

Full Stack **DATA SCIENCE**

with
Gen AI & Agentic AI



Agentic AI



Generative AI



Prompt
Engineering



LLM Models



GANs



RAG



MLOps



CICD Pipeline



Neural Network

In Collaboration With



NASSCOM®

PYTHON

Introduction to Data Science

- ✓ Introduction of Data Science
- ✓ Discussion on Course Curriculum
- ✓ Introduction to Programming

Python – Basics

- ✓ Introduction to Python: Installation and Running
(Jupyter Notebook, .py file from terminal, Google Colab)
- ✓ Data types and type conversion
- ✓ Variables
- ✓ Operators
- ✓ Flow Control : If, Elif, Else
- ✓ Loops
- ✓ Python Identifier
- ✓ Building Functions (print, type, id, sys, len)

Python - Data Types & Utilities

- ✓ List, List of Lists and List Comprehension
- ✓ List creation
- ✓ Create a list with variable
- ✓ List mutable concept
- ✓ len() || append() || pop()
- ✓ insert() || remove() || sort() || reverse()



- ✓ Backward Indexing
- ✓ Forward slicing
- ✓ Backward slicing
- Step slicing

Set

- ✓ SET creation with variable
- ✓ len() || add() || remove() || pop()
- ✓ union() | intersection() || difference()

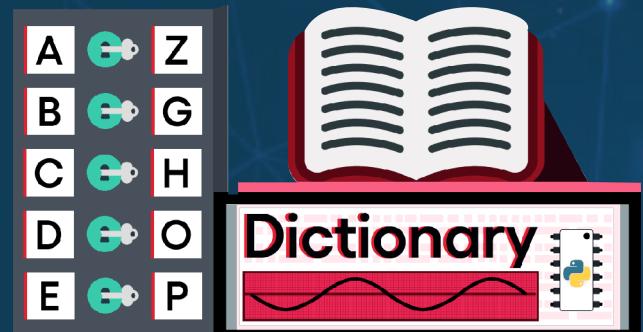


Tuple

- ✓ TUPLE Creation
- ✓ Create Tuple with variable
- ✓ Tuple Immutable concept
- ✓ len() || count() || index()
- ✓ Forward indexing
- ✓ Backward Indexing

Dictionary & Dictionary comprehension

- ✓ Create a dictionary using variable
- ✓ keys:values concept
- ✓ len() || keys() || values() || items()
- ✓ get() || pop() || update()
- ✓ comparision of datastructure
- ✓ Introduce to range()
- ✓ pass range() in the list
- ✓ range() arguments
- ✓ For loop introduction using range()



Functions

- ✓ Inbuilt vs User Defined
- ✓ User Defined Function
- ✓ Function Argument
- ✓ Types of Function Arguments
- ✓ Actual Argument
- ✓ Global variable vs Local variable
- ✓ Anonymous Function | LAMBDA

Packages | Map Reduce | OOP's

Class & Object:

- ✓ What is mean by inbuild class
- ✓ How to creat user class
- ✓ crate a class & object
- ✓ `__init__` method
- ✓ Python constructor
- ✓ Constructor, self & comparing objects
- ✓ Instane variable & class variable

Methods

- ✓ what is instance method
- ✓ what is class method
- ✓ what is static method
- ✓ Accessor & Mutator

Python DECORATOR:

- ✓ how to use decorator
- ✓ inner class, outerclass
- ✓ Inheritance

Polymorphism

- ✓ duck typing
- ✓ operator overloading
- ✓ method overloading
- ✓ method overriding
- ✓ Magic method
- ✓ Abstract class & Abstract method
- ✓ Iterator
- ✓ Generators in python

Python - Production Level

- ✓ Error / Exception Handling
- ✓ File Handling
- ✓ Docstrings
- ✓ Modularization

Pickling & Unpickling

Pandas

- ✓ Introduction, Fundamentals, Importing, Pandas, Aliasing, DataFrame



- ✓ Series – Intro, Creating Series Object, Empty Series Object, Create series from List/Array/Column from DataFrame, Index in Series, Accessing values in Series
- ✓ NaN Value
- ✓ Series – Attributes (Values, index, dtypes, size)
- ✓ Series – Methods – head(), tail(), sum(), count(), nunique() etc.,
- ✓ Date Frame
- ✓ Loading Different Files
- ✓ Data Frame Attributes
- ✓ Data Frame Methods
- ✓ Rename Column & Index
- ✓ Inplace Parameter
- ✓ Handling missing or NaN values
- ✓ iLoc and Loc
- ✓ Data Frame – Filtering
- ✓ Data Frame – Sorting
- ✓ Data Frame – GroupBy
- ✓ Merging or Joining
- ✓ Data Frame – Concat
- ✓ DataFrame - Adding, dropping columns & rows
- ✓ DataFrame - Date and time
- ✓ DataFrame - Concatenate Multiple csv files



Numpy

- ✓ Introduction, Installation, pip command, import numpy package, ModuleNotFoundError, Famous Alias name to Numpy
- ✓ Fundamentals – Create Numpy Array, Array, Manipulation, Mathematical Operations, Indexing & Slicing

- ✓ Numpy Attributes
- ✓ Important Methods- min(),max(), sum(), reshape(), count_nonzero(), sort(), flatten() etc.,
- ✓ adding value to array of values
- ✓ Diagonal of a Matrix
- ✓ Trace of a Matrix
- ✓ Parsing, Adding and Subtracting Matrices
- ✓ "Statistical Functions: numpy.mean()
- ✓ numpy.median()
- ✓ numpy.std()
- ✓ numpy.sum()
- ✓ numpy.min()"
- ✓ Filter in Numpy



Matplotlib

- ✓ Introduction
- ✓ Pyplot
- Figure Class
- ✓ Axes Class
- ✓ Setting Limits and Tick Labels
- ✓ Multiple Plots
- ✓ Legend
- ✓ Different Types of Plots:

- ✓ Line Graph
- ✓ Bar Chart
- ✓ Histograms,
- ✓ Scatter Plot
- ✓ Pie Chart
- ✓ 3D Plots
- ✓ Working with Images
- ✓ Customizing Plots+



Seaborn

- ✓ catplot() function
- ✓ stripplot() function
- ✓ boxplot() function
- ✓ violinplot() function
- ✓ pointplot() function

- ✓ barplot() function
- ✓ Visualizing statistical relationship with Seaborn relplot() function
- ✓ scatterplot() function

- ✓ regplot() function
- ✓ lmplot() function
- Seaborn Facetgrid() function
- ✓ Multi-plot grids
- ✓ Statistical Plots:
- ✓ Color Palettes:
- ✓ Faceting:
- ✓ Regression Plots:
- ✓ Distribution Plots
- ✓ Categorical Plots:
- ✓ Pair Plots

