Generative AI and ML

Training Course

(For advanced)

GENERATIVE AI and ML CURRICULUM (ADVANCED)

CONTENT

COURSE 1 - Python Programming for AI and ML

AIP1 - Introduction to Python
AIP2 - Sequences and File Operations
AIP3 - Functions and Object-oriented Programming
AIP4 - Working with Modules and Handling Exceptions
AIP5 - Array Manipulation using NumPy
AIP6 - Data Manipulation using Pandas
AIP7 - Data Visualization using Matplotlib and Seaborn
AIP8 - GUI Programming
AIP9 - Developing Web Maps and Representing Information using Plots (Self-paced)
AIP10 - Web Scraping and Computer Vision using OpenCV (Self-paced)
AIP11 - Database Integration with Python (Self-Paced)

COURSE 2 - Statistical Methods for Predictive Analysis

AIP1 - Probability and Statistics
AIP2 - Inferential Statistics
AIP3 - Regression
AIP4 - Predictive Analytics

COURSE 3 - Applied Machine Learning Techniques

AIP1 - Introduction to Machine Learning
AIP2 - Supervised Learning - Regression
AIP3 - Evaluating Regression Models
AIP4 - Supervised Learning - Classification
AIP5 - Decision Tree and Random Forest Models
AIP6 - Mathematical and Bayesian Models
AIP7 - Dimensionality Reduction
AIP8 - Unsupervised Learning using Clustering
AIP9 - Model Evaluation and Hyperparameter Tuning
AIP10 - Model Boosting and Optimization
AIP11 - Association Rule Mining and Recommendation Engines (Self-paced)
AIP12 - Time Series Analysis (Self-paced)

COURSE 4 - Artificial Intelligence and Deep Learning

AIP1 - Introduction to Text Mining and NLP
AIP2 - Extracting, Cleaning, and Preprocessing Text
AIP3 - Analyzing Sentence Structure
AIP4 - Text Classification-I

AIP5 - Text Classification-II
AIP6 - Introduction to Deep Learning
AIP7 - Getting Started with TensorFlow 2.0
AIP8 - Convolution Neural Network
AIP9 - Regional CNN
AIP10 - Boltzmann Machine and Autoencoder
AIP11 - Developing a Criminal Identification and Detection Application Using OpenCV
AIP12 - TensorFlow for Deployment
AIP13 - Project
AIP14 - Emotion and Gender Detection (Self-paced)
AIP15 - Introduction to RNN and GRU (Self-paced)
AIP16 - LSTM (Self-paced)
AIP17 - Auto Image Captioning Using CNN LSTM (Self-paced)

COURSE 5 - Generative AI and Large Language Models (LLMs)

AIP1 - Generative AI and its Industry Applications
AIP2 - Autoencoders and GANs
AIP3 - Language Models and Transformer-based Generative Models
AIP4 - Working with ChatGPT
AIP5 - Prompting Techniques for Generative Models
AIP6 - Generative AI with LLMs
AIP7 - LLMs for Search, Prediction, and Generation
AIP8 - Interacting with Data using Retrieval-Augmented Generation
AIP9 - LLMs for Word Embedding and Chunking Mechanism
AIP10 - LangChain and LlamaIndex for LLM Application Development
AIP11 - Fine Tuning and Evaluating Generative Models
AIP12 - Generative AI on Cloud
AIP13 - Generative AI with Python
AIP14 - Industry Case Studies and Project
AIP15 - Machine Learning with Generative AI (Self-paced)
AIP16 - Generative AI Tools (Self-paced)

Course -1 Python Programming for AI and ML

AIP1 - Introduction to Python

- Need of Programming
- Advantages of programming
- Demand for Python
- Application of Python in Different Domains
- Fundamentals of Python
- Using the Print Statement
- Standard Data Types
- Python Operators
- Control Structures: Conditional Statements
- Control Structures: Loops
- Structural Pattern Matching

