AI Fundamentals for Students

🤖 AI - A Machine That Can Think?

🌍 AI is Everywhere.

❓ But What is AI Actually?

Computers are getting smart!

Definition of Artificial Intelligence = Machines, computers, systems that think and learn independently

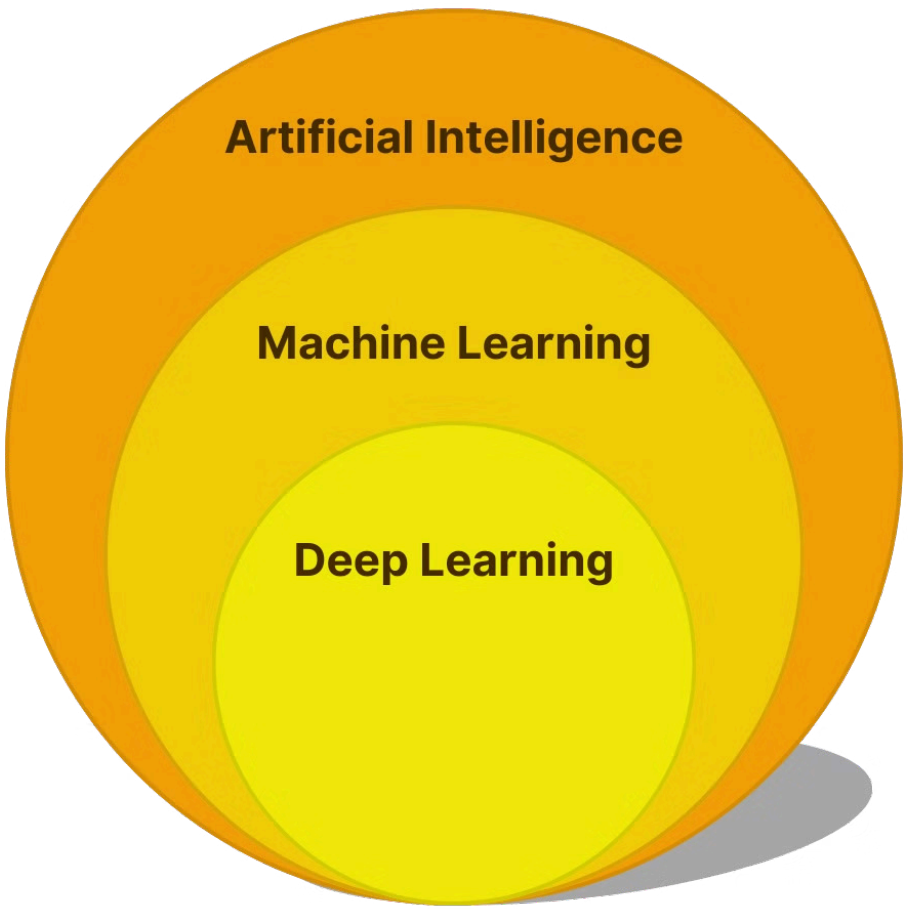
ⓘ [Definition of AI on Wikipedia]

AI can recognize patterns, make decisions, and solve problems. It can replace human intelligence for certain tasks.

📌 How does it work?

AI uses data and algorithms to learn. The more data, the smarter it becomes!

Visual Hierarchy of AI



Early Milestones and Foundations

1

1950 – Turing Test

Alan Turing develops a test procedure to evaluate machine intelligence.

2

1956 – Dartmouth Conference

Beginning of systematic AI research. The term "Artificial Intelligence" is coined.

