

# Executive Diploma in Machine Learning & AI

## Detailed Curriculum

### Optional Preparatory Content

#### ► Basic Reasoning

Develop foundational logical thinking and problem-solving skills essential for data-driven analysis and reasoning.

#### ► Advanced Reasoning

Enhance your ability to tackle complex problems using structured analytical approaches and advanced logical frameworks.

#### ► Number Systems

Understand different number representations and their applications in computation, data encoding, and algorithm design.

#### ► Arithmetic

Learn core mathematical operations and principles that underpin data analysis, statistics, and algorithm implementation.

#### ► Basic Excel

Learn to manipulate, analyze, and visualize data efficiently using spreadsheets, a vital tool for business and data analytics.

#### ► Business Problem Solving

Apply analytical techniques to real-world business scenarios, transforming data insights into actionable solutions.

### Bootcamp: Basic Mathematics and Programming for Data Science and Machine Learning

#### ► Fundamentals of Python

Build a strong programming foundation with Python, focusing on syntax, basic operations, and scripting for data analysis.

#### ► Python Control Structures

Explore decision-making and loop constructs in Python to automate workflows and solve repetitive data tasks.

#### ► Python Data Structures

Gain proficiency in Python's built-in data structures—strings lists, tuples, sets, and dictionaries—for efficient data manipulation, and apply them with real use-cases.

#### ► Combinatorics

Study counting techniques and arrangements, essential for probability, statistics, and algorithmic complexity.

#### ► Probability

Learn the mathematical framework for modeling uncertainty, making predictions, and supporting data-driven decisions.

#### ► Descriptive Statistics

Summarise and interpret data using measures of central tendency, dispersion, and visualisation techniques.

#### ► Fundamentals of Database Design and Basic SQL Querying

Understand relational database principles and practice basic SQL queries to store, retrieve, and manage structured data.

#### ► Essentials of Calculus

Explore calculus concepts such as differentiation and integration, foundational for optimisation and machine learning algorithms.

### Tools



# Core Course 1: Advanced Mathematics and Programming for Data Science and Machine Learning

- **Time Series Forecasting and Recommendation Systems**  
Analyse data distributions, apply linear transformations, and leverage multivariate calculus for advanced modelling.
- **Introduction to Object-Oriented Programming and GenAI for Problem-Solving**  
Learn object-oriented programming concepts for clean and industry oriented coding and explore how Generative AI can be used to solve complex problems.
- **Database Design and Advanced SQL Querying**  
Delve deeper into database normalisation, indexing, and advanced SQL techniques for efficient data handling.
- **NoSQL and MongoDB**  
Learn the fundamentals of document-oriented database design and explore how MongoDB's flexible schema and scalability make it ideal for building modern, data-intensive applications.
- **Python Data Science Libraries**  
Know more about the data, manipulate, and visualise with Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn.
- **Data Structures and Algorithms [optional]**  
Study essential algorithms and data structures for computation efficiency and problem-solving in programming.

## Tools



# Core Course 2: Data Analysis and Exploration

- **Introduction to Data Modeling and Descriptive Statistics**  
Learn to design data models and apply descriptive statistics to extract meaningful insights from datasets.
- **Data Preprocessing and Exploratory Data Analysis**  
Prepare raw data for analysis and uncover patterns through visualisation and statistical exploration.
- **Inferential Statistics and Hypothesis Testing**  
Draw conclusions about populations from sample data using inferential methods and hypothesis testing frameworks.
- **Introduction to Power BI and Tableau**  
Get hands-on with leading business intelligence tools for interactive data visualisation and dashboard creation.
- **Assignment**  
Perform exploratory data analysis (EDA) using Python to uncover patterns and insights from a dataset. Use Tableau and Power BI to visualize the findings and explore key trends.

