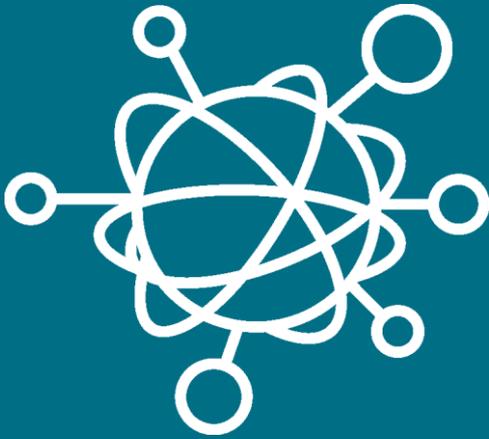# Artificial Intelligence:
Computer Vision – an Introduction

A lexoro Whitepaper

Munich, January 2020

Written by Michael Fischbäck

SCAN-X
powered by lexoro

Contents

The need for AI

∨

$31.24 billion - this figure comes from a Statista study. The study looks at **worldwide sales forecasts of business applications in the field of artificial intelligence up to 2025**. In comparison: $4.8 billion is forecast for the same statistic in 2020. With regard to this forecast, the question arises "What is the decisive factor for the almost exponential expected growth"?

This white paper will explain aspects of the basic necessity of AI, the growth factors and their challenges. The core topic deals with one category of AI - computer vision - its origin and development and the current status quo of the technology.

Artificial intelligence and its applications will meet the predicted growth potential in the years to come! This is supported by countless studies and forecasts from a wide range of industries and branches. The cause of this huge increase in sales has several factors. The overall catalysts are faster and faster computers which can process larger and larger amounts of data. As a result, more and more complex and costly tasks can be automated and optimised. Make use of the potential savings - made possible by artificial intelligence!

The key phrase "potential savings" is a broad but often-used term which should not be used as a basis for making decisions.

lexoro describes three main advantages which make it possible to objectively measure whether and to what extent artificial intelligence can optimise a company:

- Cost and time savings
- Precision & quality assurance
- Independent learning & automation

The main reasons why companies are still reluctant to use artificial intelligence despite the clear advantages can be found in a study carried out by Deloitte in 2019.

They interviewed AI experts worldwide, including 100 decision-makers from German companies. The biggest risks and challenges are the lack of trust in artificial intelligence and its advantages, as well as data protection. Furthermore, according to the study, inadequate data quality and the inability to identify use cases, coupled with a lack of skills and specialists in the company, are the greatest challenges.

Businesses need to do away with these concerns or take precautions to prevent cyber risks.

This is also confirmed by the results of a survey by adesso, in which 329 decision-makers were interviewed. The result: almost 50% see the use of new technologies such as AI as a key challenge for the next three years. This percentage makes it clear that a large number of German companies will implement AI applications in the coming years. It's important to develop concrete plans and strategies at an early stage. Otherwise it is questionable whether competitiveness can be guaranteed in the long term.

Origin & development of computer vision

Artificial intelligence is known to be a very large subject area with a wide variety of technologies, characteristics and aspects. Classic examples are machine learning, natural language processing and computer vision.

Over the years, lexoro has specialised in computer vision, among other things. Since then, as an IT solution provider with SCAN-X, we have been taking on software projects in individual applications.

Computer vision in a nutshell: computer vision is a research area of artificial intelligence which deals with the question of how machines can see and understand digital images and videos. With the aim of approximating or exceeding the hit rate compared to the human level, this information should be made usable for further processes.

Research in this area of artificial intelligence began 60 years ago. At that time, two scientists - David Hubel and Torsten Wiesel - were able to prove via initial tests that visual processing always begins with simple structures, such as edges. In the 1960s, a project was started at MIT with a small group of students to develop a platform which would implement automatic level segmentation. Although the project failed, it is commonly referred to as the birth of computer vision. Supported by innovations in technology and performance, further improvements and developments in technology were carried out in the decades which followed.

