DATA 255 - SP23 Lab 1

## Part 1: Deep Learning-Based Recommendation (10 Points)

Read the paper [Wide and Deep Learning for Recommender Systems.](#) Download the
https://www.kaggle.com/code/jirakst/book-recommendation/input. Based on the architecture
described in the paper, build your own Wide and Deep Recommender system for the Book
Review dataset. Your model should learn the features of each user and item, not just the
associated ID numbers. Utilize an 80/20 train-test split and record your model's prediction
accuracy.

Part 2: Image Classification with Deep Learning (40 Points)

1. Load the dataset Micro-Organism Image Classification dataset from the given link:
   https://www.kaggle.com/datasets/mdwaquarazam/microorganism-image-classification(2
   points)

   This dataset comprises 789 images of 8 different classes, 75 images per class.
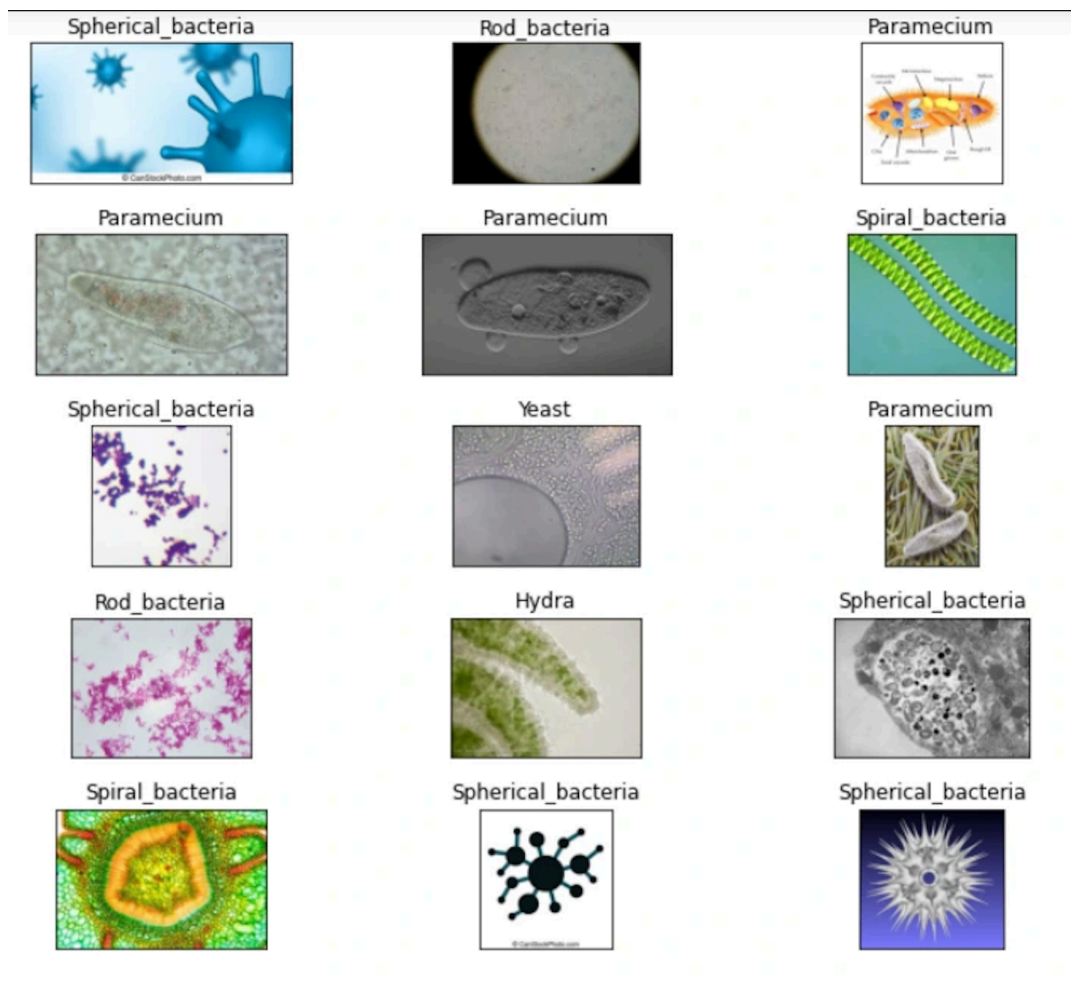
2. Explain in your own words: (7 points)

    a. Gradient Descent (1 point)
    b. Drop out (1 point)
    c. Activation functions (1 point)
    d. Back Propagation (1 point)
    e. Epochs, Iterations, and Batch size (3 points)

3. Visualize/summarize the data (10 points)

    a. Number of entities in the training and testing set and number of classes in the target variable (1 point)
    b. Number of pixels in the image (Height and width individually) (2 points) c. Number of images per class (1 point)
    d. Display at least 2 images of each class (6 points)

4. Train a neural network (21 points)

    a. Decide the number of layers and neurons in each layer (2 points)
    b. Try out different activation functions (explain each one you used) (4 points)
    c. Try with and without using dropout (4 points)
    d. Try different regularizations apart from dropout (4 points)
    e. Try different optimization algorithms (such as Gradient Descent, Adam, etc.) (4 points)
    f. Create a graph of f1 score vs epochs for training and validation set. (2 points) g. Calculate the number of trainable parameters in your final model. (1 point)

Part 3: Object Detection (50 Points)

    1. Explain what is Mask R–CNN (5 points)
    2. Explain U-Net (5 points)
    3. What is intersection over union (IOU) (2 points)
    4. Using the keyword "Traffic simulation" download images and annotate them as shown in demo_04 Object_detection using YOLOv8. (5 marks)
    5. Prepare the dataset for training.
    6. Plot some random images from the train, test, and validation set. (2 points)
    7. Perform object detection and submit your results in the format of sample_submission.csv file.
    10. Compute the IOU of your results with the test set and include it in your report (step 10 ~ 12: 30 points)
    11. Use pre-trained models such as YOLOv8.
    12. Experiment with pre-trained models and show the IOU of the test data set. Show tables and graphs of how the results change.

Part 3 is an in-class competition, each group will be ranked based on the accuracy of their models, 10 points for your build model and 10 points for pre-trained models.