

AI Engineer Roadmap for Beginners

Following is the roadmap to learning **AI Engineer** (also known as **ML Engineer**) skills for a total beginner. It includes FREE learning resources for technical skills (or tool skills) and soft (or core) skills

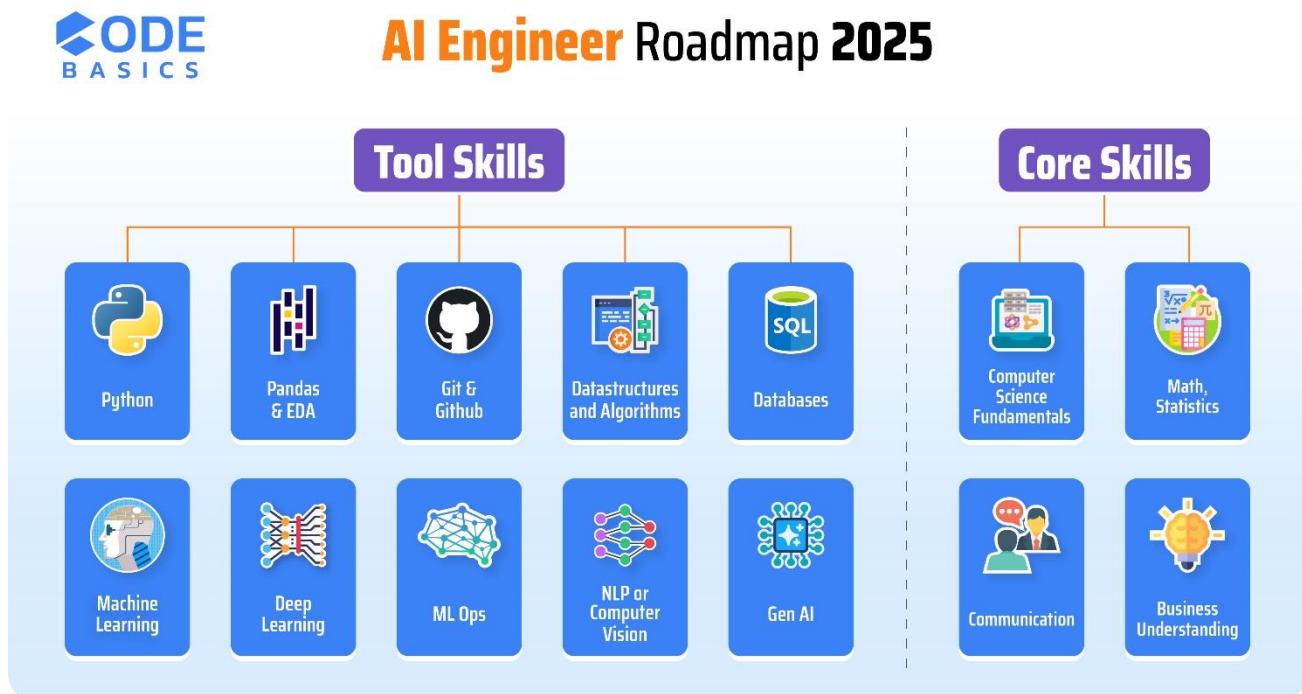


Find Your Suitability: Before you start your learning journey, it is important you find out if AI engineering career really suits your natural abilities and interests. Take this test to know your suitability: <https://codebasics.io/survey/find-your-match-ds>

Proceed further if the results show that this career role matches you.

Total Duration: **8 Months (4 hours)** of study every day, 6 days a week)

Also, **AI Engineer = Data Scientist + Software Engineer**



Week 0: Do Proper Research and protect yourself from SCAMS.

Unfortunately, a lot of systematic scams are happening in ed tech, especially in the data field where aspirants are provided with false promises like a 100% job guarantee or trapped into “Masterclasses” which are nothing but sales pitches to upsell their low-grade courses at exorbitant prices. You need to do complete research about the market and mentors before starting your journey. Providing you the links to a few posts that we have made in this regard which will support your research.

Even though these posts are **NOT** sufficient, do additional research.

