## **Project Title: Training a Neural Network: An Optimization Showdown**

## **Objectives:**

* Understand the concept of optimization in neural networks.
* Explore the effects of learning rate, batch size, and regularization.
* Learn how hyperparameter choices affect model performance and generalization.

## **Description:**

You will **train a simple neural network** (for digit classification on MNIST dataset) using **optimization algorithms** as:

* Stochastic Gradient Descent (SGD)
* Backtrack Line Search

You will:

1. **Train the same model** using each optimizer with fixed architecture and dataset.
2. **Track training and validation accuracy/loss over epochs.**
3. **Experiment with hyperparameters**: learning rate, batch size, number of hidden layers, size of each hidden layer.
4. **Present results**: Compare optimizers using plots and written reflections based on your observations on hyperparameter tuning experiments.

## **📁 Deliverables:**

* Jupyter notebook or script containing:  
  + Model and optimizer implementations.
  + Training logs and plots.
  + Experiment notes.
  + Which optimizer performed best and why.
  + Trade-offs observed (e.g., convergence speed vs. stability).
  + Insights from hyperparameter tuning.