AIP2 - Sequences and File Operations

- Reading Keyboard Input in Python
- File Input/Output Operations in Python
- File Objects in Python
- Types of Sequences and their Operations in Python
- Lists
- Tuples
- Strings
- Sets
- Dictionaries
- Bytes
- ByteArray
- Range

AIP3 - Functions and Object-oriented Programming

- Function and Its Applications
- Function Arguments
- Variable Scope
- Lambda Functions
- Built-in Functions
- Documentation Strings
- Procedure-Oriented vs. Object-Oriented Programming
- Class and Its Attributes
- Constructors and Destructors
- Generator Functions in Python
- Object-Oriented Programming Concepts

AIP4 - Working with Modules and Handling Exceptions

- Standard Libraries
- import Statement
- dir() Function
- reload() Function
- Types of Modules
- Important modules in Python
- sys Module
- os Module
- math Module
- datetime Module
- random Module
- JSON Module
- Packages
- Regular Expressions
- Exception Handling
- User Defined Exceptions

AIP5 - Array Manipulation using NumPy

- Introduction to NumPy
- NumPy Array
- Basic Operations
- Arithmetic Operators
- Matrix Product
- Functions
- Universal Functions
- Aggregate Functions
- Logic Functions
- Indexing
- Fancy Indexing
- Slicing
- Iterating in a NumPy Array
- Array Manipulation
- File Handling Using NumPy

AIP6 - Data Manipulation using Pandas

- Introduction to pandas
- Functionality of pandas
- Significance of pandas Library
- Data Structures in pandas
- Series and DataFrame
- Importing and Exporting Data
- Merging, Join, and Concatenation of Data Objects
- Cleaning Data
- Grouping Data

AIP7 - Data Visualization using Matplotlib and Seaborn

- Need for Data Visualization
- The Matplotlib Library
- Types of Plots and Charts
- Customizing Visualizations
- The Seaborn Library
- Types of Plots
- RelPlot
- Scatter Plot
- Line Plot
- Bar Plot
- Count Plot
- Box Plot
- Heatmap
- Cluster maps

AIP8 - GUI Programming

- GUI Programming
- Widgets
- Introduction to Ipywidgets
- Widgets in Ipywidgets
- Numeric Widget
- Boolean Widget
- Selection Widget
- String Widget
- Button
- Image
- Date picker
- Container
- Introduction to Tkinter
- Widgets in Tkinter

AIP9 - Developing Web Maps and Representing Information Using Plots (Self-paced)

- Introduction to Web Maps
- Flow Chart to Create Web Map
- Installing folium and pandas Library
- Applications of Web Map
- Titanic Dataset Analysis

AIP10 - Web Scraping and Computer Vision using OpenCV (Self-paced)

- Web Scrapping
- Beautiful Soup Library

- Requests Library
- Introduction to Scrapy
- Scrapy Spider
- Plotting Using Bokeh
- Image Editing Using OpenCV
- Face Detection Using OpenCV
- Image

AIP11 - Database Integration with Python (Self-paced)

- Fundamentals of Database
- Need for Database
- Structured Query Language (SQL)
- SQL Properties
- Introduction to Python MySQL
- Connecting Python with MySQL
- Creating a Database
- Creating Tables
- Inserting into a table
- NoSQL Database
- Features of NoSQL
- Advantages of NoSQL
- Types of NoSQL Databases
- Introduction to MongoDB
- Features and Advantages of MongoDB
- MongoDB Terminologies
- CRUD Operations

Course -2 Statistical Methods for Predictive Analysis

AIP1 - Probability and Statistics

- Why Use Probability?
- What is Probability?
- Rules of probability
- Types of Probability
- Marginal Probability
- Joint Probability
- Conditional Probability
- Random Variables
- Probability Distribution Functions
- Types of Probability Distribution Functions
- Introduction to Statistics
- What is Statistics?
- Why Statistics?
- Data Types
- Measures of Central Tendency
- Mean 12
- Median
- Mode
- Descriptive Statistics on