- <https://bit.ly/3FI7cEh>
- <https://bit.ly/4at9Jaw>
- <https://bit.ly/477IOOs>
- <https://bit.ly/3GPD7dp>

We have also made a mini course on scam awareness: <https://codebasics.io/courses/scam-awareness-course>

Week 1: Computer Science Fundamentals

- **Topics**

- Data representation: Bits and Bytes, Storing text and numbers, Binary number system.
- Basics of computer networks, IP addresses, Internet routing protocol
- UDP, TCP, HTTP, and The World Wide Web
- Programming basics: variables, strings, and numbers, if condition, loops
- Algorithm basics

- **Learning Resources**

- Khan Academy course: <https://bit.ly/42DUXtW>
- In the above course, only follow the first 4 sections (1) Digital Information (2) The Internet (3) Programming (4) Algorithms. Completing the remaining sections is optional. Do it if you have time and interest.
- **EXTREMELY IMPORTANT:** Use ChatGPT 😊 as your personal tutor in case you have doubts and you need clarity on anything

Skip this section if you are already a software engineer, computer science student or know the above fundamentals due to whatever reason.

Week 2: Beginners Python



• Topics

- Variables, Numbers, Strings
- Lists, Dictionaries, Sets, Tuples
- If condition, for loop
- Functions, Lambda Functions
- Modules (pip install)
- Read, Write files
- Exception handling
- Classes, Objects

• Learning Resources

- Track A (Free)
 - Python Tutorials (Codebasics) on YouTube (first 16 videos)
- <https://bit.ly/3X6CCC7>
 - Corey's Python Tutorials: <https://bit.ly/3uqUgaZ>
 - Codebasics python HINDI tutorials - <https://bit.ly/3vmXrgw>
 - **EXTREMELY IMPORTANT:** Use ChatGPT 😊 as your personal tutor in case you have questions or facing issues
- Track B (Affordable Fees)
 - AI Bootcamp: <https://codebasics.io/bootcamps/ai-data-science-bootcamp-with-virtual-internship>

• LinkedIn - Core Skill

- Create a professional-looking LinkedIn profile.
 - Have a clear profile picture and banner image.
 - Add tags such as: Open to work etc.
- Use this LinkedIn Checklist to create a profile: [Click here.](#)

• Assignment

- Track A: Finish all these exercises: <https://bit.ly/3k1mof5>
- Track B: Finish exercises and quizzes for relevant topics
- Create a professional-looking LinkedIn profile.

Week 3 and 4: Data Structures and Algorithms in Python

- **Topics**

- Data structures basics, Big O notation
- Data structures: Arrays, Linked List, Hash Table, Stack, Queue
- Data structures: Tree, Graph
- Algorithms: Binary search, Bubble sort, quick sort, merge sort
- Recursion

- **Learning Resources**

- DSA YouTube Playlist: <https://bit.ly/3uiW2Lf>

- **Motivation**

- ML Engineer after 12th: <https://bit.ly/3DqwLY>

- **Assignment**

- Finish all these exercises in this same playlist: <https://bit.ly/3uiW2Lf>

Week 5: Advance Python

- **Topics**

- Inheritance, Generators, Iterators
- List Comprehensions, Decorators
- Multithreading, Multiprocessing

- **Learning Resources**

- Python Tutorials (Codebasics) on YouTube (17th to 27th video)
 - <https://bit.ly/3X6CCC7>

- **Assignment**

- Finish all these exercises in this same playlist: <https://bit.ly/3X6CCC7>

- **Core/Soft Skills**
 - **Linkedin**
 - Start following prominent AI influencers.
 - Yann LeCun: <https://www.linkedin.com/in/yann-lecun/>
 - Daliana Liu: <https://www.linkedin.com/in/dalianaliu/>
 - Nitin Aggarwal: <https://www.linkedin.com/in/ntnaggarwal/>
 - Steve Nouri: <https://www.linkedin.com/in/stevenouri/>
 - Dhaval Patel: <https://www.linkedin.com/in/dhavalsays/>
 - Increase engagement.
 - Start commenting meaningfully on AI and career-related posts.
 - Helps network with others working in the industry build connections.
 - Learning and brainstorming opportunity.
 - Remember ***online presence is a new form of resume***
 - **Business Fundamentals - Soft Skill**
 - Learn business concepts from ThinkSchool and other YT Case Studies
 - Example: How Amul beat competition: <https://youtu.be/nnwqtZiYMxQ>
 - **Discord**
 - Start asking questions and get help from the community. This post shows how to ask questions the right way: <https://bit.ly/3I70Ebl>
 - Join codebasics discord server: <https://discord.gg/r42KbuK>

- **Assignment**

- Write meaningful comments on at least **10 AI related LinkedIn posts**
- Note down your key learnings from **3 case studies** on ThinkSchool and share them with your friend.

