Applied Deep Learning Assignment 1 - Initiate

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Project Title: Digit Recognition with CNN and Data Augmentation

1. Project Overview
   The objective of this project is to design and implement a convolutional neural network (CNN) that accurately recognizes handwritten digits from the MNIST dataset. Additionally, the model will incorporate data augmentation techniques (e.g., random rotations, shifts, and zooming) to improve robustness and potentially enhance generalization on unseen data.

2. Dataset Description
   The MNIST dataset, consisting of 60,000 training samples and 10,000 test samples of grayscale handwritten digits.

3. Methodology

   - Base Model: A CNN architecture featuring consecutive convolutional and pooling layers for feature extraction, followed by fully connected layers ending in a softmax classifier.
   - Data Augmentation: Utilize TensorFlow's ImageDataGenerator (or a similar tool to be determined later) to apply random transformations during training, thereby simulating different writing styles and noise conditions.
   - Training: Compare model performance with and without augmentation using standard metrics such as accuracy and loss.
   - Evaluation: Analyze both quantitative metrics and visual predictions under various transformation scenarios.

4. Work-Breakdown Structure
   Literature Review & Paper Research: ~4 hours
   Environment Setup & Dataset Preparation: ~5 hours

Baseline CNN Implementation: ~10 hours
Integration of Data Augmentation: ~8 hours
Model Training & Hyperparameter Tuning: ~8 hours
Evaluation & Analysis: ~3 hours
Report Writing & Presentation Preparation: ~6 hours

5. References

LeCun, Y., Bottou, L., Bengio, Y., & Haffner, P. (1998). "Gradient-Based Learning Applied to Document Recognition."

Goodfellow, I., Shlens, J., & Szegedy, C. (2015). "Explaining and Harnessing Adversarial Examples."

Shorten, C. & Khoshgoftaar, T. M. (2019). "A Survey on Image Data Augmentation for Deep Learning." Journal of Big Data, 6(1), 60.