CS-345/M45 Lab Class 4

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Due date: 04/12/2019

This lab is about utilizing Support Vector Machines and Neural Networks for classification. We will be looking at applications of the approaches to both binary and multiclass problems, using the functionality present within the scikit-learn and Keras APIs. A jupyter notebook is provided which implements the methods on a subsampled Fisher Iris dataset.

Run the jupyter notebook and study each section to understand what is happening. Try tweaking various parameters of the methods to see if you can observe a behavioural change.

There are two marked tasks in this lab, implementing both SVMs and Neural Networks to classify the Wine dataset.

☐ SVMs for Binary Classification

The first portion of the notebook involves using a binary classifier SVM to model a 2D sampling of the Fisher Iris dataset. This dataset has a binary labelling rather than the multiclass labelling present in the original dataset, this allows us to easily represent the decision boundary and purpose of the support vectors in order to help understand the SVM method. Use the Fisher Iris files from the previous lab classes.

☐ SVMs for Multiclass Classification

The second portion of the notebook implements a multiclass SVM on the same dataset. There is little change here, as the sklearn.svm.SVC object can handle multiclass labels appropriately, however multiclass problems are common in the real world.

☐ Neural Networks

The third section of the notebook utilises Tensorflow's Keras API to implement a standard Neural Network architecture with 2 hidden layers of varying widths. We then train the network and predict class labels using the Keras Model object, which allows us to create a callable object which stores our architecture.

☐ Task 4.1 – Multiclass SVM for Wine Data

- Load the full Wine dataset and divide it into a training and testing set.
- Create and train a multiclass SVM on the training set.
- Predict labels for the testing set and report the accuracy of your model.

☐ Task 4.2 – Neural Network for Wine Data

- Use the training and testing set from Task 4.1
- Create and train a neural network on the training set.
- Predict labels for the testing set and report the accuracy of your model.

☐ Challenge Task 4.3

Some questions to consider:

1. What makes a neural network a "Deep Learning" model?
2. How do I make my neural network deeper? How do I make it wider?
3. How do I train my models for longer?
4. Why does running the methods numerous times result in different accuracy rates?
5. What hyperparameters are available to our models? What happens when we alter the penalty in the SVM or the optimisation strategy in the neural network?