

Demystifying Artificial Intelligence

An Introduction to AI, Machine Learning, and Deep Learning



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Previously:

- Founder & Lead Organizer at GDG Baghdad
- Technical Instructor at Code Lab
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Agenda

- What's Artificial Intelligence?
- AI vs ML vs DL
- AI Hype - Why Now?
- How Do Machines Learn?
- The Machine Learning Engineer Toolkit
- Hands-on Demo - Building a Machine Learning Model from Scratch
- What's Next - Materials and Resources
- Q&A

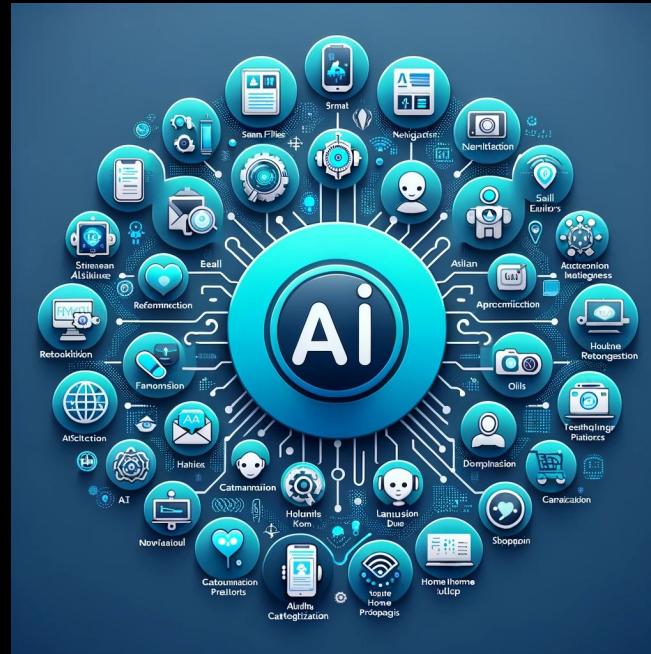
What is Artificial Intelligence?

What's Artificial Intelligence

- **Definition**
 - The science and engineering of creating intelligent agents that can perform tasks autonomously by interpreting, learning from, and acting on their environment based on data, with an aim to simulate human-like cognitive processes.
- **History**
 - 1956: Term "Artificial Intelligence" coined at Dartmouth workshop.
 - 1980s: Rise of expert systems.
 - 1997: IBM's Deep Blue defeats world chess champion.
 - 2011: IBM's Watson wins Jeopardy! against top human contestants.
 - 2016: Google's AlphaGo defeats world Go champion.
 - 2022: ChatGPT Research Preview Released

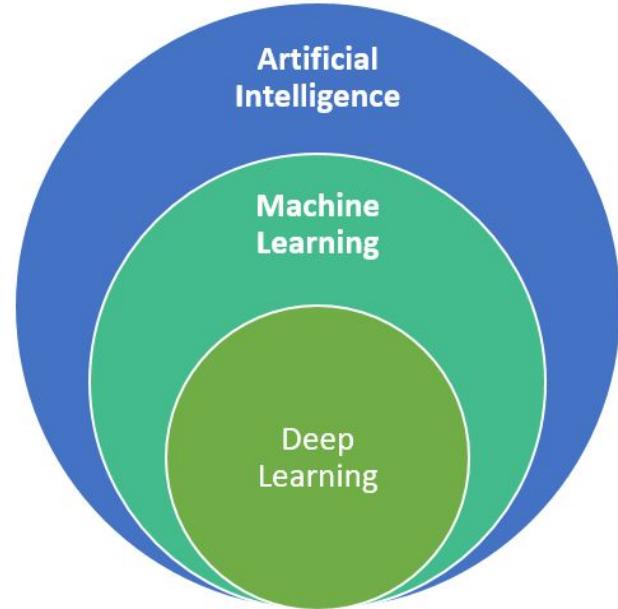
AI in Your Daily Life

- Recommendations Systems (e.g., Youtube, Amazon)
- Smart Assistants (e.g., Siri, Alexa)
- Navigation (e.g., Google Maps)
- Spam Filters (e.g., Gmail)
- Voice-to-Text (e.g., Google Keyboard)
- Language Translation (e.g., Google Translate)
- Facial Recognition (e.g., FaceID)
- Customer Support (Chatbots)



