Detailed Notes on AI and ML Syllabus

Scope

The syllabus covers:

1. Python for Data Science

2. Artificial Intelligence

3. Ethics and Law in Data and Analysis

4. Computer Vision and Image Analysis

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1. Python for Data Science

Python is extensively used in data science for data exploration, cleaning, and visualization. It also plays a key role in development.

Key Topics:

- **Application of Python**: Usage in work environments for programming, automation, and data tasks.

- **Tools and IDEs**: Editing Python using IDEs (like PyCharm, Jupyter Notebook) and text editors.

- **Python Lists**: Fundamental data structures for storing collections of items.

- **Development Areas**:

  - 2D/3D Game Development

  - Web and Internet Development

  - Database Access

  - Network Programming

  - Business Applications

- **Numpy**: A library for numerical operations with large datasets using high-level mathematical functions.

- **Matplotlib**: Visualization of data with graphs and charts.

Mathematical Concepts Applied:

  - Equations and Functions

  - Graphs and Optimization

  - Differentiation and Integration

  - Vectors, Matrices

  - Statistics and Probability

Data Tasks:

- Exploring, preparing, and cleaning data for machine learning applications.

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2. Artificial Intelligence (AI)

Artificial Intelligence (AI) introduces machine learning concepts for automating tasks and creating intelligent systems.

Key Topics:

- **AI Foundations**: Basics of Machine Learning and AI algorithms.

- **Computer Vision**: Developing models to interpret and understand visual data.

- **Bots**: Using AI to convert processes into bots.

Key Applications:

- **Handwritten Digit Recognition**: Building systems to detect digits from images.

- **Time-Series Forecasting**: Using recurrent neural networks to forecast trends and data over time.

- **LSTM-based Applications**: Developing text-based applications using Long Short-Term Memory networks.

- **Neural Machine Translation**: Building neural models to perform text translation across languages.

- **Multimodal Intelligence**: Combining data from multiple modalities like text, images, and speech.

- **Speech Recognition**:

  - Basic Signal Processing for Speech

  - Creating Acoustic Models and Decoding Speech.

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3. Ethics and Law in Data and Analysis

Data science and AI must be implemented ethically and comply with legal standards to ensure privacy and trust.

Key Topics:

- **Ethical Frameworks**: Applying ethical principles in the data profession.

- **Legal Compliance**: Frameworks for big data, data science, and AI applications.

- **Approaches**:

- Solving data problems while maintaining ethical guidelines.

  - Using dynamic programming to address challenges in big data and AI.

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4. Computer Vision and Image Analysis

Computer Vision focuses on exploring and analyzing visual data using Python libraries and deep learning techniques.

Key Topics:

- **Image Manipulation**: Use of Python libraries like OpenCV and PIL for exploring and analyzing images.

- **Image Classification**: Implementing classification techniques using:

  - Classical Machine Learning

  - Deep Learning

- **Techniques to Enhance Models**:

  - Data Augmentation

  - Transfer Learning for CNNs (Convolutional Neural Networks)

- **Object Detection and Semantic Segmentation**:

  - Detecting and classifying objects within images.

  - Performing segmentation to identify regions in images.

Knowledge and Understanding (KU)

- Preparation and contributions in production processes and meetings.

- Understanding roles, tools, and version control systems.

- Technical limitations, specifications, and operational aspects.

Generic Skills (GS)

- **Version Control**: Proper use of naming conventions, commit practices, and asset management.

- **Collaboration**: Team management, communication, and feedback to resolve issues.

- **Quality Assessment**: Ensuring committed content meets quality standards and suggesting improvements.

- **Time Management**: Planning work schedules and addressing delays efficiently.

- **Problem-Solving**: Guiding teams to overcome technical and creative challenges.