- **Motivation**

- How Kaggle helped this person become ML engineer: <https://bit.ly/3RFVruy>

Week 6: Version Control (Git, Github)

- **Topics**

- What is the version control system? What is Git and GitHub?
- Basic commands: add, commit, push.
- Branches, reverting change, HEAD, Diff and Merge
- Pull requests.

- **Learning Resources**

- YT playlist (codebasics): <https://bit.ly/3SECQQ7>
- YT playlist (Corey): <https://bit.ly/3T0Yrmb>

- **Core/Soft Skills**

- Presentation skills
 - Death by PowerPoint: <https://youtu.be/lwpi1Lm6dFo>

Week 7, 8: Databases: Relational DB and SQL

- **Topics**

- Basics of relational databases.
- Basic Queries: SELECT, WHERE LIKE, DISTINCT, BETWEEN, GROUP BY, ORDER BY
- Advanced Queries: CTE, Subqueries, Window Functions
- Joins: Left, Right, Inner, Full
- Database creation, indexes, stored procedures.

- **Learning Resources**

- Track A
 - [Khan academy SQL course: https://bit.ly/3WFku20](https://www.khanacademy.org/computer-programming/sql-course)
 - <https://www.w3schools.com/sql/>
 - <https://sqlbolt.com/>
 - YT video: <https://youtu.be/Rm0xH2Vpfi0?si=6ZLK8A5LvGqN4NmT>

- Track B
 - AI Bootcamp: <https://codebasics.io/bootcamps/ai-data-science-bootcamp-with-virtual-internship>
- **Assignment**
 - Participate in SQL resume project challenge on <https://codebasics.io/>
 - Link: <https://codebasics.io/challenge/codebasics-resume-project-challenge/7>
 - These challenges help you improve technical skills, soft skills and business understanding.
 - Make a LinkedIn post with a submission of your resume project challenge
Sample post: <https://bit.ly/48Bg5mB>

Week 9: Databases: NoSQL DB

- **Topics**
 - NoSQL Fundamentals: Why NoSQL became popular – scalability challenges, unstructured data, real-time analytics etc.
 - Data Modeling in NoSQL
 - Base vs. ACID, Data Partitioning and Sharding, Replication, CAP Theorem
- **Learning Resources**
 - How do NoSQL DB work: <https://bit.ly/3XMIKmF>
 - MongoDB Tutorial: <https://bit.ly/3DKf9ST>
- **Motivation**
 - Mechanical to Deep Learning Engineer: <https://bit.ly/48IX9aR>

Week 10: Numpy, Pandas, Data Visualization

- **Tech Skills**
 - **Numpy**
 - numpy YouTube playlist: <https://bit.ly/3GTppa8>

- o **Pandas, Matplotlib, Seaborn**

- Go through chapter 5 in this course (entire chapter is free):
<https://codebasics.io/courses/math-and-statistics-for-data-science>

Week 11, 12, 13: Math & Statistics for AI

- **Math and Statistics for AI**

- o Topics to Learn

- Basics: Descriptive vs inferential statistics, continuous vs discrete data, nominal vs ordinal data
- Linear Algebra: Vectors, Matrices, Eigenvalues and Eigenvectors
- Calculus: Basics of integral and differential calculus
- Basic plots: Histograms, pie charts, bar charts, scatter plot etc.
- Measures of central tendency: mean, median, mode
- Measures of dispersion: variance, standard deviation
- Probability basics
- Distributions: Normal distribution
- Correlation and covariance
- Central limit theorem
- Hypothesis testing: p value, confidence interval, type 1 vs type 2 error, Z test

- o Learning Resources

- Track A (Free)

- Learn the above topics from this excellent Khan academy course on statistics and probability.
 - Course link: <https://www.khanacademy.org/math/statistics-probability>
 - While doing khan academy course, when you have doubts, use statquest YouTube channel:
<https://www.youtube.com/@statquest>
 - Use this free YouTube playlist: <https://bit.ly/3QrSXis>
 - Another great youtube channel:
<https://www.youtube.com/@3blue1brown>

- Track B (Affordable Fees)
 - Learn the key concepts of Math and Statistics that lay the foundations for a strong data science career:
<https://codebasics.io/courses/math-and-statistics-for-data-science>
- **Assignment**
 - Finish all exercises in this playlist: <https://bit.ly/3QrSXis>
 - Finish all exercises in Khan academy course.
 - Track B: Finish exercises and quizzes for relevant topics.