AIP2 - Inferential Statistics

- Introduction to Inferential Statistics
- Hypothesis Testing
- Normal Distribution
- Confidence Interval
- P-value
- One-tailed and Two-tailed tests
- One Sample Z test
- One Sample T test
- Independent Sample T test
- Chi-square test
- Regression
- ANOVA

AIP3 - Regression

- Introduction to Regression
- Linear Regression
- Simple Linear Regression
- Multiple Linear Regression
- Evaluation Metrics in Regression Models

- Logistic Regression
- Regularization: Ridge, Lasso, & Elastic Net

AIP4 - Predictive Analytics

- Introduction to Predictive Analytics
- Predictive Analytics Workflow
- Data Collection and Preparation
- Exploratory Data Analysis (EDA)
- Feature Engineering and Selection
- Predictive Modeling Techniques
- Time Series Forecasting
- Evaluation and Performance Metrics
- Industry Applications and Use Cases

Course -3 Applied Machine Learning Techniques

AIP1- Introduction to Machine Learning

- What is Machine Learning?
- Machine Learning Processes
- AI vs. Machine Learning vs. Deep Learning
- Significance of Machine Learning
- Applications of Machine Learning
- Myth about Machine Learning
- Types of Machine Learning
- Data Pre-processing Techniques
- Train/Test split method

AIP2 - Supervised Learning - Regression

- Classification of Supervised Learning Algorithms
- Regression
- Linear Regression
- Assumptions of Linear Regression
- Types of Linear Regression
- OLS Regression Results Summary
- Calculation of R2
- Gradient Descent
- Regularization techniques

AIP3 - Evaluating Regression Models

- Model Evaluation
- Scenario – BMI Prediction
- Bias-Variance Trade-off
- Learning and Validation Curves
- Techniques for Evaluating Regression Models
- Relative Standard Deviation
- Relative Squared Error
- Mean Absolute Error
- Relative Absolute Error
- Mean Squared Error
- Root Mean Squared Error on Prediction
- R-Square

AIP4 - Supervised Learning - Classification

- What is Classification?
- Classification vs. Regression
- Types of Classification Algorithms
- Logistic Regression

- What is Logistic Regression?
- Log Odds
- Logistic Regression Cost Function
- Maximum Likelihood
- Evaluation Parameters

AIP5 - Decision Tree and Random Forest Models

- Decision Tree
- Decision Tree using CART Algorithm
- Decision Tree using ID3 Algorithm
- Attribute Selection
- Random Forest

AIP6 - Mathematical and Bayesian Models

- Naive Bayes Classification
- Revisiting Bayes' Theorem
- K-Nearest Neighbors (K-NN)
- Distance Metric
- Standardization (Normalization, Z-score)
- Choosing K
- Support Vector Machines (SVM)
- Linear SVM Classification
- Non-Linear SVM Classification
- SVM Regression
- Kernel SVM

AIP7 - Dimensionality Reduction

- Curse of Dimensionality
- What is Dimensionality Reduction
- Why Dimensionality Reduction
- Feature Selection and Extraction
- Principal Component Analysis
- EigenVector/Singular Vector
- EigenValue/Singular Value
- Screen Plot
- Linear Discriminant Analysis (LDA)
- Other Dimensionality Reduction Techniques

AIP8 - Unsupervised Learning using Clustering

- What is Unsupervised Learning?
- What is Clustering?
- Types of Clustering
- Hierarchical Clustering

- Agglomerative Clustering
- Division Clustering
- K-Means Clustering
- Euclidean Distance
- Elbow Method
- Fuzzy C-Means Clustering
- DBSCAN Clustering

AIP9 - Model Evaluation and Hyperparameter Tuning

- Model Selection
- Resampling Techniques
- Need for Model Evaluation
- Metrics for evaluating Regression Models
- Metrics for evaluating Classification Models
- Hyperparameter Tuning

AIP10 - Model Boosting and Optimization

- Ensemble Learning
- Bagging
- Boosting
- AdaBoost
- Gradient Boosting
- XGBoost
- CatBoost
- Model Optimization
- Elements of Optimization
- Linear Programming
- Applications
- Formulating Optimization
- Accelerated Gradient Methods
- Second-Order Methods

