Brolly Ai
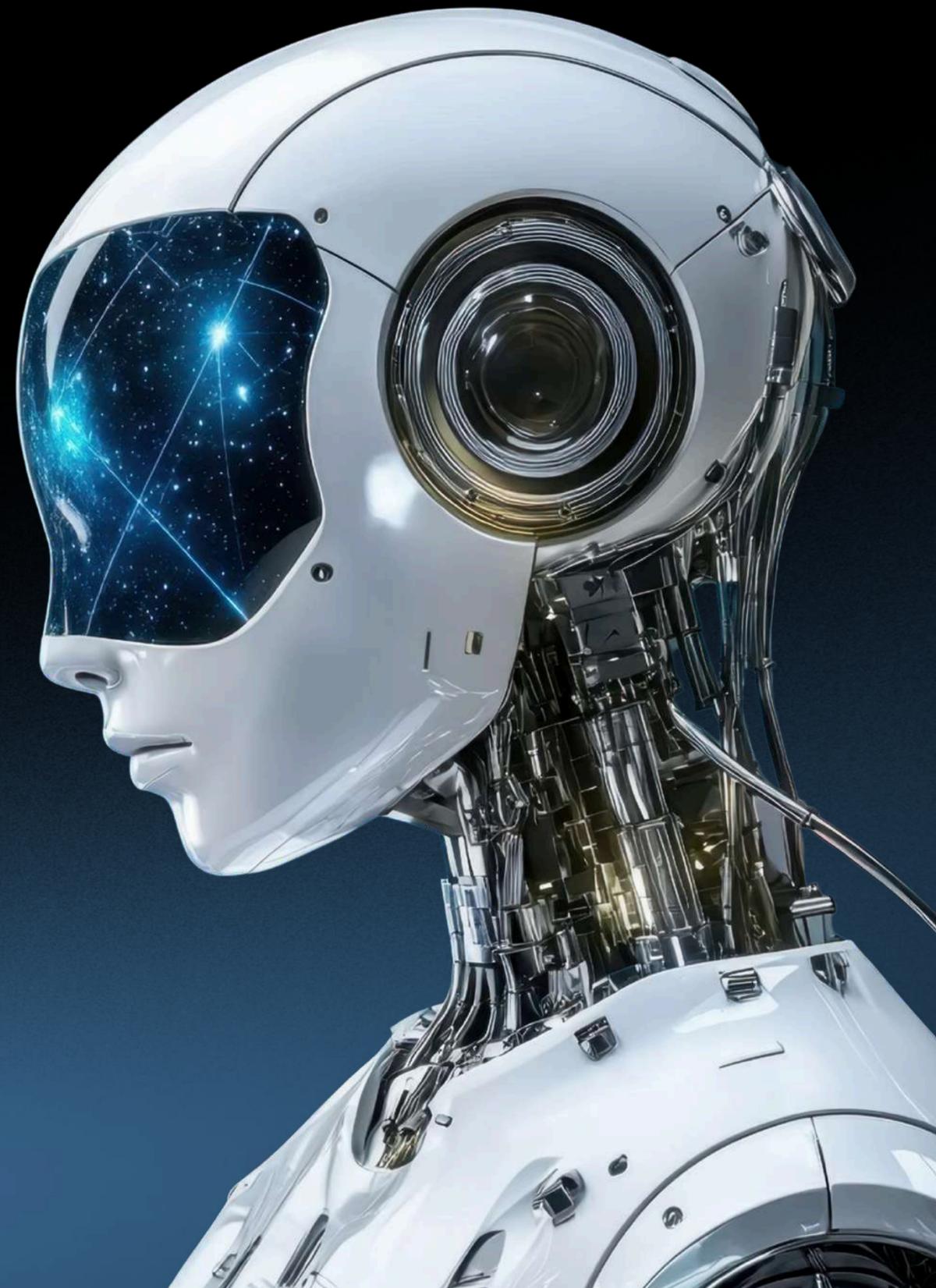
Data Science +
Generative AI +
Agent AI

PROGRAM OVERVIEW

This 4-month program (16 weeks, 5 days/week, 1hours/day, 94 hours) covers a wide range of topics from Python basics to advanced AI technologies including Generative AI, Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), and Agentic AI. It includes hands-on labs, case studies, and real-world applications.

Contents

1.Python. (20hours)

2.Data Science Libraries.(3hours)

3.Statistics & Probability in Decision Modeling. (15hours)

4.Methods and Algorithms in Machine Learning.(12 hours)

5.AI and Decision Sciences (Deep Learning, NLP)(20hours)

6.Generative AI (Gen AI) & AI Agent Creation. (27 hours)

7. Prompt Engineering.(2hours)

1.Python(20 hours)

Modelue1

A.introduction of python.