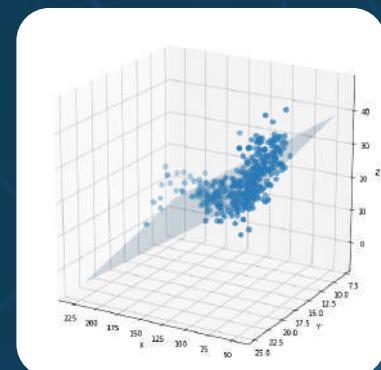


Scipy

- ✓ Signal and Image Processing (scipy.signal,scipy.ndimage):
- ✓ Linear Algebra (scipy.linalg):
- ✓ Integration (scipy.integrate)
- ✓ Statistics (scipy.stats):
- ✓ Spatial Distance and Clustering (scipy.spatial):

Statsmodels

- ✓ Linear Regression (statsmodels.regression):
- ✓ Time Series Analysis (statsmodels.tsa):
- ✓ Statistical Tests (statsmodels.stats)
- ✓ Anova (statsmodels.stats.anova):
- ✓ Datasets (statsmodels.datasets):



Mathematics

Distributions

- ✓ Data Representation & Database Operations

Combinatorics

- ✓ Feature Selection
- ✓ Permutations and Combinations for Sampling
- ✓ Hyperparameter Tuning
- ✓ Experiment Design
- ✓ Data Partitioning and Cross-Validation

Probability

- ✓ Basics
- ✓ Theoretical Probability
- ✓ Empirical Probability
- ✓ Addition Rule
- ✓ Multiplication Rule
- ✓ Conditional Probability
- ✓ Total Probability
- ✓ Probability Decision Tree
- ✓ Bayes Theorem
- ✓ Sensitivity & Specificity in Probability
- ✓ Bernouli Naïve Bayes, Gausian Naïve Bayes
- ✓ Multinomial Naïve Bayes



Distributions

- ✓ Binomial, Poisson, Normal Distribution, Standard Normal Distribution
- ✓ Gaussian Distribution, Uniform Distribution
- ✓ Z Score
- ✓ Skewness
- ✓ Kurtosis
- ✓ Geometric Distribution
- ✓ Hyper Geometric Distribution
- ✓ Markov Chain



Linear Algebra

- ✓ Linear Equations
- ✓ Matrices(Matrix Algebra: Vector Matrix Vector matrix multiplication
Matrix matrix multiplication)
- ✓ Determinant
- ✓ Eigen Value and Eigen Vector

Euclidean Distance & Manhattan Distance Calculus

- ✓ Differentiation
- ✓ Partial Differentiation
- ✓ Max & Min

Indices & Logarithms

STATISTICS

Introduction

- ✓ Population & Sample
- ✓ Reference & Sampling technique



Types of Data

- ✓ Qualitative or Categorical – Nominal & Ordinal
- ✓ Quantitative or Numerical – Discrete & Continuous
- ✓ Cross Sectional Data & Time Series Data

Measures of Central Tendency

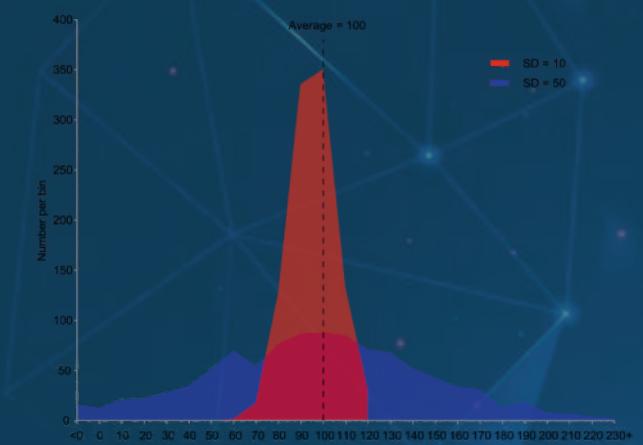
- ✓ Mean, Mode & Median – Their frequency distribution

Descriptive statistic Measures of symmetry

- ✓ skewness (positive skew, negative skew, zero, skew)
- ✓ kurtosis (Leptokurtic, Mesokurtic, Platykurtic)

Measurement of Spread

- ✓ Range, Variance, Standard Deviation



Measures of variability

- ✓ Interquartile Range (IQR):
- ✓ Mean Absolute Deviation (MAD)
- ✓ Coefficient of variation
- ✓ Covariance

Levels of Data Measurement

- ✓ Nominal, Ordinal, Interval, Ratio

Variable

- ✓ Types of Variables.
- ✓ Categorical Variables - Nominal variable & ordinal variables
- ✓ Numerical Variables: discrete & continuous
- ✓ Dependent Variable
- ✓ Independent Variable
- ✓ Control Moderating & Mediating

Frequency Distribution Table

- ✓ Nominal, Ordinal, Interval, Ratio

Types of Variables.

- ✓ Categorical Variables - Nominal variable & ordinal variables
- ✓ Numerical Variables: discrete & continuous
- ✓ Dependent Variable
- ✓ Independent Variable
- ✓ Control Moderating & Mediating

Frequency Distribution Table

- ✓ Relative Frequency, Cumulative Frequency
- ✓ Histogram ✓ Scatter Plots
- ✓ Range ✓ Calculate Class Width:
- ✓ Create Intervals ✓ Count Frequencies
- ✓ Construct the Table



Correlation, Regression & Collinearity

- ✓ Pearson & Spearman Correlation Methods
- ✓ Regression Error Metrics

Others

- ✓ Percentiles, Quartiles, Inner Quartile Range
- ✓ Different types of Plots for Continuous, Categorical variable
- ✓ Box Plot, Outliers
- ✓ Confidence Intervals
- ✓ Central Limit Theorem
- ✓ Degree of freedom

Bias & Variance in ML | Entropy in ML | Information Gain | Surprise in ML

Loss Function & Cost Function

- ✓ Mean Squared Error, Mean Absolute Error – Loss Function
- ✓ Huber Loss Function
- ✓ Cross Entropy Loss Function

Inferential Statistics

- ✓ Hypothesis Testing: One tail, two tail and pvalue
- ✓ Formulation of Null & Alternate Hypothesis
- ✓ Type-I error & Type-II error
- ✓ Statistical Tests:
- ✓ Sample Test
- ✓ ANOVA Test
- ✓ Chi-square Test
- ✓ Z-Test & T-Test



SQL

Introduction

- ✓ DBMS vs RDBMS
- ✓ Intro to SQL
- ✓ SQL vs NoSQL
- ✓ MySQL Installation

Keys

- ✓ Primary Key
- ✓ Foreign Key

Constraints

- | | |
|------------|------------------|
| ✓ Unique | ✓ Default |
| ✓ Not NULL | ✓ Auto Increment |
| ✓ Check | |

CRUD Operations

- | | |
|------------|----------|
| ✓ Create | ✓ Update |
| ✓ Retrieve | ✓ Delete |

SQL Languages

- ✓ Data Definition Language (DDL)
- ✓ Data Query Language
- ✓ Data Manipulation Language (DML)
- ✓ Data Control Language
- ✓ Transaction Control Language