AI vs ML vs DL

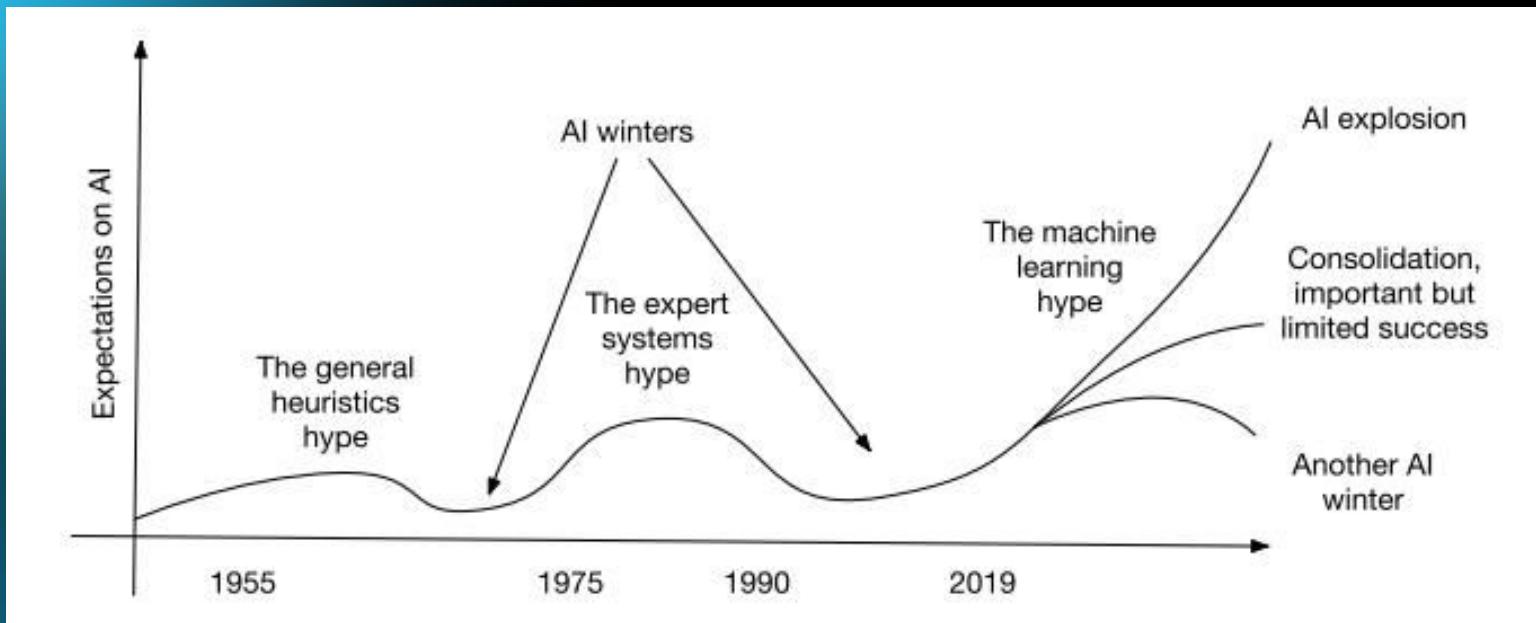
- Artificial Intelligence
 - Broad field of study in computer science focusing on emulating human intelligence and decision making
- Machine Learning
 - Enable systems to learn & improve from experience
 - Driven by the increase in user generated content and data
- Deep Learning
 - Specialized form of Machine learning that emulates the human brain's structure and function using artificial neural networks

