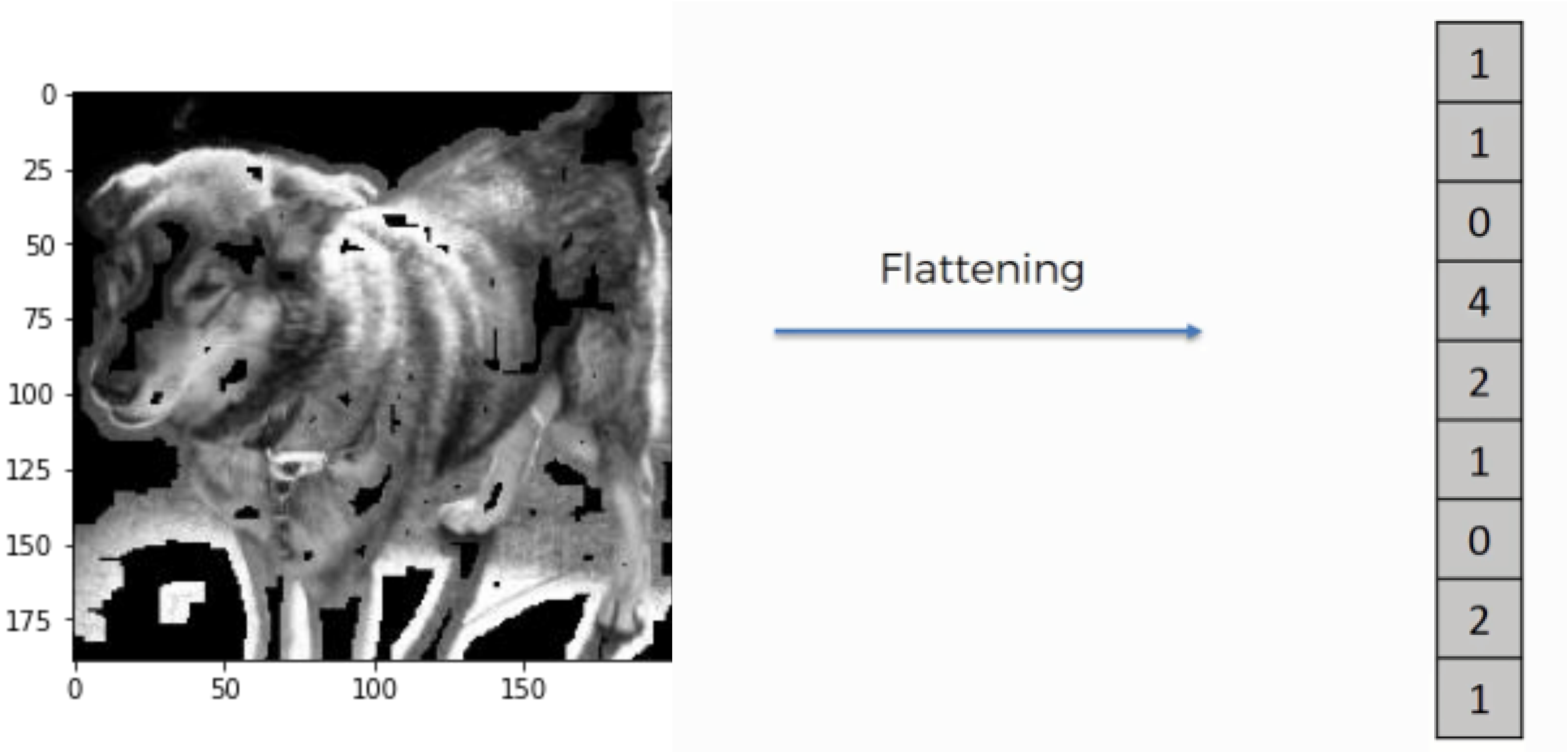
4.Speed Up Robust Feature (SURF) Feature calculation.