AIP11 - Association Rule Mining and Recommendation Engines (Self-paced)

- Association Rule Mining
- Apriori Algorithm
- Market Basket Analysis
- Recommendation Engine
- User-Based Collaborative Filtering (UBCF)
- Content-Based Filtering (CBF)

AIP12 - Time Series Analysis (Self-paced)

- Time Series Analysis

- Components of Time Series
- Types of Data
- Stationary Data
- Non-Stationary Data
- Checks for Stationarity of Data
- Augmented Dicky Fuller Test
- Convert Non-Stationary Data to Stationary Data
- Differencing
- Seasonal Differencing
- Transformation
- Time Series Analysis

Course4 - Artificial Intelligence and Deep Learning

AIP1 - Introduction to Text Mining and NLP

- Overview of Text Mining
- Need of Text Mining
- Natural Language Processing (NLP) in Text Mining
- Applications of Text Mining
- OS Module
- Reading, Writing to text and word files
- Setting the NLTK Environment
- Accessing the NLTK Corpora

AIP2 - Extracting, Cleaning, and Preprocessing Text

- Tokenization
- Frequency Distribution
- Different Types of Tokenizers
- Bigrams, Trigrams & Ngrams
- Stemming
- Lemmatization
- Stopwords
- POS Tagging
- Named Entity Recognition

AIP3 - Analyzing Sentence Structure

- Syntax Trees
- Chunking
- Chinking
- Context Free Grammars (CFG)
- Automating Text Paraphrasing

AIP4 - Text Classification-I

- Machine Learning: Brush Up
- Bag of Words
- Count Vectorizer
- Term Frequency (TF)
- Inverse Document Frequency (IDF)

AIP5 - Text Classification-II

- Converting Text to Features and Labels
- Multinomial Naive Bayes Classifier
- Leveraging Confusion Matrix

AIP6 - Introduction to Deep Learning

- What is Deep Learning?
- Machine Learning vs. Deep Learning
- Use Cases of Deep Learning
- Human Brain vs. Neural Network
- What is Perceptron?
- Learning Rate
- Epoch
- Batch Size
- Activation Function
- Single Layer Perceptron

AIP7 - Getting Started with TensorFlow 2.0

- Introduction to TensorFlow 2.x
- Installing TensorFlow 2.x
- Defining Sequence model layers
- Activation Function
- Layer Types
- Model Compilation
- Model Optimizer
- Model Loss Function
- Model Training
- Digit Classification using Simple Neural Network inTensorFlow 2.x
- Improving the model
- Adding Hidden Layer
- Adding Dropout
- Using Adam Optimizer

AIP8 - Convolution Neural Network

- What is Convolution?
- Convolutional Layer Network
- Convolutional Layer
- Filtering
- ReLU Layer
- Pooling
- Data Flattening
- Fully Connected Layer
- Predicting a cat or a dog
- Saving and Loading a Model
- Face Detection using OpenCV

AIP9 - Regional CNN

- Regional-CNN

- Selective Search Algorithm
- Bounding Box Regression
- SVM in RCNN
- Pre-trained Model
- Model Accuracy
- IoU
- RCNN – Speed Bottleneck
- Fast R-CNN
- RoI Pooling
- Fast R-CNN – Speed Bottleneck
- Faster R-CNN
- Feature Pyramid Network (FPN)
- Regional Proposal Network (RPN)
- Mask R-CNN

AIP10 - Boltzmann Machine and Autoencoder

- What is the Boltzmann Machine (BM)?
- Identify the issues with BM
- Why did RBM come into the picture?
- Step-by-step implementation of RBM
- Distribution of Boltzmann Machine
- Understanding Autoencoders
- Architecture of Autoencoders
- Brief on types of Autoencoders
- Applications of Autoencoders

AIP11 - Developing a Criminal Identification and Detection Application Using OpenCV

- Why is OpenCV used?
- What is OpenCV & its Applications
- Build a Criminal Identification and Detection App