B.Assignment of variables.

c.comments

D.Primitive Data types

E.Type Casting

F.python string operations.

G.Non-privtive Data types. –(List,Tuples,Set,Dictionaries)

H.Python Conditions and If statements

I.Python - List Comprehension

J.The Python Match Statement

Note

1) Hands-on project on Conditional statements

2)Mock Test-1

Modelue2

A.Python Loops statement. (for,while)

B.python Functions

c.Python Lambda Function

D.Python OOPS Concepts

E.Python Modules creation.

F.Exceptional Handling

G.Exceptional Handling

H..Genrator,Itterator,Map,reduer,filter,apply functions.

Note

1.Final Project.   2.FinalMock Test-2

structured 20-hour **Python learning curriculum** (1 hour per day, 5 days per week, total 4 weeks). I'll design it step by step, so you'll have a clear day-wise schedule with progressive learning, including theory + coding practice.
 Here's the structured **Python Curriculum** (20 Hours / 4 Weeks / 5 Days per Week / 1 Hour Daily)

Week 1 – Python Basics (5 Hours)

Day 1 (1 hr)
- 🔵 **Introduction to Python**
- 🔵 **Python installation, IDEs (Google colab/Jupyter)**
- 🔵 **Your first Python program (Hello World)**
- 🔵 **Input & Output**

Day 2 (1 hr)

- Assignment of variables
- Data types overview (Primitive vs Non-Primitive)
- Constants vs variables

Day 3 (1 hr)

- Comments (Single-line & Multi-line)
- Primitive Data Types (int, float, bool, str)
- type(), id(), isinstance()

Day 4 (1 hr)

- Type Casting (int(), float(), str(), bool())

- **String operations: indexing, slicing, concatenation**
- **String methods (upper(), lower(), split(), strip())**

Day 5 (1 hr)

- **Non-Primitive Data Types overview**
- **Lists: create, access, modify**
- **Tuples: immutability, indexing**
- **Sets: uniqueness, operations (union, intersection)**
- **Dictionaries: key-value pairs**

Week 2 – Control Flow & Collections (5 Hours)

⦿▶ **Goal: Master conditions, loops, and comprehension.**

Day 6 (1 hr)

⦿▶ **Python Conditions (if, elif, else)**

⦿▶ **Nested if statements**

⦿▶ **Logical operators**

Day 7 (1 hr)

⦿▶ **List Comprehension**

⦿▶ **Set & Dict comprehensions**

⦿▶ **Practical problems**

Day 8(1 hr)

- ▶ **The Python match statement (like switch-case)**

- ▶ **Examples with patterns**

Day 9(1 hr)

- ▶ **Loops – for and while**

- ▶ **break, continue, pass**

- ▶ **Loop with else**

Day 10(1 hr)

- ▶ **Nested loops**   ▶ **Iterating over lists, sets, dicts**
- ▶ **Practical exercises**

Week 3 – Functions & OOP (5 Hours)

◉▶ **Goal: Learn functions and Object-Oriented Programming.**

Day 11(1 hr)

◉▶ **Python Functions: def, arguments, return**

◉▶ **Default & keyword arguments**

◉▶ **Docstrings**

◉▶ **Loop with else**

Day 12(1 hr)

◉▶ **Lambda functions**   ◉▶ **map(), filter(), reduce()**

◉▶ **Apply() with Pandas intro**

Day 13 (1 hr)

- OOP Concepts: Class & Object
- __init__ method
- Instance vs Class variables

Day 14 (1 hr)

- OOP: Inheritance
- Polymorphis
- Encapsulation & Abstraction

Day 15 (1 hr)

- Constructors & Object Lifecycle
- Access Modifiers (public, private, protected)
- Static Methods & Static Variables

Day 16 (1 hr)

- **IS-A vs HAS-A Relationship**
- **Aggregation vs Composition**
- **Method Overriding & super keyword**
- **OOP Best Practices (Clean & Reusable Code)**

Day 17 (1 hr)

- **Python Modules creation**
- **Importing & using built-in modules (math, random, os)**
- **Creating your own module**

Week 4 -Python Libraries (5 Hours)

- **Goal: Master python Libraries & practical usage.**

Day 18 (1 hr)

- **Numpy**
- **operations**

Day 19 (1 hr)

- **pandas**
- **Data Frames**
- **Operations**

Day 20 (1 hr)

- **Matplotlib**
- **Data visualization**
- **Graphs & charts**

Day 21 (1 hr)

