Assignment 0

In this assignment you are asked to experiment with a naive neural net to do something interesting. In addition, you will get a taste of the full spectrum of what you can do with neural nets.

Part A: Basic Neural Net

1. Write the following function to initialize a neural net:

   ```python
   def initialize_net(input_size, hidden_size, output_size):
       w1 = np.random.randn(input_size, hidden_size)
       b1 = np.zeros(hidden_size)
       w2 = np.random.randn(hidden_size, output_size)
       b2 = np.zeros(output_size)
       return w1, b1, w2, b2
   ```

2. Train the neural net on the iris dataset using a single hidden layer with 10 units. Use the following parameters:

   - Learning rate: 0.01
   - Number of epochs: 100
   - Number of batches: 32
   - Optimization method: Adam

   Evaluate the performance of the trained neural net on the test set.

Part B: Advanced Neural Net

3. Create a neural net with two hidden layers, each with 50 units. Use the following parameters:

   - Learning rate: 0.001
   - Number of epochs: 500
   - Number of batches: 64
   - Optimization method: RMSprop

   Train the neural net on the MNIST dataset and evaluate its performance on the test set.

Part C: Network Architecture

4. Design a deep neural net with at least three hidden layers, each with a different number of units. Train the net on the CIFAR-10 dataset and compare its performance with the previous two models.

5. Analyze the performance of the trained networks in terms of accuracy and computational cost. Discuss the trade-offs between model complexity and performance.

Submit your code and a report summarizing your findings.