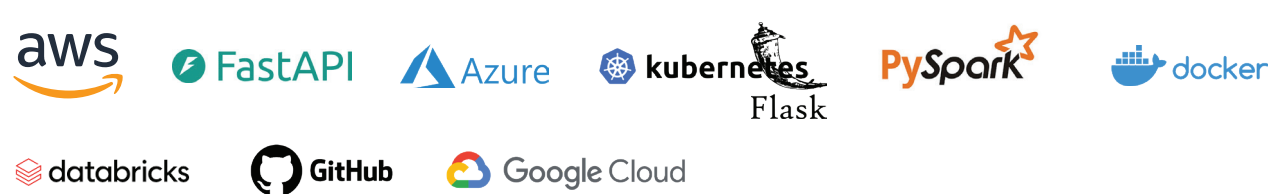
## Tools



# Core Course 3: Cloud Computing and Big Data Fundamentals

- **Cloud Computing Fundamentals**  
Learn the fundamentals of cloud computing by exploring key platforms like AWS, Azure, and GCP. Execute tasks such as data storage, processing, and analysis using their basic services, and discover how to leverage scalable solutions and distributed computing for efficient management and processing of big data. Learn to deploy models on cloud to enable realtime analytics.
- **Basics of ETL and Introduction to PySpark**  
Learn data extraction, transformation, and loading (ETL) processes and get started with distributed data processing using PySpark.
- **Big Data Analysis using PySpark**  
Analyse large-scale datasets efficiently using PySpark's distributed computing capabilities.
- **Deployment Fundamentals**  
Discover best practices for deploying data science and machine learning models into production environments.
- **Assignment**  
Analyze large-scale datasets using PySpark to efficiently process and extract insights. Leverage distributed computing capabilities to perform advanced big data analytics and uncover hidden patterns.
- **Software Development Life Cycle [optional]**  
Understand the stages of software development, from requirements gathering to maintenance, with a focus on data projects.
- **Version Control [optional]**  
Learn to manage code changes and collaborate effectively using version control systems like Git.

## Tools



## Core Course 4: Foundations of Machine Learning

- **Introduction to Machine Learning and Regression**  
Explore machine learning fundamentals and regression techniques for predictive analytics.
- **Regularisation and Hyperparameter Tuning**  
Improve model performance and prevent overfitting through regularisation methods and hyperparameter optimisation.
- **kNN, Hierarchical Clustering, k-Means Clustering**  
Master popular clustering and classification algorithms for unsupervised and supervised learning tasks.
- **Decision Trees and Ensemble Methods**  
Build interpretable models and leverage ensemble techniques like Random Forests for robust predictions.
- **Assignment**  
Apply classical machine learning models for classification and regression tasks to predict outcomes based on input data.

### Tools



## Core Course 5: Deep Learning and Natural Language Processing

- **Artificial Neural Networks**  
Understand how to mimic the human understanding by neural networks.
- **Lexical and Syntactic Processing**  
Analyse and process text data at the word and sentence structure level, foundational for NLP applications.
- **Convolutional and Recurrent Neural Networks**  
Understand how to process unstructured data like text, images and videos with CNNs and RNNs.
- **Semantic Processing**  
Extract and interpret meaning from text using advanced natural language processing techniques.
- **Assignment**  
Implement deep learning models for text and image classification to categorise data into predefined labels. Use techniques like CNNs and RNNs to build and evaluate accurate classification models.

### Tools



## MLOps Specialisation

### Course 7: Advanced Machine Learning

- **Supervised Machine Learning**  
Learn core supervised learning algorithms for classification and regression tasks.
- **Feature Engineering, Model Selection & PCA**  
Enhance model performance through feature engineering, selection techniques, and dimensionality reduction with PCA.
- **Time Series Forecasting and Recommendation Systems**  
Apply specialized models for predicting temporal trends and building personalized recommendation engines.
- **Assignment**  
Apply classical machine learning algorithms for various tasks and evaluate model performance using techniques like cross-validation. Use model selection methods to choose the best-performing model based on metrics such as accuracy, precision, and recall.

### Tools



### Course 7: Advanced Deep Learning

- **Sequential Processing with Deep Learning**  
Model sequential data using deep learning architectures like Seq2Seq and Transformers.
- **Deep Learning Architectures**  
Study advanced neural network architectures for tackling complex data science challenges.
- **Fundamentals of GenAI and Prompt Engineering**  
Understand the basics of Generative AI and learn to craft prompts for effective AI-driven solutions.
- **Assignment**  
Apply advanced deep learning architectures like Seq2Seq and Transformers to model sequential data, while leveraging other complex neural network architectures to tackle challenging data science problems and enhance model performance.

