Deep Learning and Computer Vision

What is Deep Learning?

Deep Learning is a subset of machine learning that utilizes neural networks with many layers (deep networks) to model complex patterns in data. It is particularly effective in tasks involving large amounts of unstructured data, such as images, sound, and text.

Project Objectives

- Provide students with a comprehensive understanding of deep learning and computer vision concepts.
- Teach students to implement fundamental deep learning algorithms and techniques from scratch using Java from scratch.
- Apply these techniques to practical computer vision problems.

Project Scope

Week 1: Foundations

- **Learning Objectives:** Basics of Linear Algebra and Object-Oriented Programming (OOP) relevant to deep learning.
- **Implementation:** Apply these concepts using Java.
- **Activities:**
    - Study Linear Algebra and Object-Oriented Programming concepts in the context of Java.

Week 2: Linear Regression

- **Learning Objectives:** Basics of Linear Regression.
- **Implementation:** Implement linear regression algorithms from scratch in Java.
- **Activities:**
    - Implement linear regression algorithms using Java.
    - Gather and label relevant datasets.
    - Preprocess data for training linear regression models.

Week 3: Convolutional Neural Networks (CNNs)

- **Learning Objectives:** Introduction to Convolutional Neural Networks (CNNs).
- **Implementation:** Implement key components of CNNs in Java.
- **Activities:**
    - Studying the Problems with Linear Regression and Understanding why CNNs are used.
    - Study CNN concepts and architecture.

Week 4: Convolutional Layers

- **Learning Objectives:** Implementing convolutional layers in Java.
- **Activities:**
    - Implementing **the Convolution and Correlation Functions in Java.**
    - Implement convolutional layers with stride and padding.

Week 5: Activation Layers

- **Learning Objectives:** Implementing activation layers in Java.
- **Activities:**
    - Implement common activation functions (e.g., ReLU, sigmoid) in Java.
    - Integrate activation layers into existing CNN implementations.
    - Experiment with different activation functions and observe their effects on model performance.

Week 6: Leveraging Our Neural Network for Some Practical Applications

- **Activities:**
    - Apply the developed deep learning models to practical computer vision problems.
    - Provide guidance on integrating Java-based deep learning models into real-world applications.

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Please feel free to reach out with any questions or for further discussion about this proposal. Thank you for considering our teaching services.