Professional Certificate in AI-Driven Pharmaceutical Supply Chain Management

Machine Learning Algorithms and Applications

Artificial Intelligence (AI): The simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction.

Machine Learning (ML): A subset of AI that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. It focuses on the development of computer programs that can access data and use it to learn for themselves.

Deep Learning: A subset of ML that is based on artificial neural networks with representation learning. It can process a wide range of data resources, requires less data preprocessing by humans, and is used in applications like image and speech recognition.

Supervised Learning: A type of ML where the model is trained on a labeled dataset. A labeled dataset is one where the target outcome or answer is known.

Unsupervised Learning: A type of ML where the model is trained on an unlabeled dataset. The model tries to find patterns and relationships in the data without any prior knowledge of the outcome.

Reinforcement Learning: A type of ML where an agent learns to behave in an environment, by performing certain actions and observing the results/rewards.

Neural Networks: A computing model whose layered structure resembles the neural network of the human brain. It consists of input and output layers, as well as (in most cases) a hidden layer consisting of units that transform the input into something the output layer can use.

Activation Function: A function used in ML to transform the summed weighted input from the node into an output that is sent to the next layer.

Cost Function: A function that measures the difference between the predictions made by the model and the actual data. It is used in ML to guide the learning process.

Gradient Descent: An optimization algorithm used to minimize some function by iteratively moving in the direction of steepest descent as defined by the negative of the gradient.

Overfitting: A modeling error that occurs when a model learns the detail and noise in the training data to the extent that it negatively impacts the performance of the model on new data.

Underfitting: A modeling error that occurs when a model is too simple to learn the underlying structure of the data.

Regularization: A technique used to prevent overfitting by adding a penalty term to the loss function in the

model.

Cross-validation: A technique for assessing how the results of a statistical analysis will generalize to an independent data set. It is mainly used in ML to compare and select a model for final use.

Ensemble Learning: A ML paradigm where multiple models are trained and their predictions are combined in some way (e.g., by voting or averaging) to improve overall performance.

Natural Language Processing (NLP): A field of AI that focuses on the interaction between computers and humans through natural language. The ultimate objective of NLP is to read, decipher, understand, and make sense of human language in a valuable way.

Principal Component Analysis (PCA): A statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

Support Vector Machines (SVM): A supervised ML algorithm which can be used for both classification or regression challenges. However, SVM is mostly used in classification problems.

Naive Bayes: A family of probabilistic algorithms based on applying Bayes' theorem with strong (naive) independence assumptions between the features.

Decision Trees: A type of ML algorithm that is mostly used in classification problems. It works for both categorical and continuous input and output variables.

Random Forests: An ensemble learning method, where a group of weak models combine to form a powerful model.

Apriori Algorithm: A classic algorithm for frequent item set mining and association rule learning over transactional databases.

K-means Clustering: A method of clustering data into K clusters. The algorithm works iteratively to assign each data point to one of K groups based on the features that are provided.

Pharmaceutical Supply Chain Management: The management of the flow of goods and services, involving the movement and storage of raw materials, intermediate goods, and finished pharmaceutical products from point of origin to point of consumption.

AI-Driven Pharmaceutical Supply Chain Management: The application of AI and ML techniques to optimize and automate the processes involved in pharmaceutical supply chain management.

Demand Forecasting: The process of estimating the quantity of a product or service that customers will purchase in the future.

Inventory Management: The supervision of non-capitalized assets, or inventory, and stock items. A component of supply chain management, inventory management is concerned with ordering, storage, and use of a company's inventory.

Quality Assurance: The systematic process of ensuring that a service or product will fulfill the requirements of the customer.

Fraud Detection: The process of detecting fraudulent activities in a system or organization.

Predictive Maintenance: An approach that uses data, statistical models, and AI to predict potential failures in machinery before they occur, thus enabling maintenance to be scheduled before the failure happens.

Challenges in AI-Driven Pharmaceutical Supply Chain Management: The integration of AI and ML into pharmaceutical supply chain management presents several challenges, including data privacy and security, interpretability of models, and the need for large amounts of high-quality data.