### Tools





## Course 8: Large-Scale Data Pipelining and Monitoring

### » Data Processing

Master techniques for cleaning, transforming, and preparing data for analysis and modeling.

### » Automated Data Pipelining

Design and implement automated workflows for seamless data movement and transformation.

### » Data Versioning and Monitoring

Track changes and monitor data pipelines for consistency, reproducibility, and quality.

### » Assignment

Stream and process real-time data using Kafka for high-throughput event handling. Utilise Spark Streaming to analyze live data streams and gain immediate insights from continuously flowing data."

## Tools



## Course 9: Model Pipelining and System Design

### » Model Serving Techniques

Deploy machine learning models efficiently for real-time and batch inference in production environments.

### » Automated Model Pipelining

Automate the end-to-end machine learning workflow, from data ingestion to model deployment.

### » Data Versioning and Monitoring

Implement practices for tracking data changes over time and continuously monitoring data pipelines to ensure data quality, consistency, and reproducibility in data science workflows.

### » Assignment

Deploy machine learning models for real-time and batch inference, automate the workflow from data ingestion to deployment, and track data changes while monitoring pipelines to maintain quality and consistency.

## Tools



## GenAI Specialisation

## Course 6: Advanced Machine Learning

### » Supervised Machine Learning

Learn core supervised learning algorithms for classification and regression tasks.

### » Feature Engineering, Model Selection & PCA

Enhance model performance through feature engineering, selection techniques, and dimensionality reduction with PCA.

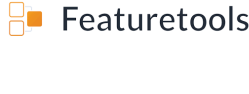
### » Time Series Forecasting and Recommendation Systems

Apply specialized models for predicting temporal trends and building personalized recommendation engines.

### » Assignment

Apply classical machine learning algorithms for various tasks and evaluate model performance using techniques like cross-validation. Use model selection methods to choose the best-performing model based on metrics such as accuracy, precision, and recall.

## Tools



## Course 7: Deep Learning for GenAI

### » Sequential Processing with Deep Learning

Model sequential data using deep learning architectures like Seq2Seq and Transformers.

### » Deep Learning Architectures

Study advanced neural network architectures for tackling complex data science challenges.

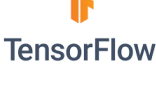
### » Fundamentals of GenAI and Prompt Engineering

Understand the basics of Generative AI and learn to craft prompts for effective AI-driven solutions.

### » Assignment

Apply advanced deep learning architectures like Seq2Seq and Transformers to model sequential data, while leveraging other complex neural network architectures to tackle challenging data science problems and enhance model performance.

## Tools



## Course 8: GenAI System Design

### » GenAI Advanced Prompt Engineering

Advance your skills in designing complex prompts to maximize the effectiveness of Generative AI systems.

### » GenAI System Design and LLM Frameworks

Learn to architect GenAI solutions, integrating large language models (LLMs) into scalable systems.

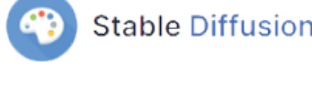
### » Multimodal GenAI

Explore Generative AI techniques that process and generate content across multiple data modalities.

### » Assignment

Design complex prompts to enhance Generative AI, architect scalable GenAI solutions with large language models (LLMs), and implement techniques to process and generate content across multiple data modalities.

## Tools



## Course 9: Advanced GenAI

### » LLM Evaluation

Assess the performance and reliability of large language models using standardized evaluation metrics.

### » GenAI RAG and Evaluation

Implement Retrieval-Augmented Generation (RAG) and evaluate GenAI outputs for accuracy and relevance.

### » Agentic AI

Understand the principles and applications of agent-based AI systems that can autonomously perform tasks.

### » Assignment

Evaluate large language models using standardized metrics, implement Retrieval-Augmented Generation (RAG) for accurate GenAI outputs, and apply agent-based AI for autonomous task execution.

## Tools



# Capstone Projects

Capstone that Adapts to Your Preference

## Infuse our Capstone with Your Data

Modify existing projects as per your industry data and problems

## Bring Your Own Capstone

Work on a completely novel project of your choice and solve problems that excite you

## Pre-Designed Industry Capstone

Choose one of our existing projects that cover in-demand trending industry domains

## Bring Your Own Capstone

Design your own capstone project relevant to your domain and interest, and get feedback throughout your capstone stages

