DATA SCIENCE FOR HEALTHCARE

Course Learning Objectives

CLO 1. To provide a strong foundation in Data Science and gain insight into the health care challenges.
CLO 2. To understand the fundamentals of healthcare data.
CLO 3. To demonstrate the data preparation, mining and predictive models for patient care.
CLO 4. To understand the use of computer vision and NLP in healthcare.
CLO 5. To familiarize with Generative AI in healthcare and optimization in healthcare operations.

Module - I

Introduction to Data Science for Healthcare - Traditional approach to healthcare decision-making, Electronic health records, Analytics in healthcare, Essence of data science in healthcare, Unraveling the key concepts in data science for healthcare, Machine Learning, Artificial Intelligence, Big Data, Predictive analytics, Lifecycle of a healthcare data science project, Predictive analytics in-patient outcomes and radiology, Challenges in merging data science with healthcare.

Module – II

Fundamentals of Healthcare Data - Types of healthcare data, Data sources in healthcare, Medical imaging in healthcare, Data formats and storage in medical imaging, Wearable devices in healthcare, Data quality in healthcare, Healthcare ontologies and coding systems, Healthcare interoperability, Real-world applications in healthcare data science.

Module – III

Data Preparation and Mining - Introduction to data preparation in healthcare, Handling missing values in healthcare datasets, Addressing outliers and noisy data, Data transformation, normalization, and standardization, Exploratory data analysis in healthcare, Clustering in healthcare data analysis, Case studies and real-world applications, Data preparation and analysis.

Predictive Modeling for Patient Care - Building machine learning models for disease diagnosis, Evaluation methods for model performance and interpretability, Predictive modeling for treatment recommendations, Regression-based predictive models.

Module - IV

Image Analysis and Computer Vision in Healthcare - Applications of computer vision in medical imaging, Utilizing deep learning for image classification, segmentation, and anomaly detection, Real-world examples of computer vision in disease diagnosis.

Natural Language Processing in Healthcare - Role of NLP in analyzing medical text, Extracting clinical insights, NLP for clinical decision support and coding, Real-world examples of NLP in disease diagnosis.

Module - V

Generative AI in Healthcare - Generative AI workflow for medical data creation, Applications of generative AI, Challenges and opportunities in using generative AI.

Healthcare Operations Optimization - Optimizing hospital operations with data science, Predictive analytics in hospital admissions and staffing, Case studies, Automation in-patient management. Ethical guidelines for patient data use. Deep learning for drug discovery and genome analysis.

Course Outcomes

At the end of the course the student will be able to:

CO1: Identify, analyze and define bigdata, data mining, predictive models, Natural Language Processing (NLP), Generative AI in health care system.
CO2: Use data mining, predictive models for healthcare system.
CO3: Design and build NLP and Generative AI models for healthcare system.
CO4: Optimize hospital operations with data science
CO5: Use deep learning for drug discovery and genome analysis.

Text Book:

1. Nitin Singh, “Data Science for Healthcare: Applying ML and AI to solve real-world healthcare problems”, BPB Publications.

Reference Books:

1. Goran Trajkovski, Principles of Healthcare Data Analytics", Cognella Inc.