DATA SCIENCE WITH GEN AI COURSE CURRICULUM

INTRODUCTION TO DATA SCIENCE & AI

Introduction to Data Science, Artificial Intelligence and Generative AI, Data Analytics and Business Intelligence, Data Science Lifecycle and AI Workflow Overview, Roles and Responsibilities of Data Analyst, Data Scientist and AI Engineer, Introduction to Machine Learning, Deep Learning and Large Language Models (LLMs), AI-Powered Automation and Agentic Workflows, Tools and Technologies used in Data Science and AI Applications.

PYTHON FOR AI DEVELOPMENT

Python Programming Fundamentals, Data Types, Operators and Control Flow Statements, Functions and Modules, Object Oriented Programming (OOP), Functional Programming using Lambda, Map, Filter and Decorators, Iterators, Generators and List Comprehensions, File Handling and Exception Handling, Working with JSON and CSV Files, Regular Expressions and Text Processing, Logging and Debugging Techniques, Type Hinting and Data Validation using Pydantic, Working with APIs and HTTP Requests, Writing Modular Python Code for Data Science and AI Applications.

BUSINESS STATISTICS

Introduction to Business Statistics and Data Interpretation, Measures of Central Tendency and Dispersion, Probability and Probability Distributions, Sampling Techniques and Random Variables, Correlation and Covariance Analysis, Hypothesis Testing and Statistical Inference, Chi-Square Test, T-Test and ANOVA, Business Forecasting and Trend Analysis, A/B Testing and Data Driven Decision Making, Statistical Analysis using Real World Business Datasets.

SQL FOR DATA ANALYTICS

Introduction to SQL and Relational Databases, Database Design and Data Modelling Basics, Retrieving, Filtering and Sorting Data, Aggregate Functions and Group By Operations, Joins, Subqueries and Common Table Expressions (CTEs), Window Functions and Analytical SQL, Data Cleaning and Transformation using SQL, Query Optimisation Techniques, SQL Integration with Python, Working with MySQL Databases for Data Analytics and Reporting Applications.

POWER BI FOR DATA ANALYTICS

Introduction to Power BI and Data Visualisation, Data Modelling and Relationships, Power Query and Data Transformation, DAX Functions and Calculated Measures, Dashboard Design and KPI Reporting, Interactive Reports and Data Storytelling, Advanced Filters, Slicers and Drill Through Reports, Real Time Reporting and Business Analytics Applications.

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TABLEAU FOR DATA ANALYTICS

Introduction to Tableau and Data Visualisation, Connecting and Blending Data Sources, Data Analysis and Dashboard Development, Calculated Fields and Parameters, Charts, Maps and Interactive Visualisations, Filters and Data Storytelling Techniques, Dashboard Actions and Business Reporting Applications.

DATA ANALYSIS USING PYTHON

NumPy for Numerical Computing and Array Operations, Pandas for Data Processing and Data Analysis, Data Cleaning and Transformation Techniques, Data Aggregation and Filtering, Working with CSV, Excel, JSON and SQL Databases, Data Collection using APIs and External Data Sources, Working with Structured and Unstructured Data, Working with Time Series Analysis, Data Analysis using SciPy and Statsmodels, Business Reporting and Insight Generation using Python.

EXPLORATORY DATA ANALYSIS (EDA)

Introduction to Exploratory Data Analysis (EDA), Handling Missing Values and Outliers, Correlation and Distribution Analysis, Feature Engineering and Data Preparation Techniques, Statistical Analysis and Data Interpretation, Data Visualisation using Matplotlib and Seaborn, Statistical and Business Data Visualisation Techniques, Automated Exploratory Data Analysis using Sweetviz and YData-profiling.

MACHINE LEARNING

Introduction to Machine Learning, Supervised and Unsupervised Learning, Data Preprocessing and Feature Engineering, Regression and Classification Models, Clustering and Dimensionality Reduction Techniques, Decision Trees, Random Forest, XGBoost, K Means Clustering and PCA, Model Training and Evaluation, Cross Validation and Hyperparameter Tuning, Scikit Learn Pipelines, Predictive Analytics and Business Use Cases, Model Deployment Basics, Case Study on Customer Churn Prediction, Sales Forecasting and Recommendation Systems.

DEEP LEARNING

Introduction to Deep Learning and Neural Networks, ANN, CNN, RNN and LSTM Models, Transfer Learning and Pretrained Models, TensorFlow and PyTorch Basics, Computer Vision and NLP Applications, Model Training and Optimisation, AI Applications using Deep Learning, Case Study on Image Classification and Text Generation Systems.

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TIME SERIES

Introduction to Time Series Forecasting, Trend, Seasonality and Stationarity, Time Series Decomposition, ARIMA and Prophet Models, Machine Learning Approaches for Forecasting, LSTM-Based Forecasting Overview, Forecasting Applications in Business and Finance, Case Study on Sales and Demand Forecasting.

NATURAL LANGUAGE PROCESSING (NLP)

Introduction to Natural Language Processing (NLP), Text Preprocessing and Tokenisation, Text Vectorisation and Embeddings, Sentiment Analysis and Text Classification, Named Entity Recognition (NER), Speech to Text and Text to Speech Systems, Transformer Models and LLM-Based NLP Applications, Case Study on Chatbots, AI Assistants and Sentiment Analysis Systems.

MLOPS AND AI ENGINEERING

Introduction to MLOps and AI Engineering, AI Application Lifecycle and Deployment Workflow, Git and GitHub for Version Control, Virtual Environments and Dependency Management, Model Serialisation and Packaging, Experiment Tracking and Model Versioning, API Development using FastAPI, Streamlit for AI Applications, Docker Basics for AI Deployment, Cloud Deployment Concepts and AI Application Monitoring Basics.

GENERATIVE AI

Introduction to Generative AI and Large Language Models (LLMs), Transformer Architecture, Tokens and Embeddings, OpenAI, Gemini, Llama and Claude Models, Prompt Engineering Techniques, Fine Tuning vs Prompting, Vector Databases and Semantic Search, Retrieval Augmented Generation (RAG), AI Hallucination and Guardrails, Building AI Applications using OpenAI APIs and Hugging Face Models, Case Study on AI Powered Chatbot and Research Assistant.

AI AGENTS AND WORKFLOW ORCHESTRATION

Introduction to AI Agents and Agentic AI Systems, Tool Calling, Memory and Multi Agent Workflows, LangChain, LangGraph, LlamaIndex and CrewAI Frameworks, MCP and A2A Fundamentals, AI Workflow Automation, API Integration with AI Agents, Case Study on AI SQL Assistant and Multi Agent Research Assistant.

2 CAPSTONE PROJECTS

Problem Definition, Data Collection and Pre-Processing, Data Analysis and Visualization, Machine Learning and AI Application Development, Generative AI and Automation Workflows, Model Evaluation and Deployment.

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