SQL Commands

- ✓ Create
- ✓ Insert
- ✓ Alter, Modify, Rename, Update
- ✓ Delete, Truncate, Drop
- ✓ Grant, Revoke
- ✓ Commit, Rollback
- ✓ Select

SQL Clause

- ✓ Where ✓ GroupBy
- ✓ Distinct ✓ Having
- ✓ OrderBy ✓ Limit



Operators

- ✓ Comparison Operators
- ✓ Logical Operators
- ✓ Membership Operators
- ✓ Identity Operators

Wild Cards | Aggregate Functions

SQL Joins

- ✓ Inner Join & Outer Join
- ✓ Left Join & Right Join
- ✓ Self & Cross Join
- ✓ Natural Join



EDA & ML

EDA

- ✓ Univariate Analysis
- ✓ Bivariate Analysis
- ✓ Multivariate Analysis

Data Visualisation

- ✓ Various Plots on different datatypes
- ✓ Plots for Continuous Variables
- ✓ Plots for Discrete Variables
- ✓ Plots for Time Series Variables

ML Introduction

- ✓ What is Machine Learning?
- ✓ Types of Machine Learning Methods
 - ✓ Supervised Learning
 - ✓ Unsupervised Learning
 - ✓ Reinforcement Learning)
- ✓ Classification problem in general
- ✓ Validation Techniques: CV, OOB
- ✓ Different types of metrics for Classification
- ✓ Curse of dimensionality
- ✓ Feature Transformations
- ✓ Feature Selection
- ✓ Imbalanced Dataset and its effect on Classification
- ✓ Bias Variance Tradeoff



Important Element of Machine Learning

Multiclass Classification

- ✓ One-vs-All
- ✓ Overfitting and Underfitting
- ✓ Error Measures
- ✓ PCA learning
- ✓ Statistical learning approaches
- ✓ Introduce to SKLEARN FRAMEWORK



Data Processing

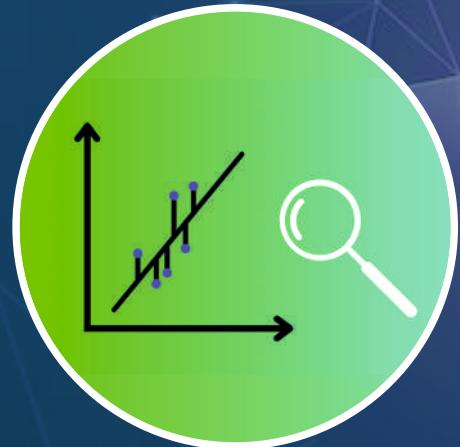
- ✓ Creating training and test sets, Data scaling & Normalisation
- ✓ Feature Engineering – Adding new features as per requirement, Modifying the data
- ✓ Data Cleaning – Treating the missing values, Outliers
- ✓ Data Wrangling – Encoding, Feature Transformations, Feature Scaling
- ✓ Feature Selection – Filter Methods, Wrapper Methods, Embedded Methods
- ✓ Dimension Reduction – Principal Component Analysis (Sparse PCA & Kernel PCA), Singular Value Decomposition
- ✓ Non Negative Matrix Factorization

Regression

- ✓ Introduction to Regression
- ✓ Mathematics involved in Regression
- ✓ Regression Algorithms:
- ✓ Simple Linear Regression
- ✓ Multiple Linear Regression
- ✓ Polynomial Regression
- ✓ Lasso Regression
- ✓ Ridge Regression
- ✓ Elastic Net Regression

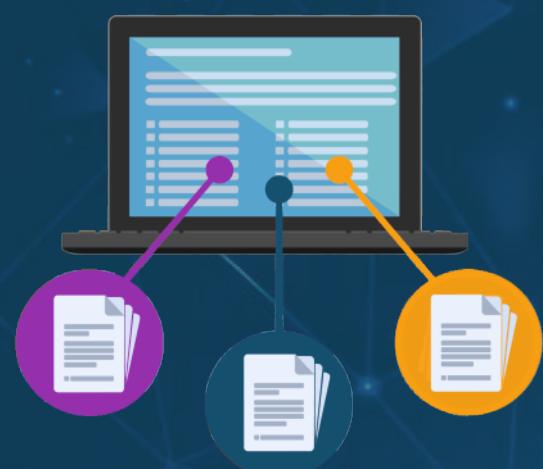
Evaluation Metrics for Regression:

- ✓ Mean Absolute Error (MAE)
- ✓ Mean Squared Error (MSE)
- ✓ Root Mean Squared Error (RMSE)
- ✓ R^2 ✓ Adjusted R^2



Classification

- ✓ Introduction
- ✓ K-Nearest Neighbors
- ✓ Logistic Regression:
 - ✓ Implementation & Optimizations
 - ✓ Stochastic gradient descent algorithms
 - ✓ Finding the optimal HyperParameters
 - ✓ through Grid Search
- ✓ Support Vector Machines (Linear SVM):
 - ✓ Linear support vector machines
 - ✓ Scikit-learn implementation
- ✓ Linear Classification
- ✓ Kernel-based classification
 - ✓ Radial Basis Function
 - ✓ Polynomial Kernel
 - ✓ Sigmoid Kernel
 - ✓ Custom Kernels
- ✓ Non-linear examples
- ✓ 2 features forms straight line & 3 features forms plane



- ✓ Hyperplane and Support vectors
- ✓ Controlled support vector machines
- ✓ Support vector Regression
- ✓ Kernel SVM (Non-Linear SVM)
- ✓ Naives Bayes:
 - ✓ Bayes theorem
 - ✓ Naive Bayes Classifiers
 - ✓ Naive Bayes in scikit learn (Bernoulli, Naive Bayes, Multinomial Naive Bayes, Gaussian Naive Bayes)"
- ✓ Decision Trees:
 - ✓ Binary Decision Trees
 - ✓ Binary decisions
 - ✓ CART Algorithm
 - ✓ Impurity measures (Gini impurity, index, Cross-entropy impurity index, Misclassification impurity index)
 - ✓ Feature importance
 - ✓ Decision tree classification with scikit learn
- ✓ Random Forest / Bagging:
 - ✓ Random Forests and Features importance in Random Forest
 - ✓ AdaBoost
 - ✓ Gradient tree boosting
 - ✓ Voting classifier
 - ✓ Ensemble:Bagging
 - ✓ Ensemble:Boosting"

- ✓ Ada Boost
- ✓ Gradient Boost
- ✓ XG Boost
- ✓ Evaluation Metrics for Classification:

- ✓ Confusion Matrix
- ✓ Accuracy & F1 Score
- ✓ Precision & Recall
- ✓ Sensitivity & Specificity
- ✓ True Positive Rate, False Positive Rate
- ✓ ROC & ROC_AUC



Clustering | Introduction | K-Means Clustering:

- ✓ Finding the optimal number of clusters
- ✓ Optimizing the inertia
- ✓ Cluster instability
- ✓ Elbow method

