Short Course on Deep Learning and Convolutional Neural Network

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Objectives

- Introduction to Machine Learning fundamentals.
- Understand the difference between traditional machine learning and Deep Learning.
- Able to Build, Train, and Test a Convolutional Neural Network (CNN) from scratch.
- Learn to use libraries and framework for implementing Deep CNN architectures.
- Collaboratively Analyze, design, implement and test solutions to real-world computer vision related problems.

Assessment Items

- Assignment-1 (Individual)

  Task:

  1. Implement a simple kNN classifier for digit classification
  2. Implement a Linear classifier using SVM for digit classification
  3. Implement a Linear classifier using Neural Network for digit classification
  4. Compare the three implementations in terms of classification accuracy and top choices.

Assessment Items

- Assignment-2 (Individual)

  Task:

  1. Customize AlexNet/GoogleNet/ResNet and reduce/increase the layers. Train and test on images
  2. Implement a custom CNN architecture for object detection and localization.
  3. Train and test the custom architecture on a given dataset for detection of multiple Objects, using Faster RCNN or Yolo object detection methods.

  (Training, validation and testing datasets will be provided.)

Assessment Items

- Assignment Task 3: Final Project (Group) (Optional)

  Task: Any one of the following problems, or any combination:

  1. Design/Implement an image classification algorithm.
  2. Design/develop an object detection system for detecting specific objects in a video and localizing them.
  3. Develop a clear problem statement that is within the capabilities of CNNs and design and capture a dataset of significant size that addresses this problem.
  4. Compare a series of algorithms against each other to determine optimum performance, and then suggest new approaches that improve performance.
  5. Develop a user interface that allows the operational use of an algorithm to achieve a real-world

Labs/Tutorials

- Implementation of Algorithms using Python
- Google Colab will be used
- Deep Learning frameworks: TensorFlow, Keras, etc.
- Datasets will be provided
- Project Groups to be formed by EOD Day-1

Day-1 Agenda

- Lecture 1: Introduction to Machine Learning and Deep Learning
- Lab 1: Environment setup and OpenCV+Python Warm-up
- Lecture 2: Machine Learning Basics and Introduction to Image Processing
- Lab 2: Part 1: Understanding Convolutions
  Part 2: Machine Learning Basics: KNN, SVM for classification