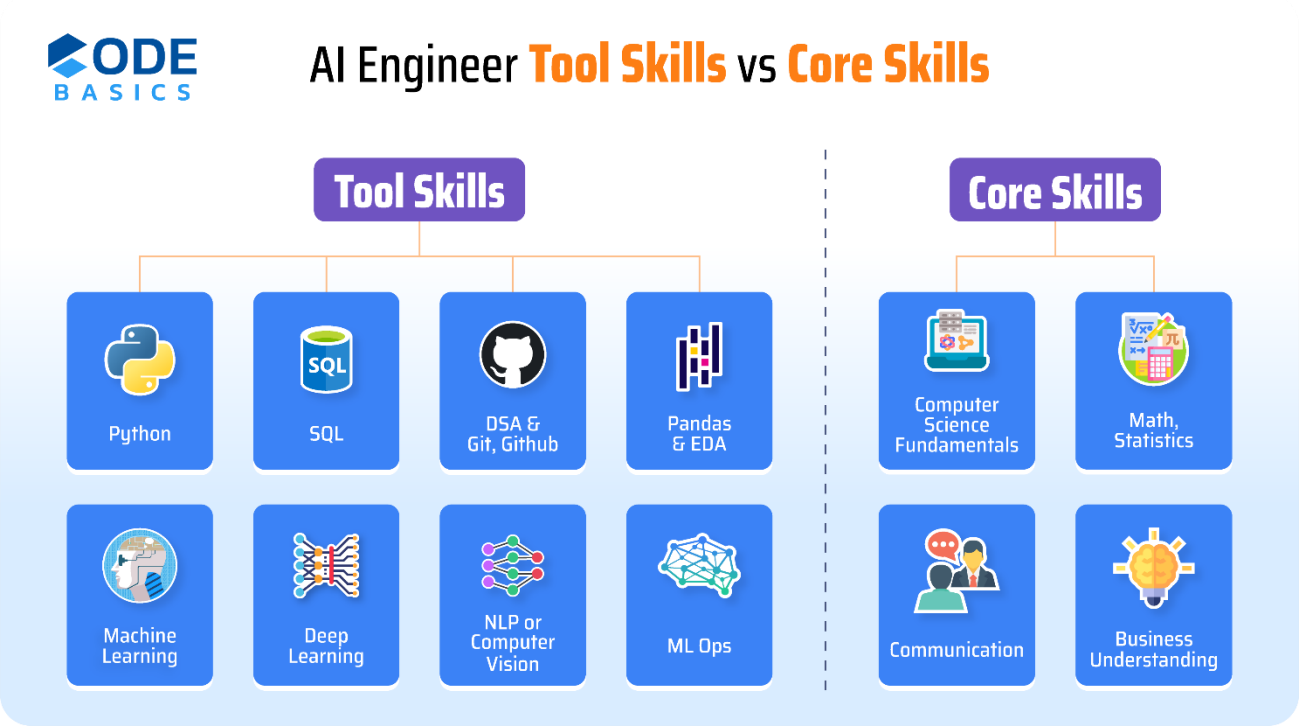
AI Engineer Roadmap for Beginners

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 🏃

Prerequisites: You must have skills or interests to build skills in Coding and Math. Without these two you cannot become an AI engineer.

Total Duration: **8 Months** (**4 hours** of study Every Day)

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 your additional research.

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

Week 1 and 2: 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.

Week 3 and 4: 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

- Track B (Affordable Fees)
    - Python course: https://codebasics.io/courses/python-for-beginner-and-intermediate-learners

- **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 5 and 6: 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**
    - How Kaggle helped this person become ML engineer**:** https://bit.ly/3RFVruy

- **Assignment**

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

Week 7, 8: 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.
      - 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/3I70EbI
    - 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.

Week 9: 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

- **Motivation**
  - Mechanical to Deep Learning Engineer: https://bit.ly/48lX9aR

- **Core/Soft Skills**
  - Presentation skills
    - Death by PowerPoint: https://youtu.be/Iwpi1Lm6dFo

Week 10, 11: 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.w3schools.com/sql/
    - https://sqlbolt.com/
    - YT video: https://youtu.be/Rm0xH2Vpfi0?si=6ZLK8A5LvGqN4NmT
  - Track B
    - SQL course for data professionals: https://codebasics.io/courses/sql-beginner-to-advanced-for-data-professionals

- **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 12: Numpy, Pandas, Data Visualization 📊

- **Tech Skills**
  - **Numpy**
    - numpy YouTube playlist: https://bit.ly/3GTppa8
  - **Pandas, Matplotlib, Seaborn**
    - Go through chapter 3 in this course (entire chapter is free): https://codebasics.io/courses/math-and-statistics-for-data-science

Week 13, 14, 15, 16: Math & Statistics for AI 👨‍🎓

- **Math and Statistics for AI**
  - Topics to Learn
    - Basics: Descriptive vs inferential statistics, continuous vs discrete data, nominal vs ordinal data
    - Linear Algebra: Vectors, Metrices, 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

    - 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 17: Exploratory Data Analysis (EDA) 👨‍🎓

- **Exploratory Data Analysis (EDA)**
  - 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 18, 19, 20, 21: 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 tunning: 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)
        - Master Machine Learning for Data Science & AI: This course takes you from beginner to advanced levels, providing deep intuition on algorithms, engaging cinematic experiences, end-to-end projects, and hands-on coding practice: https://codebasics.io/courses/machine-learning-for-data-science-beginners-to-advanced

- **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 22: ML Ops ⚙

- **Topics**
    - 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:
        - FastAPI tutorial: https://bit.ly/497p6Ex
        - Docker tutorial: https://bit.ly/3uCNpeE

- Track B (Affordable Fees):
  - Included in the above Master Machine Learning for Data Science & AI

Week 23, 24: Machine Learning Projects with Deployment 🎯

- 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 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: Sports celebrity image classification
  - YouTube playlist link: https://bit.ly/3ioaMSU
  - Project covers following
    - Data collection and data cleaning
    - Feature engineering and model training
    - Flask server as a web backend
    - Building website and deployment
- **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 2024. 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://rajag0pal.github.io/

- 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 sports celebrity classification, take any other project of your interest from Kaggle for classification 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 25, 26, 27: 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

- **Learning Resources**
    - Deep Learning playlist (tensorflow): https://bit.ly/3vOZ3zV
    - Deep learning playlist (pytorch): https://bit.ly/3TzDbWp
    - End to end potato disease classification project: https://bit.ly/3QzkVJi

- **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 28, 29, 30: NLP or Computer Vision & GenAI 📄

- 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 31, 32: LLM & Langchain 📄

- Topics
    - What is LLM, Vector database, Embeddings?
    - RAG (Retrieval Augmented Generation)
    - Langchain framework
- Learning Resources
    - Langchain, LLM playlist: https://bit.ly/3RYpxuw

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