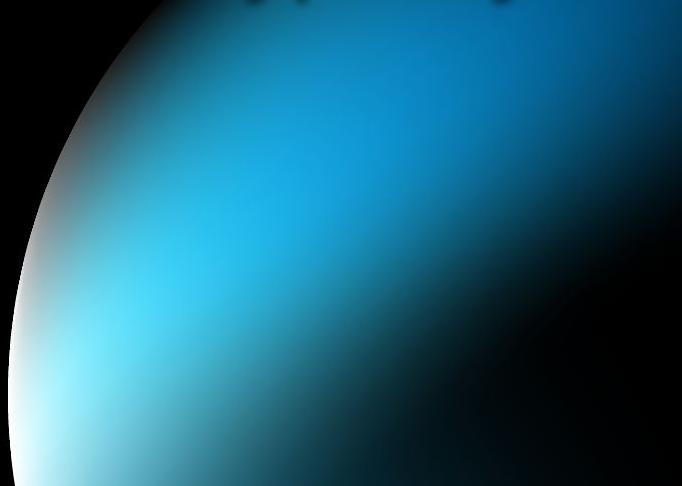


AI Hype - Why Now?



AI Hype Cycles and Winters





Is This Hype Cycle Any Different?

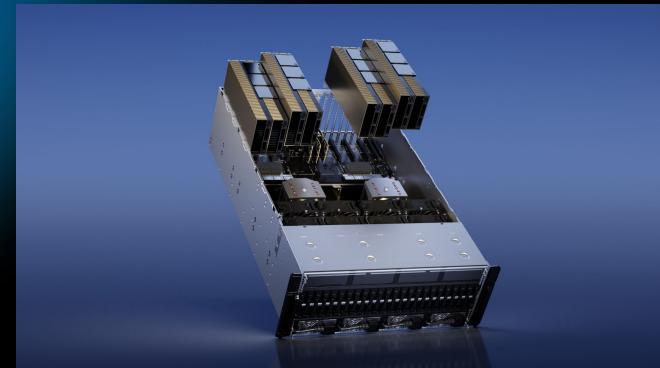
Data Abundance

- **Explosion of digital data: Social media, e-commerce, IoT devices.**
- **Cheap storage solutions: Cloud platforms (AWS, Google Cloud, Azure).**
- **Advanced data collection tools: Sensors, cameras, and user-generated content.**



Computational Power

- Graphical Processing Units (GPUs): Optimized for parallel computing essential for deep learning.
- Specialized AI hardware: TPUs, neuromorphic chips.
- Quantum Computing?



Software & Algorithmic Innovations

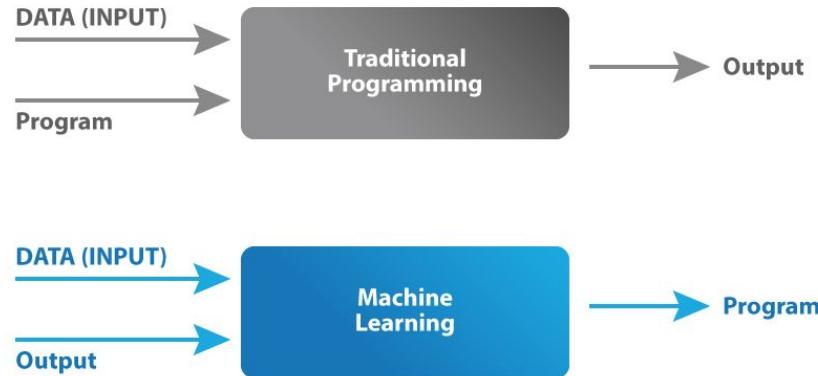
- Evolution of neural network architectures: CNNs, RNNs, transformers.
- Transfer learning & pre-trained models: GPTs, BERT, ResNet.
- Open-source libraries and platforms: TensorFlow, PyTorch, Keras.



How Do Machines Learn?

Inputs & Outputs

- Machines learn from data:
Pictures, text, numbers.
- Predict an outcome (output)
based on given information
(input).



Types of Learning

- Supervised: Learning with labeled examples
 - Regression: Learning numerical values (e.g., housing prices)
 - Classification: Learning categorical values (e.g., labeled photos of cats and dogs)
- Unsupervised: Learning from unlabeled data to find patterns or clusters (e.g., grouping customer segments).
- Reinforcement: Learning by doing and receiving feedback (e.g., video game AI improving over time).