3

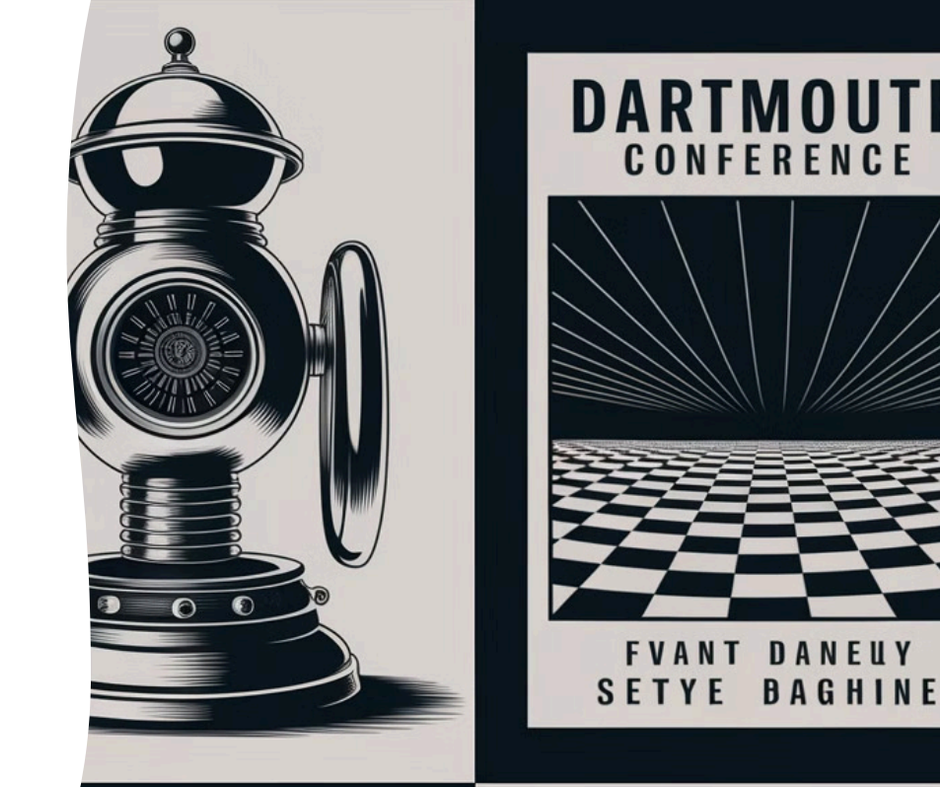
1997 – Deep Blue vs. Kasparov

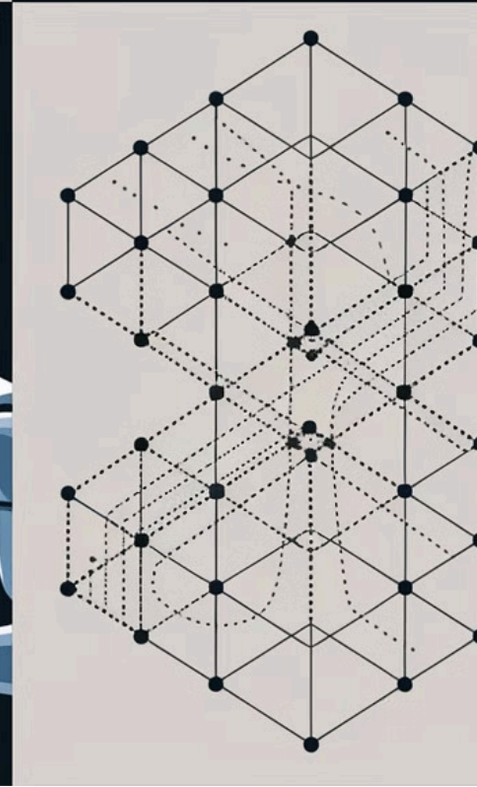
IBM computer defeats the world chess champion - a breakthrough for AI in games.

4

2006 – Rise of Deep Learning

Neural networks enable more powerful AI models.





Modern Developments After 2016

1

2017 - Transformer Model

The "Attention is All You Need" - AI language models become more efficient.

2

2019 - GPT-2 & 2020 - GPT-3

AIs generate coherent high-level texts for the first time.

