Deep Learning and Computer Vision

Introduction to Deep Learning

Deep Learning is a subset of machine learning that employs neural networks with multiple layers, known as deep networks, to model intricate patterns in data. It excels in tasks involving vast amounts of unstructured data, such as images, sound, and text. This project aims to equip students with a comprehensive understanding of deep learning and computer vision concepts, enabling them to implement fundamental algorithms and techniques from scratch using Java and apply these techniques to practical computer vision problems.

Project Objectives

1. **Comprehensive Understanding**: Provide students with an in-depth understanding of deep learning and computer vision concepts.
2. **Hands-on Implementation**: Teach students to implement fundamental deep learning algorithms and techniques from scratch using Java.
3. **Practical Applications**: Apply these techniques to solve practical computer vision problems.

Project Scope

Week 1: Foundations

Learning Objectives:

- Introduction to Deep Learning
- Basics of Neurons, Layers, and Neural Networks
- Understanding Model Output and Learning
- Mathematical Foundations of Feed Forward Neural Networks
- Forward Propagation
- Backpropagation
- Implementing a simple Feed Forward Neural Network in Python using TensorFlow
- Solving the XOR Problem

Week 2: Optimizers

Learning Objectives:

- Adding Different Optimizers to Neural Networks
- Understanding the Mathematical Foundations behind various optimizers:
    - Gradient Descent
    - RMSProp
    - Adam Optimizer

Week 3: Activation Functions

Learning Objectives:

- Adding Different Activation Functions to Neural Networks
- Observing the differences between activation functions:
    - Mean Squared Error
    - Binary Cross Entropy

Week 4: Convolutional Neural Networks (CNNs)

Learning Objectives:

- Introduction to Convolutional Neural Networks (CNNs)
- Understanding the Theoretical Concepts of Dense Layer and Activation Layer

Week 5: Implementation of CNNs

Learning Objectives:

- Understanding the Mathematical Concepts of Convolutional Layer and Max Pooling Layer
- Implementing CNN using TensorFlow
- Using the developed Neural Network to train on the MNIST Dataset

Week 6: Practical Applications

Activities:

- Applying developed deep learning models to practical computer vision problems
- Final project on Image Classifier

Contact Information

For any questions or further discussion about this proposal, please feel free to reach out to:

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Thank you for considering our teaching services. We look forward to collaborating with you on this exciting project.