SUPERVISED
LEARNING



VS

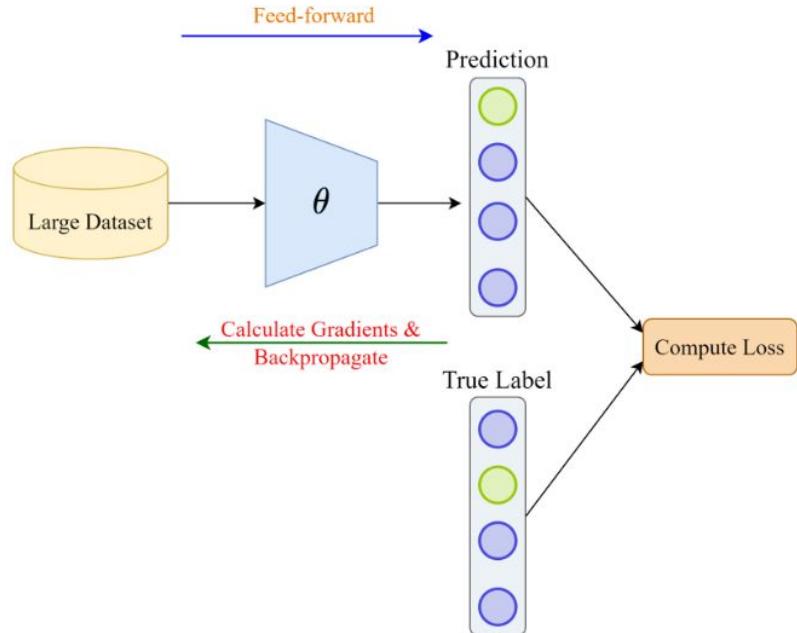
UNSUPERVISED
LEARNING



REINFORCEMENT
LEARNING

The Learning Process

- The goal is to learn how to map inputs to outputs (finding $f(x) = y$)
- The model (f) contains a set of learnable parameters
- The learning algorithms defines a “loss function”
- Repeat the learning process to minimize the loss



Model Evaluation

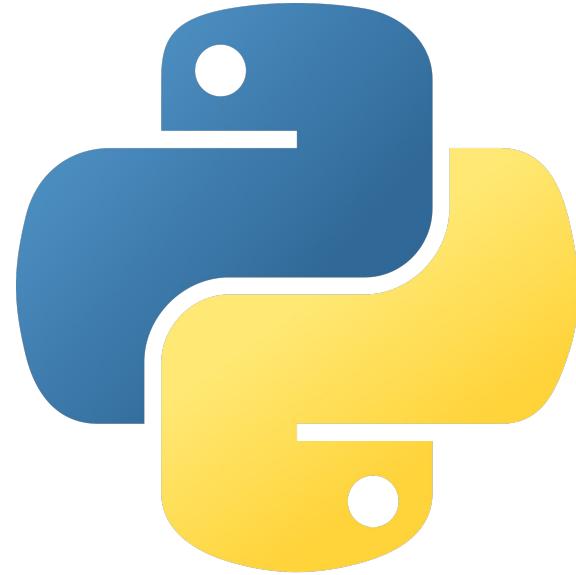
- **Testing & Validation**
 - Ensuring our model works well on unseen data.
- **Underfitting vs Overfitting**
 - Underfitting: Low accuracy on training and testing set
 - Overfitting: High accuracy on training set but low on testing set
 - Right Fit: High accuracy on training and testing set
- **Evaluation Metrics**
 - Different applications and algorithms require different evaluation metrics
- **Ethical Considerations**
 - Bias & Fairness
 - Model Interpretability



The Machine Learning Engineer Toolkit

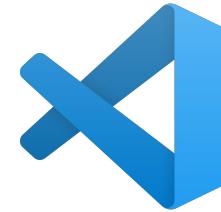
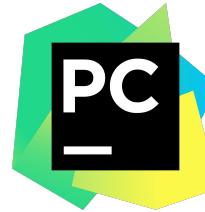
Development Environment

- Python: Primary language for ML, favored for its rich ecosystem and extensive libraries.
- Alternatives:
 - JavaScript: Suitable for web-based ML models (e.g., TensorFlow.js).
 - Java: For enterprise applications.



Programming Languages

- Editors & IDEs
 - PyCharm: Comprehensive Python-specific IDE.
 - Visual Studio Code: Versatile with extensions for various languages and tools.
- Jupyter: Interactive environment ideal for data analysis and ML prototypes.
- Colab: Cloud-based platform with GPU/TPU support; great for collaborative work.



