ChatGPT

AI/ML Transition Roadmap

This roadmap outlines a step-by-step progression for transitioning from a software testing/automation background into roles focused on building AI/ML models, agents, or training large language models. Each stage lists key topics to learn along with curated free resources. Citations correspond to footnotes in the text.

Stage	Key topics / concepts	Free resources (names)	Direct links
Mathematical foundations	Vectors & matrices; determinants & eigenvalues; calculus & probability	MIT Linear Algebra [1]; MIT Probability & Statistics [2]; Matrix Calculus for ML [3]	https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/; https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/; https://ocw.mit.edu/courses/18-s096-matrix-calculus-for-machine-learning-and-beyond-january-iap-2023/
Programming fundamentals	Python basics & data structures; Pandas/NumPy; version control (Git)	Google's Python Class [4]; Pandas & NumPy tutorials	https://developers.google.com/edu/python; https://numpy.org/doc/; https://pandas.pydata.org/docs/
Machine Learning core	Data collection & cleaning; EDA & feature engineering; supervised & unsupervised ML; evaluation metrics	Google ML Crash Course [5]; GeeksforGeeks ML roadmap [6] [7]	https://developers.google.com/machine-learning/crash-course; https://www.geeksforgeeks.org/blogs/machine-learning-roadmap/
Deep Learning	Neural networks & backpropagation; CNNs & RNNs; Transformers & generative models	fast.ai Practical DL [8]; PyTorch tutorial [9]; MIT 6.S191 (deep learning & generative AI) [10]; CS231n [11]; Karpathy Zero to Hero [12]; CS236 generative models [13]	https://course.fast.ai/; https://docs.pytorch.org/tutorials/beginner/pytorch_with_examples.html; https://introtodeeplearning.com/; https://cs231n.stanford.edu/; https://karpathy.ai/zero-to-hero.html; https://deepgenerativemodels.github.io/

Stage	Key topics / concepts	Free resources (names)	Direct links
Specializations	Computer vision; NLP; reinforcement learning; generative modeling	CS231n vision [11]; CS224n NLP [14]; Spinning Up RL [15]; HF Deep RL course [16]; MIT 6.S191 generative modeling [17] [18]; CS236 generative models [19]	https://cs231n.stanford.edu/; https://web.stanford.edu/class/cs224n/; https://spinningup.openai.com/en/latest/; https://huggingface.co/learn/deep-rl-course; https://introtodeeplearning.com/; https://deepgenerativemodels.github.io/
LLMs & agents	Tokenization & transformers; prompt engineering; retrieval-augmented generation; agent frameworks	Karpathy Zero to Hero (GPT) [12] [20]; LLM course (fundamentals, scientist, engineer) [21]; MIT 6.S191 LLM lectures [22]; Full Stack LLM Bootcamp [23]; LangChain tutorials & academy [24]; HF AI Agents course [25]	https://karpathy.ai/zero-to-hero.html; https://github.com/mlabonne/llm-course; https://introtodeeplearning.com/; https://fullstackdeeplearning.com/llm-bootcamp/; https://academy.langchain.com/; https://huggingface.co/learn/agents-course
MLOps & deployment	Experiment tracking & pipelines; containerization & CI/CD; monitoring & data engineering	DataTalksClub MLOps Zoomcamp [26] [27]; Full Stack Deep Learning [28]; Google ML Crash Course (production ML) [5]	https://github.com/DataTalksClub/mlops-zoomcamp; https://fullstackdeeplearning.com/; https://developers.google.com/machine-learning/crash-course
Advanced topics & research	Distributed training; model efficiency (LoRA, quantization); fairness & ethics; RLHF	MIT 6.S191 New Frontiers [29]; Spinning Up research guidance [15]; LLM course scientist & engineer modules [21]	https://introtodeeplearning.com/; https://spinningup.openai.com/en/latest/; https://github.com/mlabonne/llm-course

[1] Linear Algebra | Mathematics | MIT OpenCourseWare
https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/

2 Introduction to Probability and Statistics | Mathematics | MIT OpenCourseWare
https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/

3 Matrix Calculus for Machine Learning and Beyond | Mathematics | MIT OpenCourseWare
https://ocw.mit.edu/courses/18-s096-matrix-calculus-for-machine-learning-and-beyond-january-iap-2023/

4 Google's Python Class | Python Education | Google for Developers
https://developers.google.com/edu/python

5 Machine Learning | Google for Developers
https://developers.google.com/machine-learning/crash-course

6 7 Machine Learning Roadmap - GeeksforGeeks
https://www.geeksforgeeks.org/blogs/machine-learning-roadmap/

8 Practical Deep Learning for Coders - Practical Deep Learning
https://course.fast.ai/

9 Learning PyTorch with Examples — PyTorch Tutorials 2.8.0+cu128 documentation
https://docs.pytorch.org/tutorials/beginner/pytorch_with_examples.html

10 17 18 22 29 MIT Deep Learning 6.S191
https://introtodeeplearning.com/

11 Stanford University CS231n: Deep Learning for Computer Vision
https://cs231n.stanford.edu/

12 20 Neural Networks: Zero To Hero
https://karpathy.ai/zero-to-hero.html

13 19 Stanford University CS236: Deep Generative Models
https://deepgenerativemodels.github.io/

14 Stanford CS 224N | Natural Language Processing with Deep Learning
https://web.stanford.edu/class/cs224n/

15 Introduction — Spinning Up documentation
https://spinningup.openai.com/en/latest/user/introduction.html

16 Welcome to the Deep Reinforcement Learning Course - Hugging Face Deep RL Course
https://huggingface.co/learn/deep-rl-course/unit0/introduction

21 raw.githubusercontent.com
https://raw.githubusercontent.com/mlabonne/llm-course/refs/heads/main/README.md

23 LLM Bootcamp - The Full Stack
https://fullstackdeeplearning.com/llm-bootcamp/

24 LangChain Academy
https://academy.langchain.com/

25 Welcome to the AI Agents Course - Hugging Face Agents Course
https://huggingface.co/learn/agents-course/en/unit0/introduction

26 27 GitHub - DataTalksClub/mlops-zoomcamp: Free MLOps course from DataTalks.Club
https://github.com/DataTalksClub/mlops-zoomcamp

28 The Full Stack
https://fullstackdeeplearning.com/