AIP12 - TensorFlow for Deployment

- Use Case: Amazon’s Virtual Try-Out Room.
- Why Deploy models?
- Model Deployment: Intuit AI models
- Model Deployment: Instagram’s Image Classification Models
- What is Model Deployment
- Types of Model Deployment Techniques
- TensorFlow Serving
- Browser-based Models
- What is TensorFlow Serving?
- What are Servables?
- Demo: Deploy the Model in Practice using TensorFlow Serving

- Introduction to Browser based Models
- Deploy a Deep Learning Model in your Browser

AIP13 - Project

- Sentiment Classification

AIP14 - Emotion and Gender Detection (Self-paced)

- Where do we use Emotion and Gender Detection?
- Emotion Detection architecture
- Face/Emotion detection using Haar Cascade
- Implementation on Colab

AIP15 - Introduction to RNN and GRU (Self-paced)

- Issues with Feed Forward Network
- Recurrent Neural Network (RNN)
- Architecture of RNN
- Calculation in RNN
- Backpropagation and Loss calculation
- Applications of RNN
- Vanishing Gradient
- Exploding Gradient
- What is GRU?
- Components of GRU
- Update gate
- Reset gate
- Current memory content
- Final memory at current time step

AIP16 - LSTM (Self-paced)

- What is LSTM?
- Structure of LSTM
- Forget Gate
- Output Gate
- LSTM architecture
- Types of Sequence-Based Model
- Sequence Prediction
- Sequence Classification
- Sequence Generation
- Types of LSTM
- Vanilla LSTM
- Stacked LSTM
- CNN LSTM
- Bidirectional LSTM

- How to increase the efficiency of the model?
- Backpropagation through time
- Workflow of BPTT

AIP17 - Auto Image Captioning Using CNN LSTM (Self-paced)

- Auto Image Captioning
- COCO dataset
- Pre-trained model
- Inception V3 model
- The architecture of Inception V3
- Modify the last layer of a pre-trained model
- Freeze model
- CNN for image processing
- LSTM or text processing

Course - 5 Generative AI and Large Language Models (LLMs)

AIP1 - Generative AI and its Industry Applications

- Introduction to Generative AI
- Generative AI Principles
- Types of Generative Models
- Applications of Generative Models
- Machine Learning Algorithms with Gen AI
- Applications of Generative AI
- Ethical Considerations

AIP2 - Autoencoders and GANs

- Basic Autoencoders
- Variational Autoencoders (VAEs)
- Applications in Data Compression and Generation
- Basic GAN Architecture
- Training GANs
- Variants of GANs
- DCGAN
- CycleGAN

AIP3 - Language Models and Transformer-based Generative Models

- Exploring Language Models
- Types of Language Models
- Applications of Language Models
- The Transformer Architecture: Attention Mechanism
- Advanced Transformer Models
- GPT
- BERT
- Applications of Transformer-based Models

AIP4 - Working with ChatGPT

- Introduction to ChatGPT
- Leveraging ChatGPT for Productivity
- Mastering Excel through ChatGPT
- Becoming a Data Scientist using ChatGPT
- Data Analysis in PowerBI with ChatGPT
- Creating a Content Marketing Plan
- Social Media Marketing using ChatGPT
- Keyword Search and SEO using ChatGPT
- Generating Content using ChatGPT
- Implementing ChatGPT for Customer Service
- ChatGPT for Developers

- ChatGPT for Creating Programs
- ChatGPT for Debugging
- ChatGPT for Integrating New Features
- ChatGPT for Testing
- Documenting the Code with ChatGPT

AIP5 - Prompting Techniques for Generative Models

- Prompt Engineering Principles
- What is Prompt Engineering?
- Prompt Engineering with Generative AI models
- Tools for Prompt Engineering
- Prompt Design Strategies
- Types of Prompting
- Approaches for writing effective prompts
- Best practices for creating impactful prompts