Package Management

- The Python Package Index (PyPI): a repository for Python software packages. Pip is a package manager for installing and managing Python packages
- Environment Managers
 - Venv: Standard utility to create isolated Python environments.
 - Anaconda: Popular distribution for science, math, and ML packages with support for managing dependencies within isolated environments.



Machine Learning Libraries & Frameworks

Data Analysis & Engineering

- Numpy
 - Fundamental package for scientific computing with Python.
 - Provides array objects, mathematical operations, and more.
- Pandas
 - Open-source library providing high-performance, easy-to-use data structures, and data analysis tools.
- Matplotlib
 - 2D plotting library producing publication-quality figures.
 - Can visualize a wide variety of data formats.



ML/DL Frameworks

- **Scikit Learn**
 - A free software machine learning library for Python. It features various classification, regression, and clustering algorithms.
- **TensorFlow**
 - A comprehensive, open-source ecosystem of frameworks and libraries developed by Google. Known for its flexibility and support for deep learning and neural networks.
- **PyTorch**
 - An open-source machine learning library created by Facebook. It emphasizes flexibility and allows dynamic neural networks.

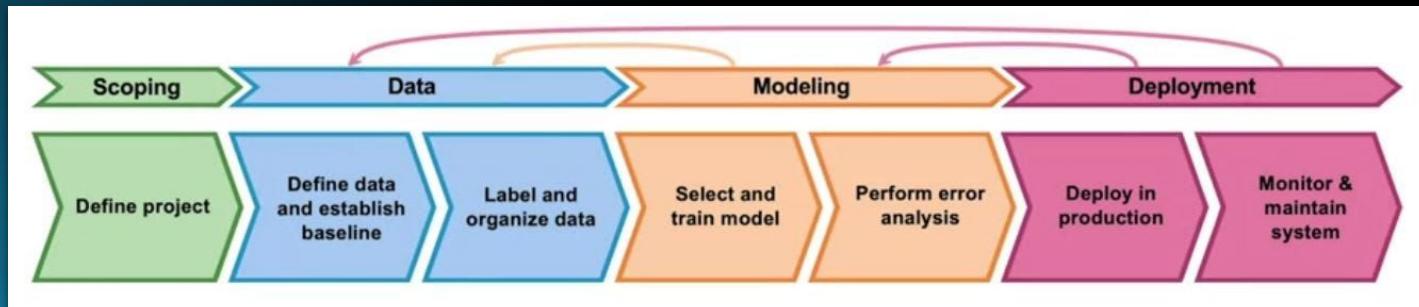


TensorFlow



Full Stack Machine Learning Lifecycle

- **Scoping**
 - Defining project requirements and goals
 - Identifying data sources
- **Data Engineering**
 - Data cleanup and preprocessing
 - Feature Selection
- **Modeling**
 - Model selection & configuration
 - Training & Evaluating
- **Deployment**
 - Optimize model for serving
 - Monitor performance



Hands-On Exercise

Recap

- What is Artificial Intelligence?
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- AI Hype - Why Now?
- How Do Machines Learn?
- Machine Learning Engineer Toolkit

What's Next - Materials and Resources

- Books
 - ["Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron](#)
 - ["AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence" by Laurence Moroney](#)
- Courses:
 - ["Machine Learning Specialization" by Andrew Ng](#)
 - ["Deep Learning Specialization" by Andrew Ng](#)
- Documentation & Websites:
 - Python Libraries:
 - [Scikit Learn Documentation: Comprehensive guide to using Scikit Learn.](#)
 - [TensorFlow Official Guide: Deep dive into TensorFlow functionalities.](#)
 - [PyTorch Tutorials: Practical guide to understanding and implementing with PyTorch.](#)
 - Community & News:
 - [Towards Data Science: Medium's community of data science and ML enthusiasts sharing insights, projects, and tutorials.](#)
 - [Practical AI Podcast: Discussions on the latest in AI research, ethics, and developments.](#)
 - [Hugging Face Daily Papers: A daily updated feed of the latest papers in AI research](#)

Q & A

Thank You!

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