

## Assignment 3

This assignment intends to test your understanding of Multilayer Perceptron concepts and how to apply it using Tensorflow/ Keras library.

### Dataset generation

Use following code to generate the training and the testing dataset. This dataset is similar to XOR but have 3 classes. X\_train and y\_train are features and labels respectively for the training dataset. Similarly, X\_test and y\_test are features and labels for the testing dataset.

```
import numpy as np
from sklearn.model_selection import train_test_split

num_observations=10000

x1 = np.random.multivariate_normal([0, 0], [[0.1, 0.2],[0.2, 0.1]], num_observations)
x2 = np.random.multivariate_normal([3, 3], [[0.1, 0.2],[0.2, 0.1]], num_observations)
x3 = np.random.multivariate_normal([3, 0], [[0.1, 0.2],[0.2, 0.1]], num_observations)
x4 = np.random.multivariate_normal([0, 3], [[0.1, 0.2],[0.2, 0.1]], num_observations)

features = np.vstack((x1, x2, x3, x4)).astype(np.float32)
labels = np.hstack((np.full(num_observations,0),
                      np.full(num_observations,1), np.full(2*num_observations,2)))

X_train, X_test, y_train, y_test = train_test_split(features,
                                                    labels, test_size=0.33, random_state=42)
```

Task 1 – Visualize the complete dataset where samples belong to one class have same color. Show the legend and axes name as well.

Task 2 – Train a neural network with 2 hidden layers. Keep both hidden layers as dense (fully connected) layer. Train it on 5 different settings.

Settings	Nodes in first hidden layer	Nodes in second hidden layer	Dropout
1 <sup>st</sup>	10	10	0.1
2 <sup>nd</sup>	20	30	0.1
3 <sup>rd</sup>	50	50	0.8
4 <sup>th</sup>	50	50	0.1
5 <sup>th</sup>	100	100	0.5

Task 3 – For each setting, plot the decision boundary.

Task 4 – Show the training and testing results for each setting and also analyze the effect of changing the hidden layers and dropout on decision boundaries.

Hint :- Go through the following link to understand how to use Keras in TensorFlow environment. Keep the model.compile, model.fit and model.evaluate as it is.

<https://www.tensorflow.org/tutorials/quickstart/beginner>