



# AI/ML Roadmap

Python > Data Science > Machine Learning > Deep Learning > Generative AI

## Importance of Mathematics in AI

Mathematics is the foundation of AI. It is essential in AI as it forms the theoretical foundation for machine learning algorithms and deep learning models. Linear algebra enables the handling and transformation of data as matrices and vectors, crucial for operations in neural networks. Calculus, particularly derivatives, allows for optimizing models by minimizing error, which is fundamental in training processes like backpropagation. Probability and statistics help in making predictions, evaluating uncertainties, and analyzing model performance, which are key for accurate decision-making in AI systems. Overall, math ensures that AI algorithms are both effective and interpretable.

## Beginning of AI

AI's roots trace back to **Alan Turing**, who in 1950 asked, "Can machines think?" and introduced the **Turing Test** as a measure of machine intelligence. Turing's

ideas on computation and his **Turing Machine** laid the groundwork for artificial intelligence and computer science.

### ▼ The Turing Test

The Turing Test is a method for determining whether a machine can exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human. (If a computer deceives a human into believing it is human, then it is considered intelligent.)

**Description of the Test:** Turing's proposal to assess a machine's ability to display human-like intelligence in conversation.

The Turing Test remains a benchmark for evaluating AI's ability to simulate human-like intelligence.

<https://www.linkedin.com/pulse/turing-test-hari-prasath-a-s-z5tjc/>

[https://media.licdn.com/dms/image/v2/D5612AQFjdtWK5OdDgQ/article-cover\\_image-shrink\\_720\\_1280/article-cover\\_image-shrink\\_720\\_1280/0/1721185511062?e=1736380800&v=beta&t=1PE-\\_eWEE24jjeVStT84KzM0DlpfSY8C-Ig5uas6SMU](https://media.licdn.com/dms/image/v2/D5612AQFjdtWK5OdDgQ/article-cover_image-shrink_720_1280/article-cover_image-shrink_720_1280/0/1721185511062?e=1736380800&v=beta&t=1PE-_eWEE24jjeVStT84KzM0DlpfSY8C-Ig5uas6SMU)

In 1956, **John McCarthy** organized the **Dartmouth Conference**, where he coined the term "artificial intelligence," marking the start of AI as a field. Early AI research focused on symbolic reasoning but stalled due to limited computational power, leading to the first "**AI winter**."

In the 1980s, advances in **neural networks** revived AI, and by the 21st century, **machine learning** and **deep learning** drove rapid progress in applications like speech recognition, computer vision, and **generative AI**. Today, AI continues to transform industries, expanding on the visions of Turing and McCarthy.

### ▼ The Roadmap

## Python

- **Topics:** Data types, control structures (loops, if-else statements), functions, and libraries.
- **Libraries to Learn:** Basics of NumPy, Pandas, and Matplotlib/Seaborn for data manipulation and visualization.

## Data Science

- **Core Libraries:** Deepen skills in NumPy, Pandas, and Matplotlib/Seaborn for working with data.
- **Data Wrangling:** Learn how to clean, normalize, and handle missing values and outliers in data.
- **Exploratory Data Analysis (EDA):** Analyze and visualize datasets, focusing on trends, distributions, and relationships in data.
- **Practice Projects:** Start with datasets like the Titanic survival dataset to practice data cleaning and analysis.

## Machine Learning

- **Supervised Learning:** Focus on regression (e.g., Linear Regression) and classification (e.g., Logistic Regression).
- **Unsupervised Learning:** Learn clustering (e.g., K-Means) and dimensionality reduction.
- **Evaluation Metrics:** Understand accuracy, precision, recall, F1 score, and AUC-ROC to evaluate model performance.
- **Core Library:** Get familiar with Scikit-Learn for building models like Linear Regression, Decision Trees, and K-Nearest Neighbors.

## Deep Learning

- **Introduction to Neural Networks:** Learn the basics of neural networks, including forward and backward propagation.

- **Deep Learning Frameworks:** Choose either TensorFlow or PyTorch to implement simple neural networks.
- **Convolutional Neural Networks (CNNs):** Dive into CNNs for image recognition tasks.
- Types: **Discriminative(Classification)** and **Generative**

## Generative AI

- **Large Language Models (LLMs):** Study foundational concepts in LLMs like GPT and BERT (Transformers).
- Types: **Generative Image Models** and **Generative Language Models**
- **Retrieval-Augmented Generation (RAG):** Learn about RAG to enhance model performance on complex queries.
- **Natural Language Processing (NLP):** Explore techniques and libraries (NLTK, SpaCy) for tasks like text generation, summarization, and sentiment analysis.
- **Libraries and Tools:** Familiarize yourself with **Hugging Face** for model access and implementation. For AI-building AI chatbots and AI Agents, use LangChain.
- <https://www.youtube.com/watch?v=2kSI0xkq2IM&t=3413s>

## AI for Non-Tech

Non-technical people can leverage AI, particularly **Generative AI**, to streamline their workflows, enhance creativity, and improve decision-making across various domains.

- Image Generation: MidJourney
- No-Code Chatbot Development: Voiceflow, Botpress, etc
- Data Analysis

## Resources

1. <https://www.w3schools.com/python/default.asp>
2. <https://www.youtube.com/@freecodecamp>
3. <https://www.youtube.com/@stanfordonline>
4. <https://www.kaggle.com/>

## Courses

1. <https://learn.365datascience.com/>
2. <https://www.deeplearning.ai/>
3. <https://grow.google/ai/>