However, the first real breakthrough came in 2012, when a team from the University of Toronto developed a new model - the so-called AlexNet. As a result, the error rate of image classification could be reduced from 26% to 16.4%.
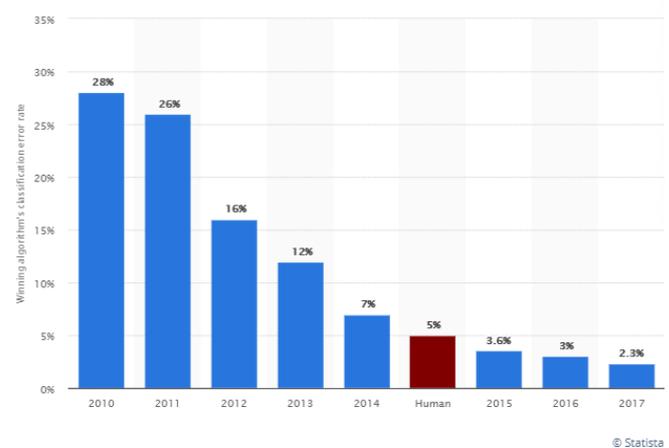

Fig. 1: Statista 2020: error rates in image recognition from 2010 (28%) to 2017 (2.3%) compared with human ability (5%)

The Statista graphic above shows the progress which has been made since the "big breakthrough". Computer vision was able to significantly exceed human capabilities and further potential for improvement can no longer be ruled out. Because of this, computer vision is extremely relevant in the company-wide AI environment, on the one hand due to its enormous performance, and on the other hand due to its individual options for application. The importance of computer vision is underpinned by a study published by "Markets and Markets" in their Market Research Report. The global computer vision market is forecast to grow from $11.9 billion to $17.4 billion between 2018 and 2023.

Features & status quo

∨

Due to the ongoing improvements in technologies and possibilities, it isn't easy to define a status quo. One reason for this is constant innovation with new use cases.

A suitable example is demonstrated by a breakthrough in computer vision which took place in the United States a few months ago: Researchers were able to recognise and determine 3D objects for the first time. The groundbreaking aspect here was training the model with deep learning. The system for recognising the object was "fed" exclusively with CAD data in order to train neural networks. Until then, there had to be a physical element which had to be photographed about 50 times to collect the necessary data.

One advantage of this procedure is the increased efficiency, since a significantly larger number of objects can be inte-grated into the system in a much shorter time.

Since the computer vision breakthrough in 2012, these kinds of innovative research results are no longer uncommon. WIPO (World Intellectual Property Organisation) has collected and published appropriate figures on this topic in its study on technology trends. Accordingly, there has been a "patent boom" in the field of artificial intelligence since 2012. Almost 50 percent of all patents related to AI mention computer vision, with an average annual growth rate of around 25 percent. It is therefore not surprising that computer vision comes first among functional applications.

Building on the two most relevant innovation factors (improved connectivity and better computer perfor-mance), various "building blocks" have been researched and developed in recent years which are used individually or in combination to solve complex problems and questions.

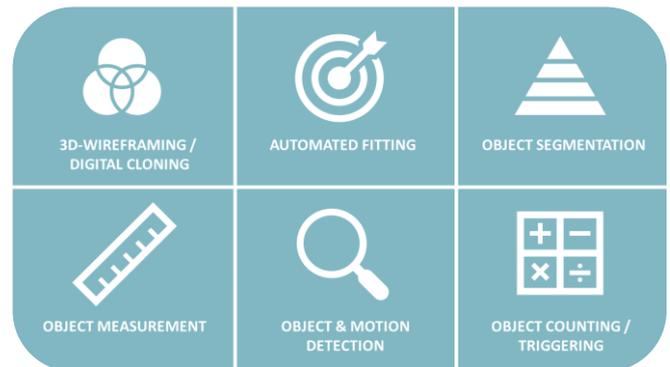With SCAN-X technology, lexoro currently defines six "features":

