**Artificial intelligence**

1. Basics

Welcome to my presentation on Artificial Intelligence (AI). In this presentation, I will give you an overview of the topic of AI and discuss its applications in industry. As a prospective mechanical engineer, it is of particular importance for me to understand the opportunities and challenges of AI in my future career field. We will see how AI is being used in manufacturing and automation, as well as look at some specific application examples. I will also look at how AI is already helping us in many areas of our lives today without us perhaps realizing it. At the beginning of this talk, I want to mention that the introduction you're already hearing was written by an AI called ChatGPT.

ChatGPT is a text-based AI that you can currently use for free. In the last few months after its release, it has already become very popular. Many of you surely know it already.

At the end of November 2022 it became freely accessible

After only five days, the site had 1 million users

By January 2023, it already had over 100 million users.

Outline:

1) Basics

* + What is AI?
  + Types of AI systems
  + Machine Learning Methods

2) Application of AI

* + Already in daily life
  + AI in industry

3) Conclusion sentence

What is AI?

* + AI is a Subfield of computer science and refers to the ability of machines to perform human-like tasks, such as problem solving, learning, pattern recognition, and natural language understanding.

**Types of AI systems:**

* Maschine Learning
* Deep Learning

**Maschine Learning:**

Machine Learning is the general term for when computers learn from data. It describes the intersection of computer science and statistics where algorithms are used to perform a specific task without being explicitly programmed; instead, they recognize patterns in the data and make predictions once new data arrives.

**Deep Learning:**

Deep learning algorithms can be regarded as a complex evolution of machine learning algorithms.

Deep learning describes algorithms that analyze data with a logical structure similar to how a human would draw conclusions. To achieve this, deep learning applications use a layered structure of algorithms called an artificial [neural network (ANN)](https://levity.ai/blog/neural-networks-cnn-ann-rnn). The design of this is inspired by the biological neural network of the human brain, leading to a process of learning that’s far more capable, than that of standard machine learning models.

**What Is a Neural Network?**

It’s a technique for building a computer program that learns from data. First, a collection of software “neurons” are created and connected together, allowing them to send messages to each other. Next, the network is asked to solve a problem, which it attempts to do over and over, each time **strengthening the connections** that lead to success and diminishing those that lead to failure.

A very simple artificial neural network consists of an input layer, a hidden layer, and an output layer.

**To understand it better I want to show it to you with a simulation.**

The background color shows what the network is predicting for a particular area. The intensity of the color shows how confident that prediction is.

For example, OpenAI's GPT-3, which is behind ChatGPT, consists of 48 billion input layers, 96 Layers and 175 billion parameters.

**Machine learning methods**

* **Supervised Learning**
* **Unsupervised Learning**
* **Reinforcement Learning**

**Supervised Learning:**

In this process, the algorithm is given well-defined inputs and associated target outputs. The algorithm analyzes the relationships between inputs and outputs to develop a working prediction or classification capability.

**Unsupervised Learning:**

The model has no predetermined labels or classes to train on data. Instead, it attempts to recognize and learn patterns and structures in the data itself. This is used when the data has no clear structure or classification.

**Reinforcement Learning:**

During this process, an agent learns through rewards and punishments how to act in its environment to achieve certain goals.

**Video „I am AI “ (NVIDIA)**

2) Application of AI

**Already in daily life:**

Nowadays, there are already many applications in our everyday lives that we are no longer aware of.

* Voice assistants on Smartphone (like Siri and Alexa)
* Online shopping and advertising
* Recommendation systems (like Netflix, Amazon and YouTube)
* Robots used in factories

And into the applications of AI in industry, I would like to tell you a little bit more now.

**AI in industry**

* AI Based Robots
* Product Development
* Visual Inspections and Quality Control
  1. **AI Based Robots (Pick and Place vs. Bin Picking)**

Here I would like to take a closer look at the bin picking problem.

Some of you are already familiar with "simple" pick and place tasks and can already program them with a Kuka or UN robot. But how does it look when the objects are no longer to be taken precisely always at the same place.

(Folie wechseln)

And position, rotation and obstacles change. A very common application of AI based robots is the bin picking task. Where a robot has to pick items from a bin that are not sorted. As it often is in practice.

Through the use of simple sensor technology and Deep Learning, AI reduces the training process needed to teach industrial robots to pick the correct objects out of a bin.

(Folie wechseln)(Video: Clear Objects)

Industrial bin picking applications are non-repeatable in that the part isn’t always in the same orientation. Industrial bin picking is a 3D application that involves using a robotic system to do all of the following:

* Find part in bin
* Plan path from pick to place avoiding singularities and joint limits
* Enter bin in specific pose for part orientation
* Avoid damaging nearby parts
* Exit bin and place part in correct orientation without hitting environment
  1. **Product Development (Generative Design):**

Generative design is a method in which a computer algorithm generates and optimizes many possible solutions. In doing so, the algorithm considers certain key data and objectives, such as material, cost and functionality. The best solutions are then presented to the user, who can choose from them. This method can reduce the time and resources required in the design process and produce innovative, creative solutions.

(Titelfolie “weg”)(Folie wechseln)

From a CAD model, an optimized concept shape is generated, which is then calculated differently depending on the manufacturing process.

Manufacturing Methods:

* Legacy
* Casting
* Subtractive (2,5 Axis/ 3 Axis/ 5 Axis)
* Additive

**Advantages:**

* Minimize part weight
* Maximize stiffness
* Reduce cost
* Optimize material usage
  1. **Visual Inspections and Quality Control:**

AI systems are used to automatically check the quality of products and detect defects.

**Detection of:**

* Positioning
* Completeness
* Cracks
* Scratches
* Color
* Differences
* External defects

**Conclusion sentence:**

"Overall, artificial intelligence has the potential to change the way we live and work, and it will be exciting to see how it continues to shape and improve various industries in the future."

By ChatGPT

My little helper in this presentation.

If you have any questions, please do not hesitate and ask them ChatGPT

Here are my sources

Thank you for your attention

**Sources:**

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