IMAGE FLATTENING

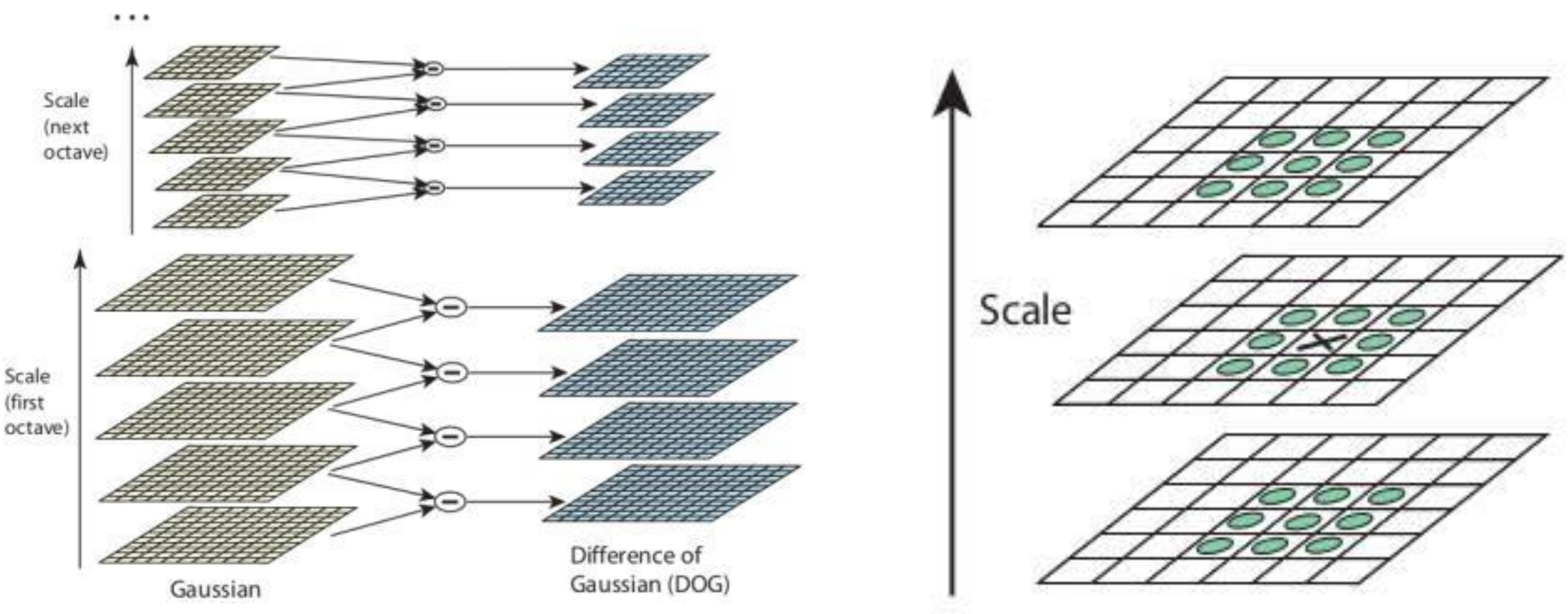


https://www.superdatascience.com/blogs/convolutional-neural-networks-cnn-step-3-flattening

OBJECT OF INTEREST SELECTION

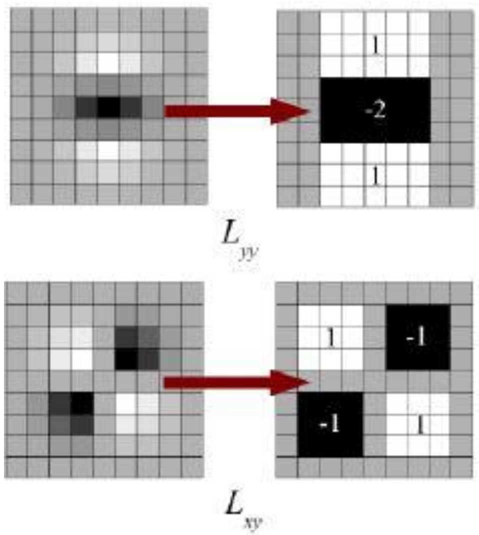


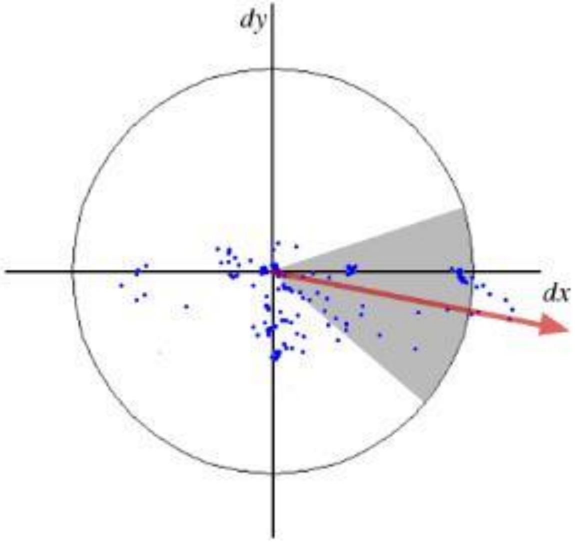
SIFT FEATURES

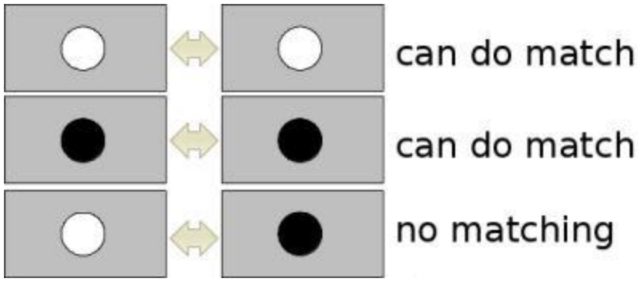


https://docs.opencv.org/master/da/df5/tutorial_py_sift_intro.html

SURF FEATURES







https://docs.opencv.org/4.5.2/df/dd2/tutorial_py_surf_intro.html

ONE-HOT ENCODING

The labels are fed to the neural network architecture as one-hot encoded labels. This can also be considered as binary representations of categorical labels for each sample.

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

NEURAL NETWORK ARCHITECTURE

Input Layer-(Features dependent)

Hidden layers (8) –containing 2-2 layers of 256,128,64 and 32 neuron units respectively.

Output Layer- 2 neuron units.

The architecture is same for all scenarios.

NEURAL NETWORK PARAMETERS

Input Layer-(Features dependent)

Hidden layers (8) -256(2),128(2),64(2),32(2) neuron units.

Output Layer- 2 neuron units.

Dataset: Training 80%,validation 33% of training data, Testing 20%.

Optimizing Algorithm-Adam.

Loss function-Binary-cross entropy.

Metrics-Accuracy.

THANK YOU