3

2022 - ChatGPT & 2023 - GPT-4

AIs become interactive & widely usable in everyday life.

🤔 Where is AI hidden in your daily life?

🌟 AI is super useful, but not perfect.

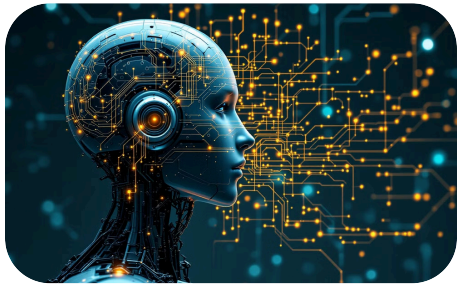
What AI do you use daily and why?

Name at least 3 applications.

🤖 The Four Types of Artificial Intelligence

Machine Learning (ML)

AI learns from example data and finds patterns independently.



Deep Learning

A special form of machine learning with many "layers" of artificial neural networks.

Computer Vision

AI models that can analyze and understand information in images and videos.

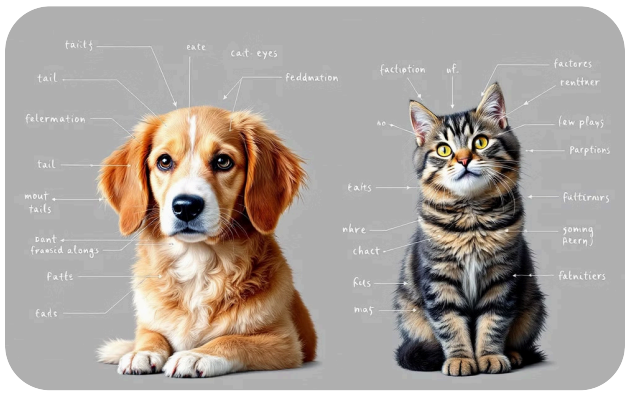
Generative AI

This AI can create new content: texts, images, music.

🔎 Comparison of AI Technologies

AI Approach	Brief Description	Examples
Machine Learning (ML)	Computers learn independently from data and recognize patterns.	📧 Spam filter recognizes unwanted emails 🔄 Recommendation systems (Netflix, YouTube)
Deep Learning	Uses deep neural networks to learn complex relationships.	📸 Image recognition (object detection in photos) 🎙️ Voice assistants (Siri, Alexa)
Computer Vision	Analyzes images and videos and recognizes objects and patterns.	🚗 Self-driving cars 😁 Facial recognition (FaceID)
Generative AI	Creates new content instead of just analyzing data.	💬 ChatGPT (generates text responses) 🎨 DALL·E (paints images) 🎵 AI-generated music (composes songs)

🧠 How does a machine learn? (Explaining Machine Learning)



Learning from Examples (Supervised Learning)

A computer receives many images of dogs & cats with the correct answer. It recognizes patterns (e.g. "Cats often have pointed ears").

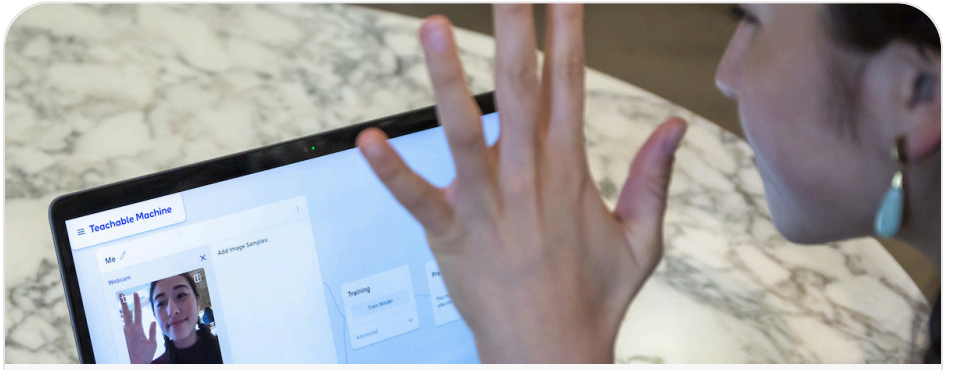
Learning without Guidance (Unsupervised Learning)

The computer receives only images, but no categories. It groups similar images independently, without knowing what is in them.

