Part C

## Virtual Lab 1: **Demonstrate the working of Back propagation**

 Theory: The Backpropagation neural network is a multilayered, feedforward neural network and is by far the most extensively used. It is also considered one of the simplest and most general methods used for supervised training of multilayered neural networks. Backpropagation works by approximating the non-linear relationship between the input and the output by adjusting the weight values internally. It can further be generalized for the input that is not included in the training patterns (predictive abilities).

Simulation Model Screenshots:
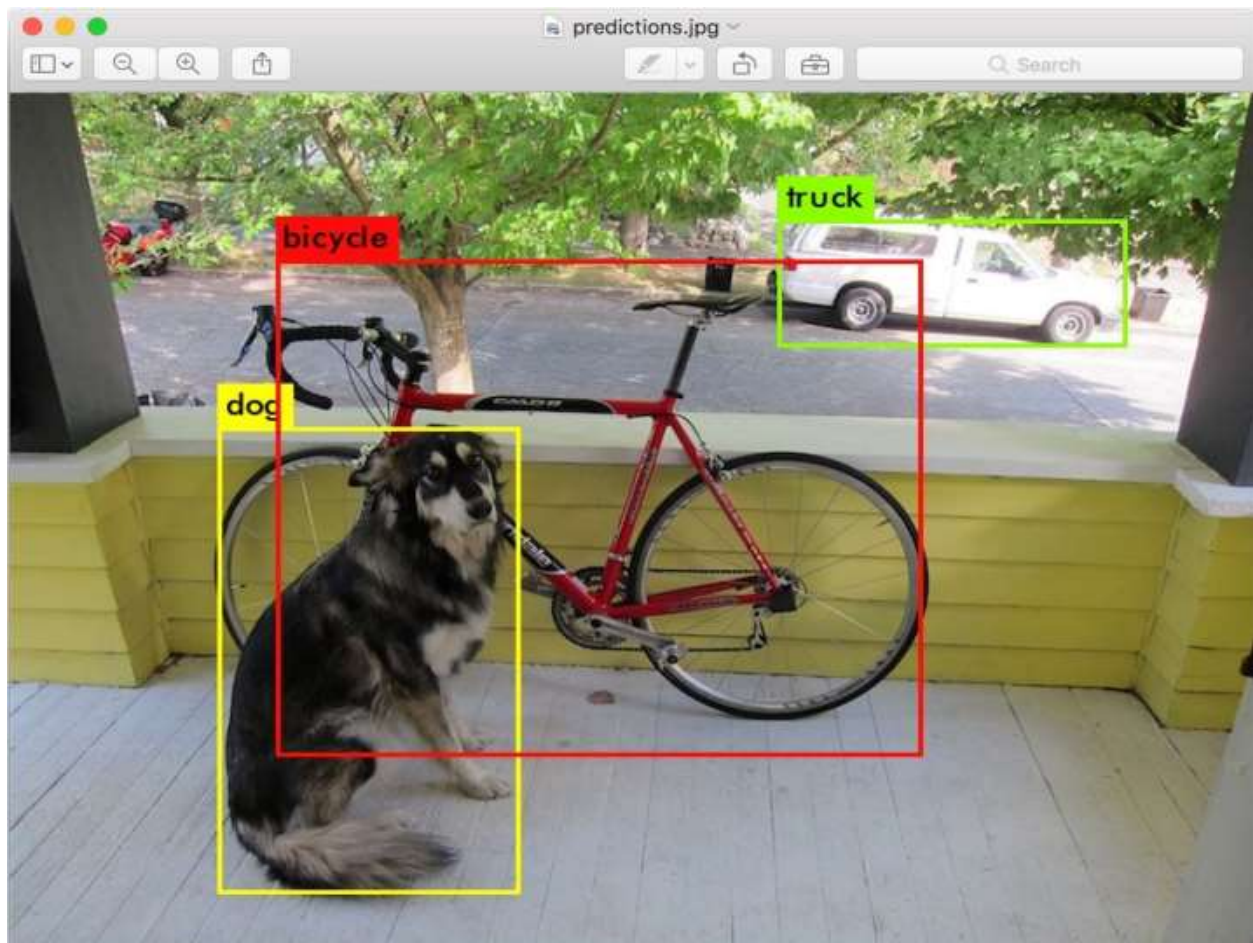
OUTPUT 1
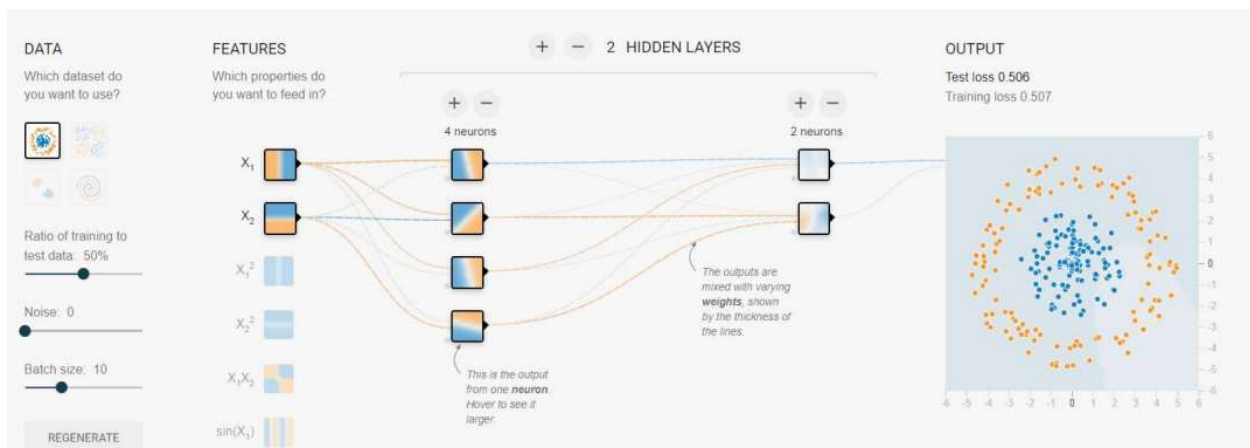
OUTPUT 2