- **Seaborn**
- **Statistical visualization Techniques**

Day 22 (1 hr)

- **Final Project**
- **Simple To-Do App**
- **Uses functions, loops, conditions, exceptions, and OOP, Modules.**

2. Statistics & Probability in Decision Modeling (15hours)

Tools: Python ▶ **1.Statistics**

▶ **A.Statistics, Limitations, Applicatinos statistics.**

▶ **B.Data, Types of Data.**

▶ **c.Population, samples**

▶ **D.Types of samplings**

▶ **E.Types of statistics.**

▶ **F.Descriptive statistics**

1) **Measure of central Tendency**
2) **Measure of Variability**
3) **Distribution shape**
4) **Graphical Visualization**

INFERENTIAL STATISTICS

- **Estmation parametr**

- **Regression analyses**

- **confidance interval**

- **Hypothesises Test.**

- **Statistical Tests**

- **Correlation & Association.**

PROBABILITY

A.Trail and outcome

B.sample Space.

c.what is Event, Types of Event in probability.

D.Random variable,Types of Radom varible

E.Permitations and combinations

F.conditional probability.

G.Bayes' Theorem

H.probability Distrilbution

2.STATISTICS & PROBABILITY CURRICULUM (12 HOURS / 5 DAYS PER WEEK)

Week 1 – Statistics Fundamentals (5 Hours)

Day 1 (1 hr)

- **Introduction to Statistics**
- **Limitations of Statistics**
- **Applications of Statistics in Data Science**

Day 2 (1 hr)

- **Data & Types of Data (Qualitative, Quantitative)**
- **Population vs Sample**
- **Types of Sampling (Random, Stratified, Cluster, Systematic)**

Day 3 (1 hr)

- **Types of Statistics → Descriptive vs Inferential**
- **Descriptive Statistics Overview**

Day 4 (1 hr)

- **Descriptive Statistics**
- **Measures of Central Tendency (Mean, Median, Mode)**
- **Measures of Variability (Range, Variance, Std. Dev, IQR)**

Day 5(1 hr)

- **Descriptive Statistics (continued)**
- **Distribution Shape (Skewness, Kurtosis)**
- **Graphical Visualization (Histogram, Boxplot, Bar, Pie, Scatterplot)**

Week 2 – Inferential Statistics (3 Hours)

+ Probability Basics (2 Hours)

Day 6 (1 hr)

- **Inferential Statistics Overview**
- **Estimation of Parameters**
- **Confidence Intervals (mean & proportion)**

Day 7 (1 hr)

- **Hypothesis Testing (Null vs Alternative, Errors, p-value,**
- **significance level)**

- **Statistical Tests: t-test, Chi-square, ANOVA**

Day 8 (1 hr)

- **Regression Analysis (Simple Linear, Logistic basics)**
- **Correlation & Association (Pearson, Spearman, Covariance)**

Probability

Day 9(1 hr)

- **Probability Basics**
- **Trial & Outcome, Sample Space**
- **Events & Types of Events (Mutually exclusive, Independent, Complementary)**

Day 10(1 hr)

- **Random Variables (Discrete, Continuous)**
- **Permutations & Combinations**

Week 3 – Probability Advanced (2 Hours)

Day 11(1 hr)

- **Conditional Probability**
- **Bayes' Theorem (with real-world example: medical test /**
- **spam filter)**

Day 12(1 hr)

- **Probability Distributions**
- **Discrete (Binomial, Poisson)**
- **Continuous (Normal, Uniform, Exponential**

3.Methods and Algorithms in Machine Learning(20hours)

A. Supervised, Unsupervised, and Reinforcement Learning.

- B. Structured Data vs. Unstructured Data.
- c. Confusion Matrix.
- D. Data Cleaning and Preprocessing data for Analysis.
- E. Regression and Classification ML Algorithms.
- F. Model Selection and Cross-Validation.
- G. Feature Engineering.
- Discrete (Binomial, Poisson)
- Continuous (Normal, Uniform, Exponential
- NLP (Natural Language Processing) and Text Mining
- Text Preprocessing.

Week 1: ML Foundations & Data Basics (5 hrs)

Day 1 (1 hr) Introduction + Data Types

- What is ML?
- Types of Learning: Supervised, Unsupervised, Reinforcement
- Learning.
- Structured vs Unstructured Data.

Day 2 (1 hr): Confusion Matrix & Evaluation Metrics

- TP, TN, FP, FN.
- Accuracy, Precision, Recall, F1-score.

