Neural Networks and Fuzzy Logic

Overview of programming assignments

The course team

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Birla Institute of Technology and Science, Pilani

Contents

1 Introduction

The five programming assignments are designed to to reinforce the understanding of course material and their applications.

2 Timeline

The following represents an approximate timeline for the programming components.

8th August	Pre-course survey.
12th August	Hands-on-coding session 0: Introduction to Python and Numpy.
14th August	Assignment 0 release: Introduction to Matrix operations and Fuzzy logic.
23rd August	Assignment 0 Submission.
29th August	Hand-on-coding session 1: Plotting with Matplotlib and k-means clustering.
2nd September	Assignment 1 release: Fuzzy Logic and Genetic Algorithms.
11th September	Assignment 1 Submission.
14th September	Hand-on-coding Session 2: Introduction to Scikit-Learn for data pre-processing and visualisation.
16th September	Assignment 2 release: RBF Networks, SVM and Multi-layer perceptron.
25th September	Assignment 2 Submission.
3rd October	Mid-Semester survey.
17th October	Hand-on-coding session 3: Hassle-free set-up of deep learning frameworks with DL-docker, Introduction to Pytorch.
17th October	Assignment 3 release: Exploring activation functions and variations of gradient descent, Introduction to high-level machine learning libraries.
26rd October	Assignment 3 Submission.
26th October	Hand-on-coding session 4: Scikit-Learn and Scikit-fuzzy by examples.
7th November	Hand-on-coding session 5: Pytorch by examples.
7th November	Open hours: Assignment 4 topic selection help.
7th November	Assignment 4 release: Guided project.
14th November	Assignment 4:Stage 0 evaluation.
21-23nd November	Assignment 4:Stage 1 evaluation.
26th November	End-Semester survey.

3 Evaluation scheme

The first four assignments will be for 15 marks each and the final assignment would carry 45 marks out of the course total of 300 marks.

4 Details

4.1 Hands-on-coding session 0

The first session would provide an introduction to Python, Numpy and jupyter notebooks.

4.2 Assignment 0

Assignment 0 would start with some practice problems on python basics and Numpy, so as to get students comfortable with matrix operations. The problems shall be focused on data handling in python and core Numpy concepts including slicing, fancy-indexing and masked index.

Assignment 0 would deal with fuzzy set operations, the functions written in the first assignment shall be used for more implementation of the fuzzy logic algorithms in the next assignment.

4.3 Hands-on-coding session 1

Introduction of Matplotlib and demonstration of different examples of loading and plotting data in python will be the main agenda of this session.

4.4 Assignment 1

The first half of assignment 1 will be concerned with implementing a fuzzy c-means clustering and defuzzification algorithms.

Formulating a problem for genetic algorithm could be tricky and shall be the centre of our focus. Students will have to model solution for a real world problem and compete in Kaggle like competition.

4.5 Hands-on-coding session 2

Data pre-processing is an crucial step to make any learning algorithm work and hence we shall cover vector representations for different kind of data and normalization schemes. In the later half of session will provide a brief introduction to Scikit-learn.

4.6 Assignment 2

Students would have to model one common problem throughout using SVM, RBF Nets and Multi-layer perceptron and perform comparative analysis of the three algorithms.

This assignments will also have a live scoreboard like the previous one.

4.7 Hands-on-coding session 3

In this session, we shall provide a gentle introduction to pytorch and auto-differentiation libraries.

4.8 Assignment 3

Activation functions and decent algorithm are possibly the most important meta parameter in a neural network. The first half of the assignment would deal with implementing various activation functions and variations of gradient descent in numpy (building over the code in assignment 2) and analysing it's results.

In the later half, we shall have a modelling problem which students would have to code in pytorch. Again, we could have a scoreboard. This exercise would be instrumental towards the final assignment.

4.9 Hands-on-coding session 4

In this session we would explore some examples using Scikit-Learn and Scikit-fuzzy. This session is meant to facilitate final assignment.

4.10 Hands-on-coding session 5

The sixth and final hands-on coding session would also be on similar lines as that of the previous one except it would focus on applying pytorch on real world problems.

4.11 Assignment 4

The final assignment will be special since it will carry thrice the weightage of other assignments. Students would have to work in teams for this assignment. Every team will be assigned a specific paper based on their prior knowledge and interests.

The first stage of evaluation would test the understanding of the paper. While the second stage would involve submission of code and Viva.