2. YOLO CNN for Object Detection

Theory: YOLO is a convolutional neural network (CNN) technique for doing object detection in real-time. The algorithm applies a single neural network to the full image, and then divides the image into regions and predicts bounding boxes and probabilities for each region.

• YOLO first takes an input image:

• The framework then divides the input image into grids (say a 3 X 3 grid):

 • Image classification and localization are applied on each grid. YOLO then predicts the bounding boxes and their corresponding class probabilities for objects (if any are found)

Sample Screenshots:

OUTPUT 1

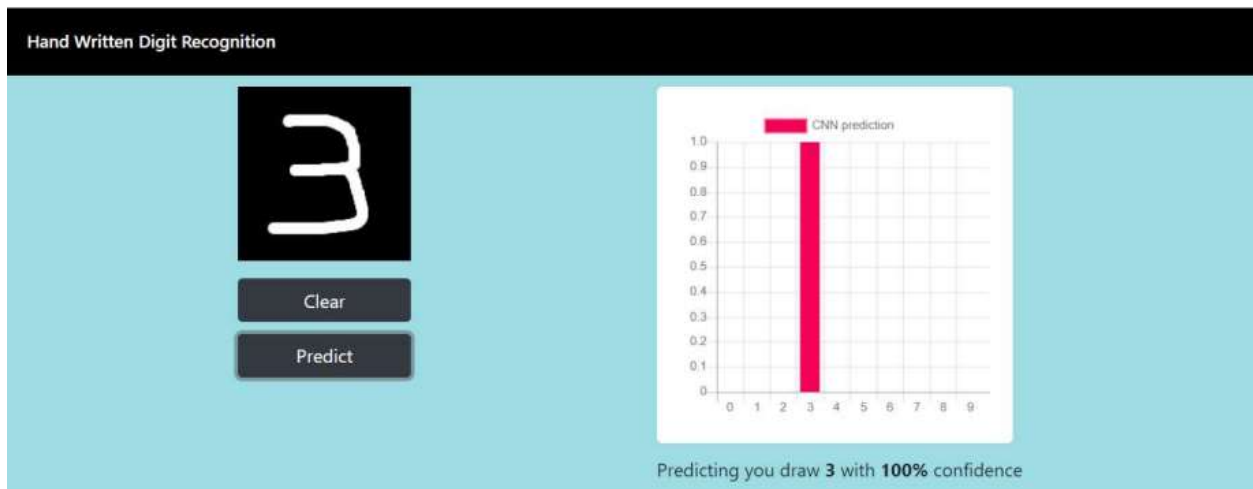**OUTPUT 2**

3. Handwritten Digit Recognition Using CNN:

Theory: CNNs, like neural networks, are made up of neurons with learnable weights and biases. Each neuron receives several inputs, takes a weighted sum over them, pass it through an activation function and responds with an output.

Convolution: Take the filter and slide it over the complete image and along the way take the dot product between the filter and chunks of the input image. The convolution layer comprises of a set of independent filters. Each filter is independently convolved with the image and we end up with feature maps.

Pooling Layers: Its function is to progressively reduce the spatial size of the representation to reduce the number of parameters and computation in the network. Pooling layer operates on each feature map independently.

Sample Screeshot:

OUTPUT 1

OUTPUT 2