Week 14: Exploratory Data Analysis (EDA)

- **Exploratory Data Analysis (EDA)**
 - Online retail analysis tutorial: <https://bit.ly/420JrtT>
 - <https://www.kaggle.com/code?searchQuery=exploratory+data+analysis>
 - Use the above link to search for exploratory data analysis notebooks.
 - Practice EDA using at least 3 datasets.
 - e.g. <https://www.kaggle.com/datasets/rishabhkarn/ipl-auction-2023/data>
- **Assignment**
 - Perform EDA (Exploratory data analysis on **at least 2 additional datasets** on Kaggle)

Week 15, 16, 17, 18: Machine Learning

- **Machine Learning: Preprocessing**
 - Handling NA values, outlier treatment, data normalization
 - One hot encoding, label encoding
 - Feature engineering
 - Train test split
 - Cross validation

- **Machine Learning: Model Building**
 - Types of ML: Supervised, Unsupervised
 - Supervised: Regression vs Classification
 - Linear models
 - Linear regression, logistic regression
 - Gradient descent
 - Nonlinear models (tree-based models)
 - Decision tree
 - Random forest
 - XGBoost
 - Model evaluation
 - Regression: Mean Squared Error, Mean Absolute Error, MAPE
 - Classification: Accuracy, Precision-Recall, F1 Score, ROC Curve, Confusion matrix
 - Hyperparameter tuning: GridSearchCV, RandomSearchCV
 - Unsupervised: K means, Hierarchical clustering, Dimensionality reduction (PCA)
- **Learning Resources**
 - Track A
 - YouTube playlist (more than 2 million views): <https://bit.ly/3io5qqX>
 - First 21 videos
 - Feature engineering playlist: <https://bit.ly/3IFa3Yf>
 - Track B (Affordable Fees)
 - AI Bootcamp: <https://codebasics.io/bootcamps/ai-data-science-bootcamp-with-virtual-internship>
- **Core/Soft Skills**
 - **Project Management**
 - Scrum: <https://scrumtrainingseries.com/>
 - Kanban: <https://youtu.be/jf0tlbt9lx0>
 - Tools: JIRA, Notion

- **Assignment**

- Complete all exercises in ML playlist: <https://bit.ly/3io5qqX>
- Work on **2 Kaggle ML notebooks**
- Write **2 LinkedIn posts** on whatever you have learnt in ML
- Discord: Help people with **at least 10 answers**
- Track B: Finish exercises and quizzes for relevant topics

Week 19: ML Ops

- **Topics**

- What is ML Ops? Experiment Tracking with MLFlow
 - What is API? FastAPI for Python server development
 - DevOps Fundamentals: CI/CD pipelines, containerization (Docker, Kubernetes)
 - Familiarity with at least one cloud platform (AWS, Azure etc.)

- Learning Resources

- Track A:
 - What is ML Ops: <https://bit.ly/3R4uGA0>
 - FastAPI tutorial: <https://bit.ly/497p6Ex>
 - MLFlow Tutorial: <https://bit.ly/497p6Ex>
 - Docker Tutorial: <https://bit.ly/3uCNpeE>
 - Track B (Affordable Fees):
 - AI Bootcamp: <https://codebasics.io/bootcamps/ai-data-science-bootcamp-with-virtual-internship>

Week 20, 21: Machine Learning Projects

- You need to finish **two** end to end ML projects. One on **Regression**, the other on **Classification**
- Regression Project: Bangalore property price prediction
 - YouTube playlist link: <https://bit.ly/3ivycWr>

- Project covers the following
 - Data cleaning
 - Feature engineering
 - Model building and hyper parameter tuning
 - Write flask server as a web backend
 - Building website for price prediction
 - Deployment to AWS
- Classification Project: Log Classification System
 - YouTube link: <https://bit.ly/4hu5EoL>
 - Project covers the following
 - How to use hybrid approach (regex, BERT, Logistic Regression and LLM) for classification)
 - DB Scan clustering
 - Building FastAPI Backend

- **ATS Resume Preparation**

- Resumes are dying but not dead yet. Focus more on online presence.
- Here is the resume tips video along with some templates you can use for your data analyst resume: <https://www.youtube.com/watch?v=buQSI8NLOMw>
- Use this checklist to ensure you have the right ATS Resume: [Check here.](#)

- **Portfolio Building Resources:**

You need a portfolio website in 2025. You can build your portfolio by using these free resources.

