

# EE 550

## Artificial Neural Networks

### Homework 5

Due: 20/05/2020

#### Implementation of Winner Take-All Network

- 1) **Generate** a 3-D dataset randomly by placing 3 clusters of input data on the **unit sphere**. There should be 90 sample points (Choose 3 regions/clusters on the unit sphere and randomly place 30 sample points on these regions).
- 2) **Plot** the sample vectors, each class with a different sign/color on the 3-D unit sphere.
- 3) Start with random weight vectors (unit length) for each category. Each weight vector (for 3 output categories) should be represented with a large cross sign (**X**) each with a different color on the unit sphere. These vectors should be normalized to unit length.
- 4) Implement the learning algorithm (with normalized weights) for the winner take-all network, for a network with 3 inputs and 3 outputs (Start with random weight vectors, find the winner  $i^*$  for each  $\zeta^\mu$ ,  $\mu = 1, \dots, 90$  and update the corresponding weight vector). Record the data for each outputs weight vector as it is being updated. **Plot** the trajectory for each output weight vector on the unit sphere. You should observe convergence of the weight vectors to the centers of the clusters.
- 5) **Test** your model with 9 samples from your dataset (9 samples - 3 samples from each cluster from the data which you have not used for training). Plot all three outputs of the model for each sample and show that each sample vector is correctly classified with the corresponding output unit.

#### NOTES:

- 1) Please upload all your files (codes and report) to Moodle with the file convention `Lastname_Firstname_project5.rar`.
- 2) Plagiarism will not be tolerated.
- 3) Late submission will not be accepted.