Day 3 (1 hr): Data Cleaning

- Handling missing values.
- Removing duplicates

Day 4 (1 hr): Data Preprocessing I

- Encoding categorical features (LabelEncoder, OneHotEncoder)

Day 5 (1 hr): Data Preprocessing II

- Feature scaling (StandardScaler, MinMaxScaler).
- Train-test split

Week 2: Core ML Algorithms (5 hrs)

- Linear Regression, Multiple Regression
- Regularization: Ridge, Lasso, ElasticNet

Day 7 (1 hr): Classification Basics

- Logistic Regression.
- Naive Bayes.
- k-Nearest Neighbors

Day 8 (1 hr): Decision Trees

- ▶ Splitting criteria: Gini, Entropy.

- ▶ Overfitting in trees, pruning

Day 9 (1 hr): Ensemble Methods

- ▶ Bagging: Random Forest
- ▶ Boosting: AdaBoost, Gradient Boosting, XGBoost

Day 10 (1 hr): Support Vector Machines (SVM)

- ▶ Linear & Nonlinear SVM

- ▶ Kernel trick (RBF, Polynomial)

Week 3: Feature Engineering & Recommendation Systems (5 hrs)

Day 11 (1 hr): Feature Engineering

- Creating new features
- Feature selection (filter, wrapper, embedded methods)

Day 12 (1 hr): Dimensionality Reduction

- PCA (Principal Component Analysis)
- t-SNE (intro only)

Day 13 (1 hr): Hyperparameter Tuning

- GridSearchCV
- Content-based filtering.
- RandomizedSearchCV

Day 14 (1 hr): Recommendation Systems Basics

- Collaborative filtering (user-based, item-based).

Day 15 (1 hr): Recommendation Systems Advanced

- Matrix Factorization (SVD).

- Surprise library

Week 4: NLP & Text Mining (5 hrs)

Day 16 (1 hr): NLP Basics

- Real-world applications
- What is NLP & Text Mining?

Day 17 (1 hr): Text Preprocessing I

- Tokenization

- Lowercasing, removing punctuation, stopwords.

Day 18 (1 hr): Text Preprocessing II

- Lemmatization, stemming.
- Bag of Words, TF-IDF

Day 19 (1 hr): Text Classification

- Naive Bayes, Logistic Regression for text

Day 20 (1 hr): Capstone Project

- End-to-End Project combining numerical + text features.
- Workflow: data cleaning → feature extraction → model → evaluation.

4.AI and Decision Sciences (Deep learning)

- A. Artificial Neural Networks (ANNs)
- B. Deep Learning
- c. Convolutional Neural Networks (CNNs)
- D. Recurrent Neural Networks (RNNs)

- E. Long Short-Term Memory (LSTM)
- F. Generative Adversarial Networks (GANs)
- G. Transformer Architecture

Day 1 (1 hr): Artificial Neural Networks (ANNs)

- Introduction to Neural Networks.
- Neuron structure: inputs, weights, bias, activation
- Common activation functions: Sigmoid, Tanh, ReLU, Softmax.
- Use cases of ANNs in decision sciences

Day 2 (1 hr): Deep Learning Foundations

- Shallow vs Deep networks.
- Training process: Forward pass, Backpropagation, Loss functions.
- Gradient Descent & Optimizers (SGD, Adam, RMSProp)

Day 3 (4 hrs): Convolutional Neural Networks (CNNs)

- CNN architecture: Convolution, Pooling, Fully Connected layers.
- Image feature extraction & hierarchical learning.
- Popular CNN models: LeNet, AlexNet, VGG, ResNet.
- Transfer Learning with CNNs.

Day 4 (4 hrs): Recurrent Neural Networks (RNNs) & LSTMs/GRUs

- RNN architecture & sequence modeling
- Challenges: Vanishing/exploding gradients.
- Long Short-Term Memory (LSTM): gates & memory cells.
- Gated Recurrent Units (GRU) as a simpler alternative

Day 5 (2 hrs): Advanced Generative & Attention-Based Models

- Generative Adversarial Networks (GANs): Generator vs
- Discriminator, applications in synthetic data & images.

- Variational Autoencoders (VAEs): Encoding, decoding, latent representations.
- Transformers: Attention mechanism, encoder-decoder structure.
- Pretrained Large Models: BERT, GPT, Vision Transformers.