Hierarchical Clustering | Agglomerative clustering

DBSCAN Clustering | Association Rules

- ✓ Market Basket Analysis
- ✓ Apriori Algorithm

Recommendation Engines

- ✓ Collaborative Filtering:
- ✓ User based collaborative filtering
- ✓ Item based collaborative filtering
- ✓ Recommendation Engines

Time Series & Forecasting

- ✓ What is Time series data
- ✓ Different components of time series data
- ✓ Stationary of time series data
- ✓ ACF, PACF ✓ Time Series Models:
 - ✓ AR ✓ ARMA ✓ ARIMA ✓ SARIMAX

Model Selection & Evaluation | Over Fitting & Under Fitting

- ✓ Bias-Variance Tradeoff
 - ✓ Cross Validation:
 - ✓ Stratified Cross validation
 - ✓ K-Fold Cross validation
 - ✓ Hyper Parameter Tuning
 - ✓ Joblib And Pickling

Others

- ✓ Dummy Variable, Onehotencoding
- ✓ gridsearchcv vs randomizedsearchcv

ML Pipeline | ML Model Deployment in Flask

PowerBI

Introduction

- ✓ Power BI for Data scientist
- ✓ Types of reports
- ✓ Data source types
- ✓ Installation

Basic Report Design

- ✓ Data sources and Visual types
- ✓ Canvas and fields
- ✓ Table and Tree map
- ✓ Format button and Data Labels
- ✓ Legend,Category and Grid
- ✓ CSV and PDF Exports



Visual Sync, Grouping

- ✓ Slicer visual
- ✓ Orientation,selection process
- ✓ Slicer:Number,Text,slicer list
- ✓ Bin count,Binning

Hierarchies, Filters

- ✓ Creating Hierarchies
- ✓ Drill Down options
- ✓ Expand and show
- ✓ Visual filter,Page filter,Report filter
- ✓ Drill Thru Reports



Power Query

- ✓ Power Query transformation
- ✓ Table and Column Transformations
- ✓ Text and time transformations
- ✓ Power query functions
- ✓ Merge and append transformations

DAX Functions

- ✓ DAX Architecture, Entity Sets
- ✓ DAX Data types, Syntax Rules
- ✓ DAX measures and calculations
- ✓ Creating measures
- ✓ Creating Columns

Deep Learning

Deep learning at Glance

- ✓ Introduction to Neural Network
- ✓ Biological and Artificial Neuron
- ✓ Introduction to perceptron
- ✓ Perceptron and its learning rule & drawbacks
- ✓ Multilayer Perceptron, loss function
- ✓ Neural Network Activation function



Training MLP: Backpropagation | Cost Function

Gradient Descent Backpropagation - Vanishing & Exploding Gradient Problem

Introduce to Py-torch | Regularization | Optimizers

Hyperparameters and tuning of the same TENSORFLOW FRAMEWORK

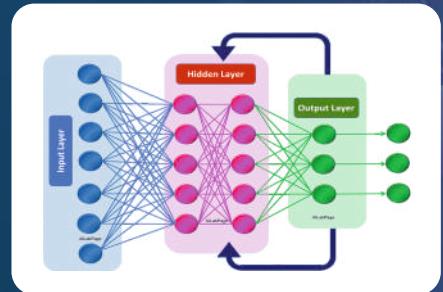
- ✓ Introduction to TensorFlow
- ✓ TensorFlow Basic Syntax
- ✓ TensorFlow Graphs
- ✓ Variables and Placeholders
- ✓ TensorFlow Playground

ANN (Artificial Neural Network)

- ✓ ANN Architecture
- ✓ Forward & Backward Propagation, Epoch
- ✓ Introduction to TensorFlow, Keras
- ✓ Vanishing Gradient Descent
- ✓ Fine-tuning neural network hyperparameter
- ✓ Number of hidden layers, Number of neurons per hidden layer

RNN (Recurrent Neural Network)

- ✓ Introduction to RNN
- ✓ Back Propagation through time
- ✓ Input and output sequences
- ✓ RNN vs ANN
- ✓ LSTM (Long Short-Term Memory)
- ✓ Different types of RNN: LSTM, GRU
- ✓ Biirectional RNN
- ✓ Sequential-to-sequential architecture (Encoder Decoder)
- ✓ BERT Transformers
- ✓ Text generation and classification using Deep Learning
- ✓ Generative-AI (Chat-GPT)



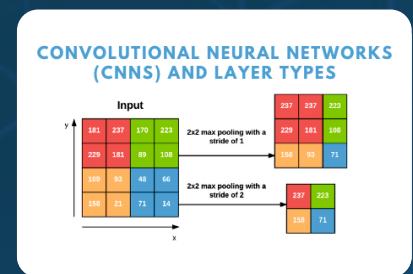
Basics of Image Processing

- ✓ Histogram of images
- ✓ Basic filters applied on the images



Convolutional Neural Networks (CNN)

- ✓ ImageNet Dataset
- ✓ Project: Image Classification
- ✓ Different types of CNN architectures
- ✓ Recurrent Neural Network (RNN)
- ✓ Using pre-trained model: Transfer Learning



Natural Language Processing (NLP)

Natural Language Processing (NLP)

- ✓ Text Cleaning
- ✓ Texts, Tokens
- ✓ Basic text classification based on Bag of Words

Document Vectorization

- ✓ Bag of Words
- ✓ TF-IDF Vectorizer
- ✓ n-gram: Unigram, Bigram
- ✓ Word vectorizer basics, One Hot Encoding
- ✓ Count Vectorizer
- ✓ Word cloud and gensim
- ✓ Word2Vec and Glove
- ✓ Text classification using Word2Vec and Glove
- ✓ Parts of Speech Tagging (PoS Tagging or POST)
- ✓ Topic Modelling using LDA
- ✓ Sentiment Analysis