Learning through Rewards (Reinforcement Learning)

AI tries out various actions. Good decisions are rewarded, bad ones are punished (e.g. in games).

Machine Learning - Exercise



TM teachablemachine.withgoogle.com

Teachable Machine

Train a computer to recognize your own images, sounds, & poses. A fast, easy way to create machine learning...

Try it out!

🧠 The more data, the better!

🔁 AI needs many examples and repetitions to reduce errors.

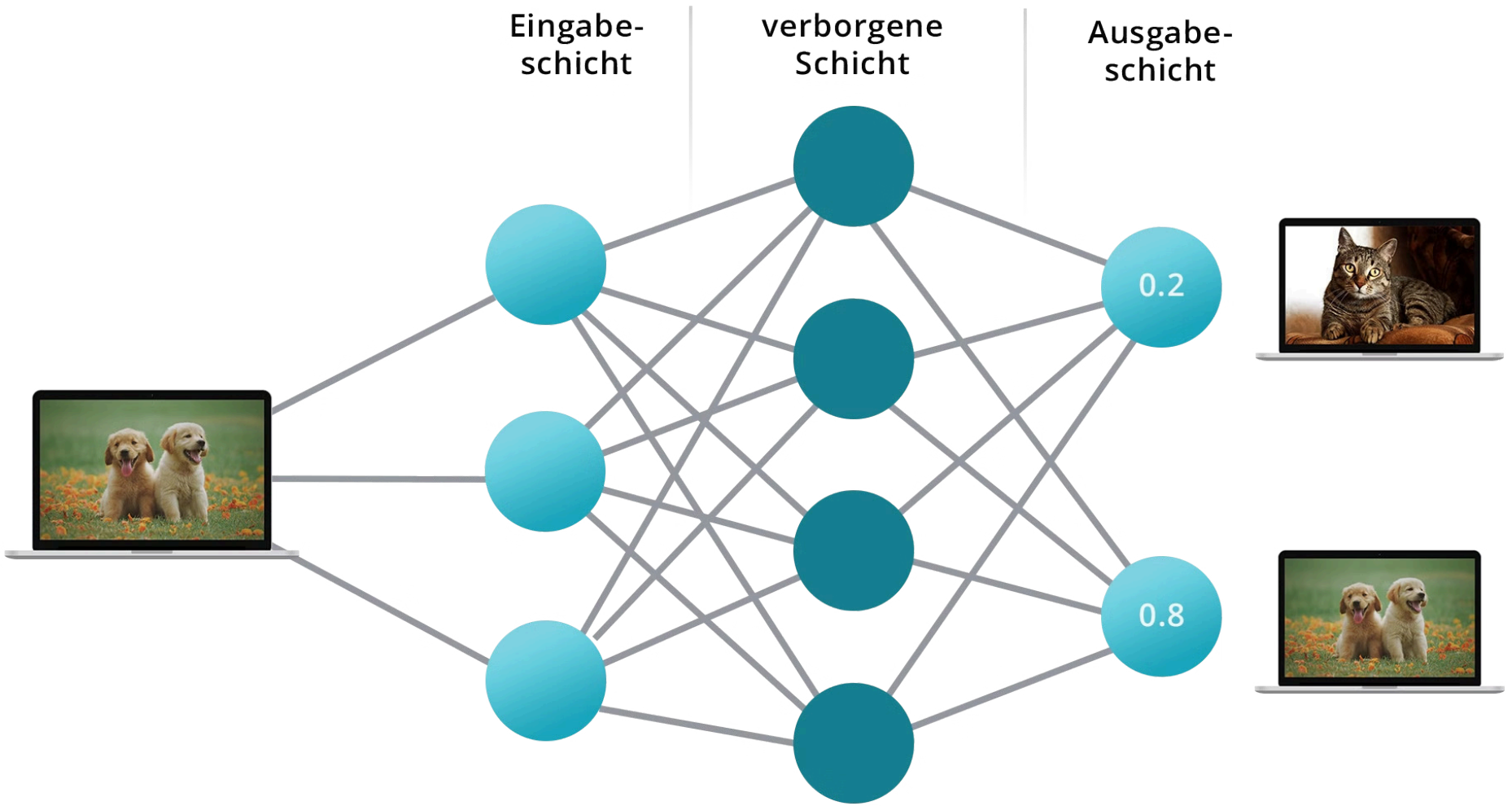
🔢 Algorithms help learn from mistakes - similar to how we humans do.

