

Artificial Intelligence

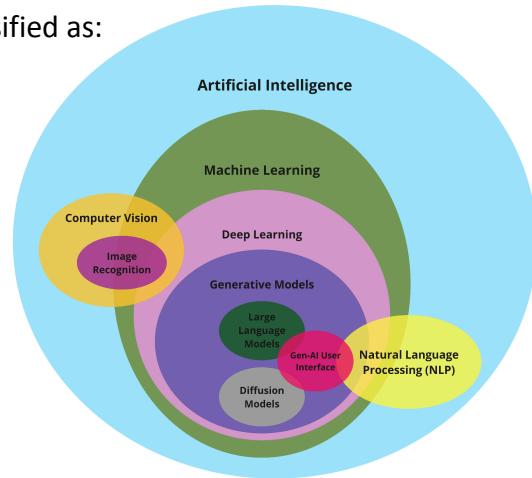
1. OVERVIEW

The **AI-ML-DL** domain focuses on creating intelligent systems that can **learn, reason, and make decisions** from data.

This field combines **mathematics, programming, and data analysis** to solve real-world problems like image recognition, speech analysis, and natural language understanding.

Developers and researchers in this field can be classified as:

- **Machine Learning Engineers**
- **Deep Learning Engineers**
- **Computer Vision Engineers**
- **AI Researchers / Data Scientists**



2. SUBDOMAINS OVERVIEW

1. Machine Learning (ML)

Machine Learning enables systems to **learn patterns from data** and improve performance over time without being explicitly programmed.

It includes supervised, unsupervised, and reinforcement learning techniques.

Examples: spam detection, recommendation systems, predictive analytics.

2. Deep Learning (DL)

Deep Learning is a subset of ML that uses **neural networks** to model complex patterns in large datasets.

It powers modern AI systems such as **speech recognition, image classification, and language translation**.

Examples: ChatGPT, image captioning, facial recognition.

3. Computer Vision (CV)

Computer Vision focuses on **enabling machines to interpret and understand visual information** from the world.

It combines image processing, feature extraction, and neural networks to recognize and analyze visual data.

Examples: object detection, face recognition, autonomous driving.

4. Natural Language Processing (NLP)

NLP allows computers to **understand, interpret, and generate human language**.

It's the backbone of chatbots, virtual assistants, and text analysis systems.

Examples: sentiment analysis, text summarization, speech-to-text.

3. CORE TOPICS TO LEARN

- Python for AI/ML
- Data Preprocessing & Feature Engineering
- Statistics & Probability for ML
- Linear & Logistic Regression
- Decision Trees, Random Forest, SVM
- Neural Networks & Deep Learning
- CNNs (Convolutional Neural Networks)
- RNNs, LSTMs, Transformers
- Computer Vision (OpenCV, YOLO, CNNs)
- NLP (BERT, GPT, word embeddings)
- Model Evaluation Metrics
- Hyperparameter Tuning
- Model Deployment (Streamlit, Flask, FastAPI)

4. REFERENCES / LEARNING RESOURCES

PYTHON & MATHS

- Python for Data Science:
https://youtube.com/playlist?list=PLu0W_9II9agwh1XjRt242xIpHhPT2Ilg&si=cseYkSg9mn3hFhez
- Statistics & Probability for ML:
https://youtube.com/playlist?list=PLKnIA16_RmvbYFaaeLY28cWeqV-3vADST&si=HTUNEg5aSEKdQNXx

- Numpy, Pandas, Matplotlib Tutorials:
<https://youtube.com/playlist?list=PL9n0l8rSshSnragNbIKDBsT8Xu3otp3jA&si=Qij49xCaSjQQB3QY>

MACHINE LEARNING

- Scikit-learn Documentation: <https://www.youtube.com/watch?v=YyFulubbqpo&t=1516s>
- CampusX 100 Days of ML:
https://youtube.com/playlist?list=PLKnIA16_Rmvbr7zKYQuBfsVkjolCJgxHH&si=_CMcLpPsmZ_5HRsK

DEEP LEARNING

- Neural Networks Explained: https://www.youtube.com/watch?v=fne_UE7hDn0&t=481s
- Extras: https://www.youtube.com/watch?v=V_xro1bcAuA&t=14s
- 100 Days of Deep Learning by CampusX:
https://youtube.com/playlist?list=PLKnIA16_RmvYuZauWaPIRTC54KxSNLtNn&si=liUBKaLuJxDIjXP

COMPUTER VISION

- OpenCV Full Course:
https://youtube.com/playlist?list=PLMoSUbG1Q_r_sc0x7ndCsqdIkL7dwrNF&si=pRS7BuKcwW0v-Gtn
- YOLO Object Detection: <https://www.youtube.com/watch?v=ag3DLKsl2vk&t=296s>
- Image Classification Projects: https://www.youtube.com/watch?v=0K4J_PTgysc

FAST API

- Fast Api Course:
https://youtube.com/playlist?list=PLKnIA16_RmvZ41tjbKB2ZnwchfniNsMuQ&si=qj4u0ZSEVCXCqQGM

NLP (Natural Language Processing)

- <https://youtu.be/dIUTsFT2MeQ?si=RAc8VdRNlJRgwxrg>
- CampusX NLP:
https://youtube.com/playlist?list=PLKnIA16_RmvZo7fp5kkIth6nRTeQQsifX&si=6AayGul1rl3I7xU2

LANGCHAIN

- Course Link:
https://www.youtube.com/playlist?list=PLKnIA16_RmvaTbihpo4MtzVm4XOQa0ER0

LANGGRAPH

- Course Link:
https://www.youtube.com/playlist?list=PLKnIA16_RmvYsvB8qkUQuJmJNuiCUJFPL

DEPLOYMENT

- Streamlit Crash Course: <https://www.youtube.com/watch?v=d7fnzDQ5qM8>
- Model Deployment with Docker / FastAPI:
<https://youtu.be/h5wLuVDr0oc?si=ROnXrHCnvVDQkeWU>
- Model Deployment with Flask: https://youtu.be/UbCWoMf80PY?si=L9_uIJss1ABkGBQd

5. TOOLS

- Jupyter Notebook
- Google Colab
- Kaggle
- Hugging Face
- TensorBoard

6. AI TOOLS FOR ML/DL DEVELOPMENT

- **ChatGPT / Gemini / Claude** – Code explanation & debugging
- **GitHub Copilot / Replit Ghostwriter / Cursor** – Assisted coding
- **Weights & Biases / TensorBoard** – Model tracking & visualization
- **Kaggle Notebooks / Colab / Lovable AI** – Cloud-based model training

Drawbacks of Overusing AI Tools:

- May hinder deep understanding of algorithms.
- Risk of biased or incorrect model suggestions.
- Limited flexibility for unique data problems.
- Overfitting risk if blindly following AI-generated code.
- Not ideal for production-level optimization without review.

7. DOCUMENTATION

- **Scikit-learn Docs:** <https://scikit-learn.org/>
- **TensorFlow Docs:** <https://www.tensorflow.org/>
- **PyTorch Docs:** <https://pytorch.org/docs/>
- **OpenCV Docs:** <https://docs.opencv.org/>
- **Hugging Face Docs:** <https://huggingface.co/docs>
- **Kaggle:** <https://www.kaggle.com/>

8. OPTIONAL ADD-ONS

- **Projects:** Sentiment Analysis | Object Detection | Speech Emotion Recognition | Smart Attendance System | Face Spoof Detection
- **Datasets:** Kaggle, Roboflow, ImageNet, COCO
- **Portfolio:** Showcase ML & DL projects on GitHub

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