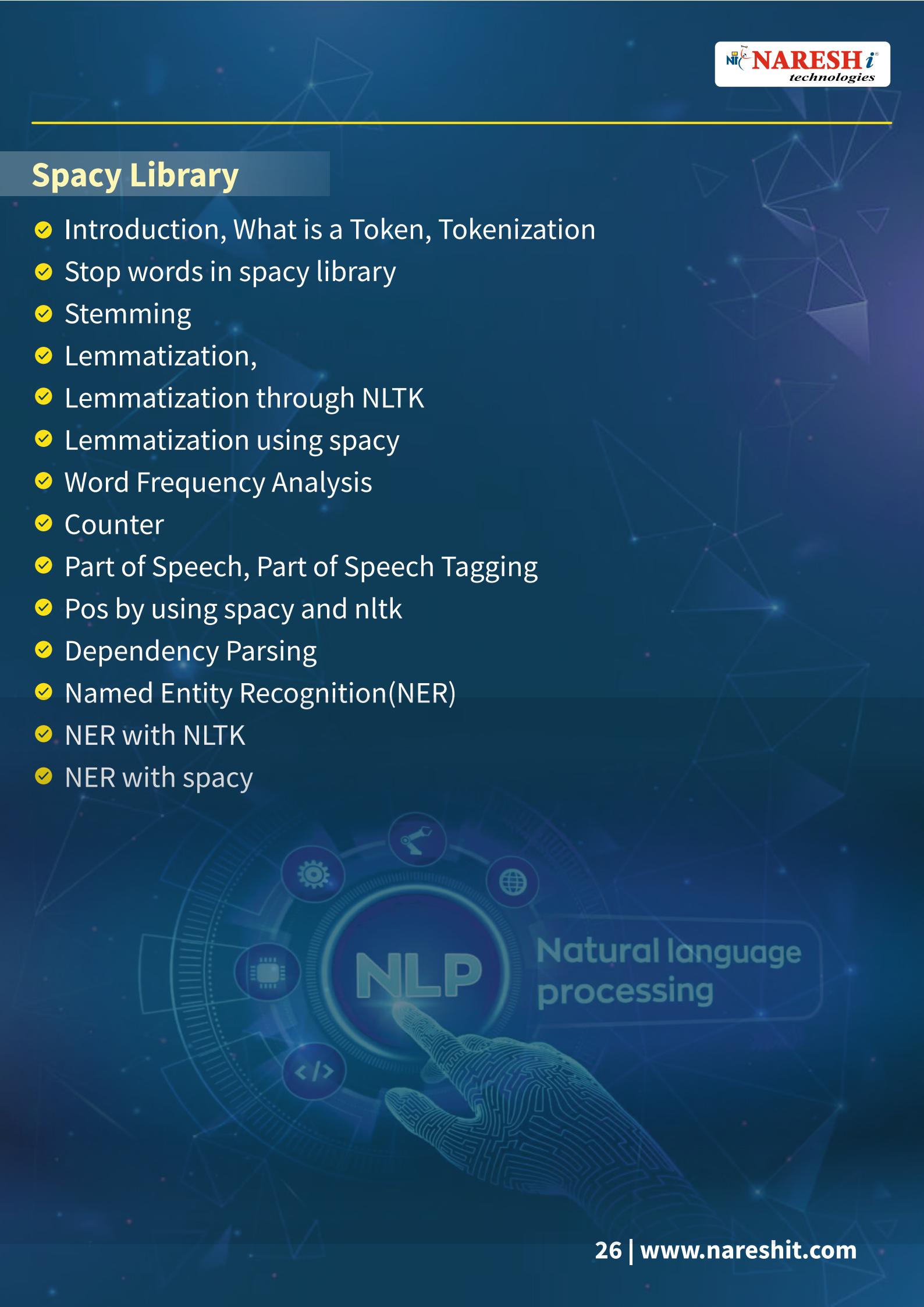


Twitter Sentiment Analysis Using Textblob

- ✓ TextBlob
- ✓ Installing textblob library
- ✓ Simple TextBlob Sentiment Analysis Example
- ✓ Using NLTK's Twitter Corpus

Spacy Library

- ✓ Introduction, What is a Token, Tokenization
- ✓ Stop words in spacy library
- ✓ Stemming
- ✓ Lemmatization,
- ✓ Lemmatization through NLTK
- ✓ Lemmatization using spacy
- ✓ Word Frequency Analysis
- ✓ Counter
- ✓ Part of Speech, Part of Speech Tagging
- ✓ Pos by using spacy and nltk
- ✓ Dependency Parsing
- ✓ Named Entity Recognition(NER)
- ✓ NER with NLTK
- ✓ NER with spacy



Natural language
processing

Computer Vision

Human vision vs Computer vision

- ✓ CNN Architecture
- ✓ CONVOLUTION – MAX POOLING – FLATTEN LAYER – FULLY CONNECTED LAYER
- ✓ CNN Architecture
- ✓ Striding and padding
- ✓ Max pooling
- ✓ Data Augmentation
- ✓ Introduction to OpenCV & YoloV3 Algorithm



Image Processing with OpenCV

- ✓ Image basics with OpenCV
- ✓ Opening Image Files with OpenCV
- ✓ Drawing on Images, Image files with OpenCV
- ✓ Face Detection with OpenCV

Video Processing with OpenCV

- ✓ Introduction to Video Basics, Object Detection
- ✓ Object Detection with OpenCV

Reinforcement Learning

- ✓ Introduction to Reinforcement Learning
- ✓ Architecture of Reinforcement Learning
- ✓ Reinforcement Learning with Open AI
- ✓ Policy Gradient Theory

OPEN AI

- ✓ Introduction to Open AI
- ✓ Generative AI
- ✓ Chat Gpt (3.5)
- ✓ LLM (Large Language Model)
- ✓ Classification Tasks with Generative AI
- ✓ Content Generation and Summarization with Generative AI
- ✓ Information Retrieval and Synthesis workflow with Gen AI

Time Series & Forecasting

- ✓ Time Series Forecasting using Deep Learning
- ✓ Seasonal-Trend decomposition using LOESS (STL) models.
- ✓ Bayesian time series analysis

MakerSuite Google

- ✓ PaLM API
- ✓ MUM models Bayesian time series analysis

Azure ML

Advanced Course on Agentic AI: Single-Agent & Multi-Agent Systems

Module 1: Introduction to Agentic AI

- ✓ What is Agentic AI? From Traditional AI to Autonomous AI
- ✓ Single-Agent vs Multi-Agent Systems (MAS)
- ✓ Agentic AI in Large Language Models (LLMs)
- ✓ Applications of Agentic AI in Automation, Research, and Business

Hands-on:

- ✓ Running a basic autonomous agent using OpenAI API
- ✓ Setting up a local agent with Python

Module 2: Building Single-Agent Systems



- ✓ Single-Agent AI: Concepts & Architectures
- ✓ Decision-Making in Single-Agent AI
- ✓ Memory & Long-Term Planning
- ✓ Integrating LLMs with Agents (LangChain, OpenAI, Hugging Face)
- ✓ Handling User Inputs & Actions with Tool-Use Capabilities

Hands-on:

- ✓ Building a goal-driven single AI agent with LangChain
- ✓ Implementing memory-based reasoning with FAISS

Module 3: Multi-Agent Systems (MAS)

- ✓ What are Multi-Agent Systems (MAS)?
- ✓ Agent Communication & Coordination
- ✓ Role Assignment in Multi-Agent Environments
- ✓ Task-Oriented AI vs Autonomous Decision-Making
- ✓ Swarm Intelligence & Distributed Agents

Hands-on:

- ✓ Creating a multi-agent research assistant
- ✓ Implementing a task-based workflow with CrewAI

Module 4: AI Agents with CrewAI

- ✓ Overview of CrewAI: AI Agents Working in Teams
- ✓ Role-Based Agent Assignments
- ✓ Orchestrating Task Execution Between Agents
- ✓ Implementing Workflow Pipelines with CrewAI



Hands-on:

- ✓ Creating an AI-powered content generation team
- ✓ Using CrewAI for multi-step research tasks

