

2. Introduction to AI programming

Q.) Choose at least three commonly used Python libraries in manufacturing, such as NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow and OpenCV. Provide a brief overview of each selected library, including its purpose, features, and functionalities relevant to manufacturing.

ANS :

1. NumPy

Purpose: NumPy (Numerical Python) is a fundamental library for numerical computing in Python. It provides support for large, multi-dimensional arrays and matrices, along with mathematical functions to operate on these arrays.

Features and Functionalities:

- Efficient handling of large datasets, which is essential for analysing sensor data in manufacturing.
- Fast mathematical and statistical operations, improving real-time data processing.
- Used in simulation modelling for process optimization and defect detection.

Relevance to Manufacturing:

Manufacturing processes involve vast amounts of numerical data, including measurements, sensor readings, and quality control parameters. NumPy enables quick processing of this data, making it ideal for real-time monitoring and predictive analytics.

2. Pandas

Purpose: Pandas is a powerful library for data manipulation and analysis. It provides flexible data structures like Data Frames, which simplify the handling of structured datasets.

Features and Functionalities:

- Easy data cleaning and preprocessing, crucial for manufacturing logs and production reports.
- Time-series analysis, which helps in predictive maintenance and process optimization.
- Integration with other libraries for seamless AI implementation in manufacturing workflows.

Relevance to Manufacturing:

Pandas is widely used for analysing production data, tracking inventory, and forecasting demand. Manufacturers leverage it to identify patterns in operational efficiency, detect anomalies, and enhance decision-making.

3. OpenCV

Purpose: OpenCV (Open Source Computer Vision) is a widely used library for image processing and computer vision applications.

Features and Functionalities:

- Supports real-time image and video analysis, essential for quality control.
- Provides tools for defect detection, automated inspection, and pattern recognition.
- Works with deep learning models to enhance vision-based automation.

Relevance to Manufacturing:

Manufacturers use OpenCV for visual inspections, identifying defective products, and ensuring product consistency. Automated vision systems powered by OpenCV reduce human errors and improve production accuracy.

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