- [GitHub](#)
 - Upload your projects with code on github and using github.io create a portfolio website
 - Sample portfolio website: <http://rajagopal.github.io/>
 - Codebasics bootcamp student portfolio:
<https://codebasics.io/portfolio/Rachana-Hadke>
- [Linktree](#)
 - Helpful to add multiple links in one page.

- **Assignment**

- In above two projects make following changes
 - Use **FastAPI** instead of **flask**. FastAPI tutorial: <https://youtu.be/Wr1JjhTt1Xg>
 - **Regression project:** Instead of property prediction, take any other project of your interest from Kaggle for regression
 - **Classification project:** Instead of log classification, take any classification project using a Kaggle dataset and build end to end solution along with **deployment to AWS or Azure**
 - Add a link of your projects in your resume and LinkedIn.
(Tag Codebasics, Dhaval Patel and Hemanand Vadivel with the hashtag #dsroadmap24 so we can engage to increase your visibility)

Week 22, 23, 24, 25: Deep Learning

- **Topics**

- What is a neural network? Forward propagation, back propagation
- Building multilayer perceptron
- Special neural network architectures
 - Convolutional neural network (CNN)
 - Sequence models: RNN, LSTM
 - Transformers

- **Learning Resources**

- Track A (Free)
 - Deep Learning playlist (tensorflow): <https://bit.ly/3vOZ3zV>
 - End to end potato disease classification project: <https://bit.ly/3QzkVJi>
- Track B (Affordable Fees):
 - AI Bootcamp: <https://codebasics.io/bootcamps/ai-data-science-bootcamp-with-virtual-internship>

- **Assignment**

- Instead of potato plant images use tomato plant images or some other image classification dataset.
- Deploy to Azure instead of GCP.
- Create a presentation as if you are presenting to stakeholders and upload video presentation on LinkedIn.

Week 26, 27, 28: NLP or Computer Vision

- Many AI engineers choose a specialized track which is either NLP or Computer vision. You don't need to learn both.
- **Natural Language Processing (NLP)**
 - Topics
 - Regex
 - Text presentation: Count vectorizer, TF-IDF, BOW, Word2Vec, Embeddings
 - Text classification: Naïve Bayes
 - Fundamentals of Spacy & NLTP library
 - One end to end project
 - Learning Resources
 - NLP YouTube playlist: <https://bit.ly/3XnjfEZ>
- **Computer Vision (CV)**
 - Topics
 - Basic image processing techniques: Filtering, Edge Detection, Image Scaling, Rotation
 - Library to use: OpenCV
 - Convolutional Neural Networks (CNN) – Already covered in deep learning.
 - Data preprocessing, augmentation – Already covered in deep learning.
- **Assignment**
 - NLP Track: Complete exercises in this playlist: <https://bit.ly/3XnjfEZ>

Week 29, 30: Gen AI (Including AI Agents)

- Topics
 - What is LLM, Vector database, Embeddings?
 - RAG (Retrieval Augmented Generation)
 - Langchain framework
 - AI Agents, Agno (previously called phidata) framework

- Learning Resources
 - Gen AI crash course: <https://bit.ly/3Fn7Zoh>
 - AI Agents Tutorial: <https://bit.ly/4io8YD5>
 - Agentic AI Tutorial using LangGraph :
<https://www.youtube.com/watch?v=CnXdddeZ4tQ>
 - Crew AI: <https://www.youtube.com/watch?v=G42J2MSKyc8>

Week 31, 32: Gen AI Projects

- Topics
 - Projects that include using LLMs, RAG, Agents to solve real life problems
- Learning Resources
 - Gen AI project playlist: <https://bit.ly/4ilzEnX>

Week 33 onwards...

- More projects 
- Online brand building through LinkedIn, Kaggle, Discord, Opensource contribution

- Job application and Success 

Tips of effective learning

- **Spend less time in consuming information, more time in**
 - Digesting
 - Implementing
 - Sharing
- **Group learning**
 - Use **partner-and-group-finder** channel on codebasics discord server for group study and hold each other accountable for the progress of your study plan. Here is the discord server link: <https://discord.gg/r42Kbuk>