6.Generative AI (Gen AI) & AI Agent Creation. (27hours)

- Week 1: Generative AI & LLM Foundations (5 hrs)
- Day 1: Introduction to Generative AI
- What is Generative AI?
- Applications (Text, Image, Audio, Video, Code)

Day 2: Introduction to Large Language Models (LLMs)

- What are LLMs?
- Training concepts (pre-training, fine-tuning, RLHF)

- **Day 3: Word Embeddings**
- Concepts of embeddings.
- Word2Vec, GloVe, contextual embeddings

Day 4: Hugging Face Basics

- Introduction to Hugging Face Hub
- Exploring pre-trained models
- **Day 5: Hugging Face Pipelines**
- Using pipeline for NLP tasks (sentiment, summarization, Q&A)

Week 2: Hugging Face Model Usage & Fine-tuning (5 hrs)

Day 6: Hugging Face Without Pipelines

- Loading models/tokenizers manually
- Inference with Transformers

- **Day 7: Fine-Tuning Models on Hugging Face**
- **Dataset preparation.**
- **Training & evaluation basics.**

Day 8: Fine-Tuning Hands-On (Text Classification)

- **Train a classifier using Hugging Face Trainer API.**
- **Day 9: Hugging Face Advanced Use**
- **Model saving, deployment options.**

Day 10: Project Discussion

- **Choosing use cases for fine-tuned models.**

Week 3: LangChain Foundations (5 hrs)

- **Day 11: Introduction to LangChain**

- **What is LangChain?**
- **Why it's important for GenAI apps.**

Day 12: LangChain Core Components

Prompt Template, LLM, Output Parsers.

Day 13: LangChain Chains

Sequential chains.

Input/Output design.

Day 14: LangChain Memory

Conversation Buffer, Conversation Summary

Memory in chatbots.

Day 15: LangChain Agents

Tools & Agents.

When to use agents.

Day 16: LangGraph

- What is LangGraph?
- Why LangGraph is needed beyond LangChain
- Graph-based control flow for LLMs
- Nodes, edges, and state
- Deterministic vs dynamic execution
- LangChain vs LangGraph comparison

Day 17: LangGraph Core Concepts

- State management in LangGraph
- Conditional edges and branching logic
- Cycles and looping behavior
- Human-in-the-loop workflows

Week 4: Retrieval-Augmented Generation (RAG) (5 hrs)

Day 16: RAG Introduction

- What is RAG?
- Architecture & workflow.

Day 17: Vector Databases

- Embeddings storage.
- Using FAISS/Chroma.

Day 18: RAG Implementation

- Document loaders, splitters, embeddings.
- Building a retriever

Day 19: Building a retriever

- Connecting retriever + LLM
- Testing with real datasets

Day 20: Validating RAG Performance

▶ **Evaluating precision/recall in RAG.**

Week 5: Advanced GenAI Applications (5 hrs)

Day 21: Mastering Chatbots with Memory

▶ **Multi-turn conversations.**

▶ **Long-term memory.**

Day 22: LangChain Advanced Agents

▶ **Multi-tool agents**

▶ **Planning vs Reactive agents**

Week 6: Advanced GenAI Applications (5 hrs)

Day 1: Introduction to Agentic AI

- **What is Agentic AI?**
- **Evolution of AI (Rule-based → ML → LLMs → Agentic AI)**
- **LLMs vs Chatbots vs AI Agents**

Day 2: AI Agent Architecture

- **What is an AI Agent?**
- **Core components of an Agentic AI system**
- **Agent lifecycle (Think → Plan → Act → Observe → Iterate)**

Day 3: Agent Reasoning & Planning

- **Reasoning in Agentic AI**
- **Chain-of-Thought & ReAct pattern**
- **Planning-based agents vs Reactive agents.**

Day 4: Agentic AI Framework – LangChain Agents

- Why frameworks are needed for Agentic AI
- LangChain Agents overview
- Chains vs Agents vs RAG

Day 5: Agentic AI Applications & Design

- Real-world Agentic AI use cases
- multi-agent systems (conceptual)

Day 6: Introduction to MCP (1 hrs)

- What is MCP (Model Context Protocol)?
- Why MCP is needed in modern GenAI systems
- Limitations of tool calling without MCP
- MCP as a standardized interface between

- LLMs
- Tools
- Data sources
- MCP vs traditional API integrations
- Role of MCP in scalable Agentic AI

Day 7: MCP Architecture & Core Concepts (1 hrs)

- MCP architecture overview
- MCP servers and MCP clients
- Resources, tools, and prompts in MCP
- Context management and state sharing
- Security and access control concepts
- How MCP enables reusable AI tools

7. Prompt Engineering. (2hours)

- Day 1: Advanced Prompt Engineering (Part 1)
- Principles of effective prompting
- Zero-shot, Few-shot, Chain-of-thought prompting

Day 2: Advanced Prompt Engineering (Part 2)

- Structured outputs (JSON, tables)
- Prompt optimization & evaluation techniques.