Fig. 2: Overview of the six features of computer vision

Object segmentation:
automatic segmentation of the object from the background for digital processing operations
Object counting/triggering:
Counting of typal objects
Automated fitting:
automatic adjustment of different objects for fitting
Object & motion detection:
automatic object and motion detection by scanning (e.g. with a smartphone)
Object Measurement:
measurement of the object according too various attributes (length, depth, height, etc.)
3D wireframing/digital cloning:
generation of a point cloud for further use of the digital clone in various application environments

Summary & conclusion

∨

Countless studies by various well-known institutions show that the upheaval and trend towards new technologies are coming or have already been implemented in many areas. The advantages are obvious, as are the risks. It is therefore important to use the positive aspects for competitive advantages and to counter the risks.

A considerable part of this is in computer vision. With almost 50% participation in AI patent applications, computer vision is already a crucial influencing factor in the AI world of the future. Driven by innovation, research and technological progress, groundbreaking achievements have been made in this field over the past decade. In the meantime, human capabilities are far exceeded by the possibilities of vision systems. As a result, increasingly complex projects with more difficult challenges can be implemented and solved automatically.

The most important thing here is not to implement artificial intelligence in the company or implement projects on this topic at all costs. On the contrary, market share and profitability should still be the main concerns.

This means that for lexoro, the return on investment (ROI) has a very high priority and importance. In combination with the afore-mentioned advantages - if implemented correctly - you can achieve enormous competitive advantages in order to generate sustainable added value for your company.

The decisive criteria: the correct implementation of the right use cases! The development of know-how and expertise is a costly and lengthy process, which in many cases doesn't lead to the desired result.

In recent years lexoro has specialised in Computer Vision topics as an IT solution provider and is therefore the ideal partner to implement your projects with you.

State institutions, pharmaceutical companies, retailers or companies in the manufacturing industry: use cases and fields of application of artificial intelligence are almost everywhere.

If you believe that your company is ready to head into the next few years fit for the future, please visit our website **www.lexoro.ai** and speak to one of our experts about your plans and concerns without any obligation.

**Contact us now!
Just click here!**

List of figures & references

ᐁ

List of figures:

- Figure 1: Error rates in image recognition from 2010 (28%) to 2017 (2,3%) compared to human ability (5%) **https://www.statista.com/statistics/808190/worldwide-large-scale-visual-recognition-challenge-error-rates/** (20.1.20)
- Figure 2: Overview of the six features of computer vision defined by lexoro

List of references:

- Breitkopf, A. (2018, Dezember 17). Prognose zum Umsatz mit Unternehmensanwendungen im Bereich Künstliche Intelligenz weltweit im Jahr 2025. Viewed on 10th of January 2020, at

  https://de.statista.com/themen/3103/kuenstliche-intelligenz/
- Sallaba, M. (2019). KI-Studie 2019: Wie nutzen Unternehmen Künstliche Intelligenz?. Viewed on 13th of January 2020, at

  https://www2.deloitte.com/de/de/pages/technology-media-and-telecommunications/articles/ki-studie-2019.html
- Gruhn, V. (2019, Januar). KI Report 2019. Viewed on 10th of January 2020, at

  https://ki.adesso.de/de/erste-schritte/
- Demush, R. (2019, Februar 26). A Brief History of Computer Vision (and Convolutional Neural Networks). Viewed on 14th of January 2020, at

  https://hackernoon.com/a-brief-history-of-computer-vision-and-convolutional-neural-networks-8fe8aacc79f3
- WIPO (2019). WIPO-Studie über Technologietrends 2019 – Künstliche Intelligenz. Viewed on 7th of January 2020, at

  https://www.wipo.int/publications/en/details.jsp?id=4396&plang=DE