Module 5: SmolAgent – Lightweight AI Agents

- ✓ Introduction to SmolAgent: Minimalistic AI Agents
- ✓ When to Use SmolAgent vs Heavyweight AI Agents
- ✓ Optimizing AI Agents for Cost and Performance
- ✓ Combining SmolAgent with LLMs for Fast Execution

Hands-on:

- ✓ Deploying a SmolAgent-based chatbot
- ✓ Running SmolAgent on an edge device

Module 6: Phi Data – Memory & Context Optimization

- ✓ Introduction to Phi Data: AI Agent Memory & Learning
- ✓ Vector Database Integration (FAISS, Pinecone, ChromaDB)
- ✓ Retrieval-Augmented Generation (RAG) for AI Agents
- ✓ Personalized AI Assistants with Memory

Hands-on:

- ✓ Implementing Phi Data for long-term memory
- ✓ Storing and retrieving context for AI-powered Q&A

Module 7: Building & Deploying Agentic AI Applications

- ✓ Deploying AI Agents on Cloud (Hugging Face, AWS, Azure)
- ✓ Integrating AI Agents into Web Applications (FastAPI, Streamlit)
- ✓ Security Considerations in Autonomous AI

Mastering Prompt Engineering for LLMs

Module 1: Introduction to Prompt Engineering

➲ What is Prompt Engineering?

- ✓ The role of prompts in LLMs
- ✓ How LLMs process and interpret prompts

➲ Why Learn Prompt Engineering?

- ✓ Optimizing LLM performance
- ✓ Reducing hallucinations & improving accuracy
- ✓ Enhancing AI-driven applications

Hands-on:

- ✓ Experimenting with OpenAI's API for basic text generation

Module 2: LLM Model Settings & Configurations

➲ Understanding LLM Settings:

- ✓ Temperature, Top-k, Top-p (Nucleus Sampling)
- ✓ Stop Tokens, Context Length & Tokenization

➲ Fine-tuning vs Prompt Optimization

Customizing Model Behavior with System Prompts

Hands-on:

- ✓ Experimenting with different model settings in OpenAI Playground

Module 3: Prompt Elements & Structuring

⇒ Key Components of a Well-Designed Prompt:

✓ Instructions ✓ Context ✓ Input Data

⇒ Optimizing Prompts for Accuracy & Consistency

Hands-on:

✓ Structuring prompts for summarization, classification, & question-answering

Module 4: Prompt Engineering Techniques (Shot-Based Prompting)

- ✓ Zero-Shot Prompting
- ✓ One-Shot Prompting
- ✓ Few-Shot Prompting
- ✓ Comparing Shot-Based Techniques for Different Use Cases

Hands-on:

✓ Designing and testing different shot-based prompts on GPT models

Module 5: Chain of Thought (CoT) Prompting

- ✓ What is CoT Prompting?
- ✓ Step-by-Step Reasoning in LLMs
- ✓ Implementing CoT in Math, Logic & Coding Tasks

Hands-on:

✓ Using CoT to improve reasoning-based problem-solving

Module 6: Self-Consistency in Prompt Engineering

- ✓ What is Self-Consistency?
- ✓ Generating Multiple Answers & Selecting the Best
- ✓ Improving Output Reliability with Self-Consistency

Hands-on:

- ✓ Implementing Self-Consistency for multi-answer tasks

Module 7: Out-of-Date Learning in Prompt Engineering

- ✓ How LLMs Handle Outdated Information
- ✓ Strategies to Overcome Out-of-Date Learning:
 - ✓ Prompting with External Data
 - ✓ Fine-Tuning vs Retrieval-Augmented Generation (RAG)
- ✓ When to Use Updated APIs & Tools

Hands-on:

- ✓ Experimenting with model responses on time-sensitive queries

Module 8: Role-Playing in Prompt Engineering

- ✓ What is Role-Playing in Prompting?
- ✓ Creating AI Personas for Specialized Tasks
- ✓ Enhancing Response Accuracy with Role-Based Prompts

Hands-on:

- ✓ Designing AI assistants with different personas (e.g., Doctor, Lawyer, Coder)

Module 9: RAG (Retrieval-Augmented Generation) in Prompt Engineering

- ✓ What is RAG & Why is it Important?
- ✓ Integrating Vector Databases (FAISS, Pinecone, ChromaDB)
- ✓ Enhancing AI Responses with External Knowledge

Hands-on:

- ✓ Implementing a RAG-based chatbot using FAISS & OpenAI

Module 10: ReAct (Reasoning + Acting) in Prompt Engineering

- ✓ What is ReAct Framework?
- ✓ Combining CoT + Tool Use for Autonomous Agents
- ✓ Building AI Agents that Reason & Execute Actions

Hands-on:

- ✓ Implementing a ReAct-based agent using LangChain

Module 11: DSP (Dynamic Structured Prompting)

- ✓ What is Dynamic Structured Prompting (DSP)?
- ✓ Generating Structured & Dynamic Prompts Based on Context
- ✓ Using DSP for Adaptive AI Interactions

Hands-on:

- ✓ Creating dynamically structured prompts for personalized AI responses

Advanced Course on Generative AI:

Module 1: Introduction to Generative AI

- ✓ What is Generative AI?
- ✓ Types of Generative AI Models:
 - ✓ Text-based (GPT, LLaMA, Claude)
 - ✓ Multimodal (CLIP, DALL·E, Stable Diffusion)
 - Text-based (GPT, LLaMA, Claude)
 - Multimodal (CLIP, DALL·E, Stable Diffusion)
 - ✓ Use Cases in NLP, Image Generation, & Code Generation

Hands-on:

- ✓ Running a simple text-based generative model using OpenAI API

Module 2: Text-Based Generative Models

- ✓ How Text-Based Models Work
- ✓ Training LLMs (Large Language Models) with Transformers
- ✓ Pretrained Models vs Fine-Tuned Models
- ✓ Popular LLMs: GPT-4, LLaMA, Mistral, Falcon

Hands-on:

- ✓ Generating text using Hugging Face Transformers

Module 3: Multimodal Models (Text + Image + Audio)

- ✓ What are Multimodal Models?
- ✓ Combining Text & Vision Models for AI Applications
- ✓ Examples of Multimodal Models: CLIP, DALL·E, Gemini, GPT-4 Turbo

Hands-on:

- ✓ Running OpenAI's CLIP model for text-to-image retrieval

Module 4: CLIP (Contrastive Language-Image Pretraining) Architecture

- ✓ How CLIP Works: Text-Image Pairing
- ✓ Applications of CLIP in Image Search & Generation
- ✓ Fine-tuning CLIP for Custom Tasks

Hands-on:

- ✓ Using CLIP to find relevant images based on text prompts

Module 5: VQGAN & Taming Transformers

- ✓ Introduction to VQGAN (Vector Quantized GAN)
- ✓ How Taming Transformers Improve Image Quality
- ✓ Combining VQGAN + CLIP for AI Art

Hands-on:

