**Project 3: Neural Networks and Classification**

In this project, you must

* Create the following 2D classification data sets
  + PIECE OF CAKE: two classes that are linearly separable
  + EASY: two classes not linearly separable (e.g., two Gaussian clouds with “some” overlap)
  + MODERATE: 2 classes that are HIGHLY non-linearly separable (e.g., the “spiral data set”)
  + TOUGH(ER): 10 classes that are not linearly separable
* You can use codes like the following to generate your data sets
  + [https://scikit-learn.org/stable/auto\_examples/cluster/plot\_linkage\_comparison.html#sphx-glr-auto-examples-cluster-plot-linkage-comparison-pyLinks to an external site.](https://scikit-learn.org/stable/auto_examples/cluster/plot_linkage_comparison.html#sphx-glr-auto-examples-cluster-plot-linkage-comparison-py)
  + [https://gist.github.com/45deg/e731d9e7f478de134def5668324c44c5Links to an external site.](https://gist.github.com/45deg/e731d9e7f478de134def5668324c44c5)

I want you to

* Experiments
  + Design
    - What should you pick as train, validation, and test data?
  + Evaluation
    - Resub and cross-validation
    - Build and report confusion matrices
    - Report various metrics (that we went over in class! (ACC, recall, precision, F1-score)) to help understand and visualize network performance
  + Network
    - Architecture
      * Experiment with “width versus depth”, nonlinearities, error functions, and other architectural parameters like we discussed in class
    - Optimization
      * Experiment with SGD, momentum, and another optimizer like Adam
      * Experiment with variations in optimization parameters

You can

* Use/extend any of my Python codes that I provided in Jupyter

Gang, the goal is for you to create some “simple” low dimensional data sets that you can build a NN on and explore the *vast array* of options w.r.t. experimental design, evaluation, architecture, optimization.

I want a report (PDF), but this time I will accept a 10-15 page MAX report that is JUST experiments + conclusion. You do NOT need to do the other sections like we have all semester.