AIP6 - Generative AI with LLMs

- LLMs and Generative AI Project Lifecycle
- LLM Pre-Training and Scaling
- Fine-Tuning LLMs with Specific Instructions
- Efficient Fine-Tuning of Parameters
- Reinforcement Learning from Human Response

AIP7 - LLMs for Search, Prediction, and Generation

- Search Query Completion
- Next Word Prediction
- Word Embeddings
- Transformers
- Generating Text
- Stacking Attention Layers

AIP8 - Interacting with Data using Retrieval-Augmented Generation

- Understanding RAG
- RAG Architecture
- Retriever Techniques
- Keyword Matching
- Sentence Transformers
- LLM Integration with Prompt and Retrieved Information
- Augmentation Strategies
- Benefits of RAG
- Access to Real-time Information
- Improved Grounding and Factual Accuracy
- Advanced RAG: Moving Beyond Naive RAG

- Modular RAG
- Retrieval Quality Enhancement

AIP9 - LLMs for Word Embedding and Chunking Mechanism

- Word Embedding Introduction
- Word Embedding Techniques
- Capturing Word Relationships
- Sentence Embedding Techniques
- Introduction to Vector Databases
- Different Types of Vector Databases
- Chunking
- Perform Chunking of the Document
- Traditional Chunking mechanism
- Advanced Chunking Mechanism Character
- Splitting Recursive
- Character splitting
- Document-based Chunking
- Semantic Chunking
- Agentic Chunking

AIP10 - LangChain and LlamaIndex for LLM Application Development

- LangChain Framework
- Chaining LLMs with other AI Components for Complex Workflows
- Building Applications with Combined Functionalities
- LlamaIndex for Large-Scale Factual Knowledge Indexing for LLMs

AIP11 - Fine Tuning and Evaluating Generative Models

- Fine Tuning Fundamentals
- Fine Tuning Techniques for Generative Models
- Data Augmentation
- Hyperparameter Tuning
- Curriculum Learning
- Transfer Learning
- PEFT (Parameter-Efficient Fine-Tuning)
- Low-Rank Adaptation (LoRA)
- Quantized LoRA (QLoRA)
- Feature Extraction
- Full Fine Tuning
- Selective Fine Tuning

AIP12 - Generative AI on Cloud

- Cloud Computing Foundations
- AWS S3 in Generative AI

- Amazon EC2 Trn1n for Generative AI
- Amazon EC2 Inf2 for Generative AI
- Amazon Sagemaker for Generative AI
- Amazon CodeWhisperer
- Amazon Bedrock
- Azure OpenAI

AIP13 - Generative AI with Python

- Python Code Generation with Generative AI
- Gen AI Tools for Coding
- Advanced Code Optimization with ChatGPT Gen AI Tool
- Coding with ChatGPT
- Building an Application in Python with ChatGPT

AIP14 - Industry Case Studies and Project

- In-class Project: AI-Powered Text and Image Generator
- Case Study: Generative AI for Personalized Learning
- Case Study: Generative AI for Creative Content Generation
- Case Study: Generative AI for Business

AIP15 - Machine Learning with Generative AI (Self-paced)

- Artificial Intelligence Essentials
- Disciplines of AI
- Types of AI
- Machine Learning Fundamentals
- Predictive ML Models
- ML Algorithms: Deep Dive
- Supervised Learning
- Unsupervised Learning
- Semi-Supervised Learning
- Reinforcement Learning

AIP16 - Generative AI Tools (Self-paced)

- Hugging Face Transformers
- OpenAI GPT3 API
- Google Cloud AI Platform
- MidJourney
- DALL E-2
- Google Gemini

PROJECT DETAILS FOR ADVANCED

Create a system that uses cutting-edge AI algorithms to extract insights and summaries from intricate financial reports.

- Develop a system for recommending material that takes user preferences into account when recommending books, movies, or other types of media.

AI-Driven Carbon Reduction Planner

- Create AI-driven carbon emission reduction plans suited to certain cities or industries.

Advanced Personalized Health Insights Generator

- Build an AI system that generates detailed health reports by analyzing a patient's medical history, current data, and potential risk factors.