- ✓ Generating AI Art using VQGAN + CLIP

Module 6: Autoencoders & VAEs (Variational Autoencoders)

- ✓ What is an Autoencoder?
- ✓ Difference Between Autoencoders & VAEs
- ✓ Generating High-Resolution Images with VAEs

Hands-on:

- ✓ Implementing a simple Variational Autoencoder (VAE) in PyTorch

Module 7: Retrieval-Augmented Generation (RAG)

- ✓ What is RAG & Why It Matters for AI?
- ✓ Enhancing LLMs with External Knowledge
- ✓ Vector Databases for RAG (FAISS, Pinecone, ChromaDB)

Hands-on:

- ✓ Implementing a RAG-based chatbot using LlamaIndex & FAISS

Module 8: Hugging Face Ecosystem

- ✓ Overview of Hugging Face Transformers
- ✓ Fine-tuning LLMs with Hugging Face
- ✓ Deploying Models Using Hugging Face Spaces

Hands-on:

- ✓ Fine-tuning a text generation model on Hugging Face

Module 9: CrewAI for Multi-Agent AI Systems

- ✓ What is CrewAI?
- ✓ Building Teams of AI Agents
- ✓ Role-Based Task Assignment in CrewAI

Hands-on:

- ✓ Setting up an AI research team using CrewAI

Module 10: Groq – High-Speed AI Inference

- ✓ What is Groq?
- ✓ Running AI Models at Lightning Speed
- ✓ Optimizing Large Models for Low Latency

Hands-on:

- ✓ Deploying a transformer model with Groq hardware

Module 11: Stable Diffusion for Image Generation

- ✓ Understanding Stable Diffusion Architecture
- ✓ Text-to-Image Generation with Diffusion Models
- ✓ Fine-Tuning & Customizing Stable Diffusion

Hands-on:

- ✓ Running Stable Diffusion on a local machine

Module 12: GitHub Copilot for AI-Powered Coding

- ✓ How GitHub Copilot Uses AI for Code Generation
- ✓ Best Practices for Using AI in Software Development
- ✓ Comparing Copilot with Other AI Coding Tools

Hands-on:

- ✓ Writing AI-assisted Python scripts using GitHub Copilot

Module 13: LlamaIndex – AI-Powered Document Processing

- ✓ What is LlamaIndex?
- ✓ Connecting LLMs to Private Data
- ✓ Using LlamaIndex for Enterprise AI Applications

Hands-on:

- ✓ Implementing LlamaIndex for a document-based AI assistant

Module 14: FastAPI for AI Model Deployment

- ✓ Introduction to FastAPI for AI
- ✓ Building a REST API for LLMs
- ✓ Deploying AI Models as Web Services

Hands-on:

- ✓ Deploying a text-based LLM using FastAPI

Advanced Course on : LLMs

Module 1: Introduction to Generative AI & LLMs

- ✓ What is Generative AI?
- ✓ Types of Generative AI Models (Text, Image, Multimodal, Speech)
- ✓ Comparison of Leading AI Models (GPT, Gemini, LLaMA, Claude, Mixtral, DeepSeek, Grok)
- ✓ Foundation Models vs Fine-Tuned Models

Hands-on:

- ✓ Running a basic LLM-powered chatbot using OpenAI API

Module 2: OpenAI's AI Ecosystem | LangChain Framework

- ✓ Introduction to LangChain
- ✓ Building AI Agents with LangChain
- ✓ Memory & Context Handling in LangChain
- ✓ Connecting LLMs with External Data Sources

Hands-on:

- ✓ Implementing a chatbot using OpenAI + LangChain
- OpenAI Whisper (Speech-to-Text AI)
 - ✓ What is OpenAI Whisper?
 - ✓ Multilingual Speech Recognition
 - ✓ Building Real-World Applications with Whisper

Hands-on:

- ✓ Transcribing audio into text using OpenAI Whisper

Module 3: Google's Generative AI Ecosystem

- ✓ Gemini AI: Google's Multimodal LLM
- ✓ Introduction to Gemini AI
- ✓ Comparison with OpenAI & Meta Models
- ✓ Using Gemini API for Text & Image Generation

Hands-on:

- ✓ Generating text & images using Gemini API
- Google Vision: AI for Image Analysis & Recognition
 - ✓ ·What is Google Vision?
 - ✓ ·AI-Powered Image Processing & OCR
 - ✓ ·Building AI-powered Image Search Systems

Hands-on:

- ✓ Using Google Vision API for image classification

Module 4: DeepSeek, Mistral, Mixtral, Grok & Claude

- ✓ DeepSeek AI
 - ✓ Overview of DeepSeek Language Model
 - ✓ Optimizing Search and AI Retrieval with DeepSeek
 - ✓ Applications in AI-Assisted Knowledge Systems

Hands-on:

- ✓ Running DeepSeek for document-based AI search
- Mistral &Mixtral: High-Performance Open-Source AI
 - ✓ What is Mistral &Mixtral?
 - ✓ Dense vs Sparse Transformer Models
 - ✓ Optimizing Mixtral for Multi-Task AI

Hands-on:

- ✓ Running Mixtral models on Hugging Face
- Grok (X AI by Elon Musk)
 - ✓ How Grok is Designed for Real-Time AI Processing
 - ✓ Comparison with GPT, Gemini & Claude
 - ✓ Use Cases of Grok in AI Chatbots & Assistants

Hands-on:

- ✓ Running Grok on X (formerly Twitter) API
- Claude (Anthropic AI)
 - ✓ What is Claude & How It Differs from Other LLMs?
 - ✓ Claude's Approach to AI Safety & Constitutional AI
 - ✓ Fine-Tuning Claude for Enterprise Applications

Hands-on:

- ✓ Building an AI-powered assistant with Claude API

Module 5: Meta's Generative AI Ecosystem

- ✓ LLaMA 3: Open-Source LLM by Meta
 - ✓ Introduction to LLaMA 3
 - ✓ Comparison with GPT-4, Gemini, Mixtral, & Claude
 - ✓ Fine-Tuning & Customizing LLaMA for Specific Tasks

Hands-on:

- ✓ Running LLaMA 3 on a local machine using Hugging Face
- Building Generative AI on Cloud
 - ✓ Cloud Platforms for AI (AWS, GCP, Azure, Meta Cloud)
 - ✓ Deploying LLMs on Cloud for Scalability
 - ✓ Building AI-Driven Web Apps with Cloud-Based LLMs

Hands-on:

- ✓ Deploying an LLM-powered chatbot on Cloud
- Meta's Foundation Models
 - ✓ Understanding Meta's AI Foundation Models
 - ✓ Pre-Trained Models vs Custom Models
 - ✓ Adapting Foundation Models for Industry Use Cases

Hands-on:

- ✓ Using Meta's AI Models for custom NLP tasks

Module 6: Fine-Tuning LLMs with Quantization, LoRA&QLoRA

- ✓ Fine-Tuning Large Language Models (LLMs)
 - Why Fine-Tune an LLM?
 - Datasets & Preprocessing for LLM Fine-Tuning
 - Fine-Tuning vs Prompt Engineering
- ✓ LoRA (Low-Rank Adaptation) Fine-Tuning
 - What is LoRA?
 - Reducing Computation for LLM Training
 - Implementing LoRA with Hugging Face &PyTorch
- ✓ QLoRA (Quantized LoRA) for Efficient Model Fine-Tuning
 - What is QLoRA?
 - Memory Optimization for Large LLMs
 - Running Fine-Tuned Models on Low-End Hardware

Hands-on:

- ✓ Fine-tuning a LLaMA 3 model using LoRA&QLoRA

Module 7: End-to-End AI Model Deployment & Optimization

- ✓ Deploying AI Models with APIs (FastAPI, Flask)
- ✓ Optimizing AI Models for Performance & Cost
- ✓ Best Practices for AI Model Security & Governance

Hands-on:

- ✓ Deploying a fine-tuned LLM as a FastAPI web service

Vector database

Module 1: Introduction to Vector Databases

- ✓ What is a Vector Database?
- ✓ Difference Between Traditional & Vector Databases
- ✓ Why Use Vector Databases in Generative AI & LLMs?
- ✓ How Vector Embeddings Work in AI Search & Retrieval

Hands-on:

- ✓ Generating vector embeddings from text using OpenAI's text-embedding-ada-002

Module 2: Understanding Vector Embeddings

- ✓ What Are Embeddings in AI?
- ✓ How LLMs Convert Text, Images & Audio to Vectors
- ✓ Similarity Metrics: Cosine Similarity, Euclidean Distance, Dot Product
- ✓ Choosing the Right Embedding Model (OpenAI, Hugging Face, SentenceTransformers, BERT, etc.)

Hands-on:

- ✓ Generating embeddings with OpenAI, Hugging Face, and BERT models

Module 3: Implementing FAISS (Facebook AI Similarity Search)

- ✓ What is FAISS & How It Works?
- ✓ Indexing & Searching Large-Scale Vectors with FAISS
- ✓ Optimizing FAISS for Fast Retrieval

Hands-on:

- ✓ Implementing a FAISS-based search engine for document retrieval

Module 4: Using Pinecone for Scalable AI Search

- ✓ Introduction to Pinecone: A Managed Vector Database
- ✓ Building Real-Time AI Search Applications with Pinecone
- ✓ Comparing FAISS vs Pinecone vs Milvus

Hands-on:

- ✓ Creating a question-answering chatbot using OpenAI + Pinecone

Module 5: ChromaDB for LLMs & AI Applications

- ✓ What is ChromaDB?
- ✓ How ChromaDB Works with LangChain
- ✓ Building RAG (Retrieval-Augmented Generation) Pipelines with ChromaDB

Hands-on:

- ✓ Integrating ChromaDB with OpenAI's GPT for AI-powered search

Module 6: Exploring Weaviate & Its AI Capabilities

- ✓ Overview of Weaviate as a Hybrid Search Engine
- ✓ Using Weaviate for Semantic Search & Knowledge Graphs
- ✓ Deploying Weaviate on Cloud & Local Environments

Hands-on:

- ✓ Implementing a semantic search engine with Weaviate

Module 7: Milvus & Qdrant for Large-Scale AI Applications

- ✓ Milvus (Distributed & Cloud-Based Vector Search)
 - ✓ Introduction to Milvus for AI Applications
 - ✓ Optimizing Milvus for Large-Scale Data Processing
- ✓ Qdrant (High-Performance Open-Source Vector DB) What is Qdrant & How It Works?
 - ✓ Fine-Tuning Qdrant for AI Search & Recommendation Systems

Hands-on:

- ✓ Deploying Milvus & Qdrant for AI-driven search and recommendations

Module 8: Building AI-Powered Search & RAG Applications

- ✓ What is Retrieval-Augmented Generation (RAG)?
- ✓ Integrating Vector Databases with LLMs for Intelligent Search
- ✓ Building Enterprise AI Assistants Using Vector Databases

Hands-on:

- ✓ Building an RAG pipeline using LangChain, Pinecone, and OpenAI

MLOps & CI/CD Pipeline for AI & Machine Learning

Module 8: Building AI-Powered Search & RAG Applications

- ✓ What is MLOps & Why is it Important?
- ✓ DevOps vs MLOps: Key Differences
- ✓ MLOps Lifecycle & Stages
 - Understanding CI/CD Pipelines in AI/ML Projects
 - Challenges in Deploying ML Models at Scale

Hands-on:

- ✓ Setting up a basic CI/CD pipeline for ML models using GitHub Actions

Module 2: Containerization & Model Packaging with Docker

- ✓ Why Containerize ML Models?
- ✓ Building & Running Docker Containers for ML Applications
- ✓ Deploying ML Models inside Docker Containers
- ✓ Optimizing Containers for AI Workloads

Hands-on:

- ✓ Containerizing an ML Model with Docker & Running it Locally

Module 3: CI/CD Pipeline for ML with GitHub Actions & Jenkins

- ✓ What is CI/CD & How Does It Work in ML?
- ✓ Setting up a CI/CD Pipeline for ML Models
- ✓ Automating Model Testing, Validation & Deployment
- ✓ CI/CD with GitHub Actions,

Hands-on:

- ✓ Implementing a CI/CD Pipeline for an AI Model Deployment Using GitHub Actions

Module 4: MLOps with MLflow

- ✓ Introduction to Kubeflow for AI & ML
- ✓ Integrating with MLflow for Experiment Tracking

Hands-on:

- ✓ Building an ML Workflow with Kubeflow Pipelines

Students Placed in -2024



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faculty: Mr. Prakash Senapathi I joined Full stack data science course. He is very friendly and professional. This course helps to learn from basics as I am a non-technical student. Live
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I have completed Full stack Data science & AI course under Prakash Senapati sir. He covered Python basics, Data cleansing, ML, NLP, Deep Learning (ANN, CNN, RNN) in detail.
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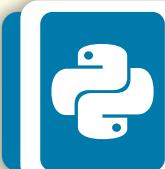
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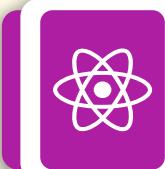
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Full Stack
PYTHON



GEN AI



UI Full Stack
with **React**



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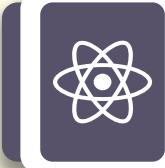
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Head Office :

2nd Floor, Durga Bhavani Plaza, Ameerpet,
Hyderabad, 500016.

Ameerpet Branch :

Ground Floor, Manjeera square, opp Prime Hospital,
Ameerpet, Hyd.

KPHB Branch :

2nd Floor, Sreeramoju Complex, K P H B Phase 1,
Hyderabad, 500072.

JNTU Branch :

4th Floor, Plot No. 47-48, Above HDFC Bank,
JNTU , Hyd.

USA :

5007 Arbor View Pkwy NW Acworth, GA, 30101