🧠 Neural networks are often used here

What are neural networks?

- Artificial neural networks are inspired by the human brain 🧠.
- They consist of many interconnected, simple elements - the neurons 🔗.
- These neurons work together to solve complex problems 🏆.

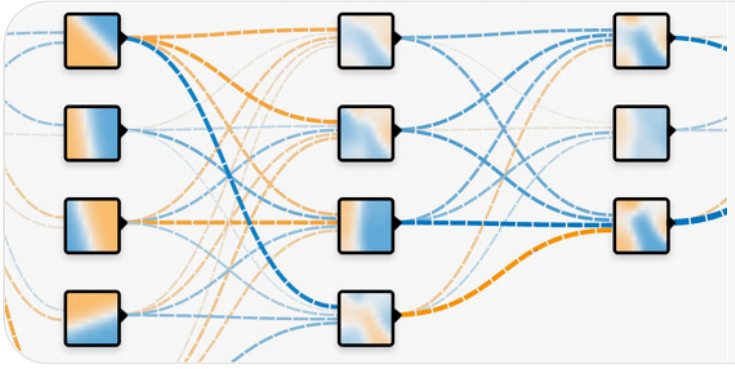
Building a Neural Network



How does a neural network learn?

- **Each connection has a weight ⚖️ that determines how strongly one neuron influences the next.**
- **Through training, the network automatically adjusts these weights 📈.**
- **Errors are detected and corrected, so the model improves over time ✅.🤖 How does an LLM work?**

⚙️ Neural Networks - Exercise



https://playground.tensorflow.org/#activation=tanh&batchSize=10&dataset...

Tensorflow — Neural Network Playground

Tinker with a real neural network right here in your browser.

Try it out!

🗣️ Large Language Models (LLMs)

- What's behind them? -

💡 ChatGPT and Co. are "large language models" (LLMs).

❓ But what exactly is that?

Well-Known LLMs

- ChatGPT (from OpenAI)

  Gemini (from Google)

  Claude (from Anthropic)

- LLaMA (from Meta)

👩‍💻 LLMs by region

USA

- ChatGPT
- Gemini

Europa

- Mistral
- Gopher

China

- DeepSeek
- Ernie

🤖 How does an LLM work?

📚 Massive Knowledge

- **Trained on millions of books, websites, and articles.**
  Recognizes patterns in language and calculates probabilities for meaningful responses.

🧠 Neural Network & Deep Learning

Consists of billions of parameters (= adjustable weights in the network).

- **Learns how words and sentences fit together.**

💬 What can an LLM do?

✅ **Answer questions**
Summarize texts
Translations
Engage in fluent conversations

⚠️ Caution: LLMs only imitate understanding!

❌ **No true "thinking" - only pattern recognition.**
❌ **Errors possible ("hallucinations").**

Outlook

🤩 What opportunities does AI offer?

🤔 What challenges are there?