# Artificial Intelligence (AI)

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## Demystifying AI

Historically, the efforts to develop AI have been aimed at equipping a computer with algorithms that allow it to react intelligently or behave like a human being. Even after decades of research, the development of a so-called "strong AI" is still a long way off. Many scientists (but not all) believe that it will never be achieved. Therefore, this "philosophical approach" is hardly pursued anymore, also because there is no meaningful and complete definition of human intelligence.

The problem starts with not knowing how to measure intelligence: The idea of doing this with an "intelligence quotient" (according to the "formula" "age of knowledge divided by age") has been adapted several times, but at best allows the comparison of people with very similar cultural backgrounds.

But also among humans, there is presumably not one intelligence, but characteristics/gifts in different directions. For example, Wahlster speaks of cognitive intelligence, sensorimotor intelligence, emotional intelligence and social intelligence, and other structures have also been suggested. In order to test whether a computer is intelligent, Turing's (A. Turing) simulation game is often quoted: A human A can ask two players any questions over the net, where one of the players is a human, the other a computer. If, after many questions and answers, A still doesn't know who the person is and who the computer is, then the computer is intelligent after Turing. So far, no computer has seriously passed the Turing test, although this is sometimes claimed by the chatbot called Eugene Goostman.

## Current developments of AI

In contrast to the “strong AI”, the "weak AI" is "only" concerned with overcoming concrete application problems. In fact, with methods such as "learning systems", "neural networks", analysis of large knowledge bases, use of optimization algorithms, etc., it has been possible exceed humans in many fields. In the following text, when we use the word AI without addition, then we use it to reference this, so-called “weak AI”.

One of the classic AI problems is probably chess, where famous chess players repeatedly predicted that it would be a long time before a computer would be the world's best chess player. But the specially developed chess machine Deep Blue from IBM beat world champion Kasparov in 1997 in a competition spreading over six games. However, earlier developments were also very successful, but the desired goal to understand human thinking better by such programs was never achieved: the computers won by "brute force" because of their speed and the storage of advantageous positions, etc. The computers were able to win by "brute force". In 2017 AlphaZero from Google astounded the chess world: The program had taught itself to play chess only on the basis of the gameplay rules, playing millions of games against itself. Meanwhile, there is no one left who can beat the world's best chess programs.

The Japanese board game Go has always been regarded as much more difficult for computers than chess because success requires a large-scale, long-term strategy. That's why it was believed until after 2010 that a breakthrough in Go could be a breakthrough in AI. But even here, DeepMind (a company that has been part of Google for some time) succeeded in creating a self-learning system with AlphaGo and its successors that is now considered the best Go player in the world. See (K. Müller et al.) on computer programs that master mental games.

It is these breakthroughs in mental games, in the use of extensive data sets for medical diagnosis, for economic forecasts, for solving legal problems, etc. that have led some computer scientists to believe that they are slowly approaching “strong AI”. This belief is supported by the fact that in the unusually severe quizz "Jeopardy" (Watson wins Jeopardy) the computer Watson defeated the best people, or that translation programs became so good that it seems that they understand the human languages.

Thus there is a group of computer scientists and journalists who warn loudly of the danger that the computers could enslave or dominate us in the near future. But even if such well-known people as Tesla and Space-X mastermind Elon Musk warn that humanity is in danger of turning into "dependent domestic cats" of super-intelligent computers, this is only a new infusion of the saying of the rightly famous AI MIT professor Marvin Minsky from the last century: "We will be lucky if computers will keep us as pets". By the way, Minsky didn't really mean this seriously like his statement "such negative scenarios are hard to take seriously".

If intelligence cannot be defined anyway, it is in our point of view idle to talk about computers that are superior to humans in intelligence in all aspects. Above all, such a strong AI is hardly conceivable without consciousness and feelings (love, hate, fear, joy,...), and such feelings are perhaps simulable, but are they therefore real?

## Concrete Examples

Undoubtedly, AI has a lot of exciting and useful applications. It should not be overlooked that it also brings dangers with it, but this topic is not discussed here. Of course, autonomous vehicles will statistically save many lives, but they will still be responsible for some fatal accidents. AI in warfare can be frightening. Automation through AI can lead to the loss of many jobs. AI-supported decisions, be it in medicine, business or anywhere else will not always be optimal, etc. But the limits of AI should also be clear: long before AI enslaves people, AI and media will be used to influence other people (which anyway is already the case). The following examples demonstrate some of AI.

The analysis of enormous amounts of data often requires the use of AI methods. Thus new correlations can be found, profiles of internet users can be created and used or misused, correlations between events and properties can be found, etc. But also with such applications, caution is appropriate: Sometimes correlations are found which are not causal.

For example, by analysing attacks on ships in the sea, one can find that "pirate attacks are more frequent where the water is clean". In this case, it is easy to see that there is no causal link between the two facts, but only an indirect one via the fact that the sea is particularly clean where there is no large city and no busy shipping lanes nearby and therefore little military/police presence.

However, there are cases where this lack of causality is less apparent or blurred. The statement "More cars produce more CO2, and are therefore jointly responsible for global warming" can hardly be contradicted. If the consequence is that we have to limit/abolish the cars in order to reduce global warming, we are wrong. This is how it looks causally: Every year, the earth's population grows by more than one per cent and the standard of living by 3 per cent. So the problem is that as the population grows and the standard of living rises, more and more cars are driving. So one would have to try to bring the world population to a standstill or to a gradual decline, and not to rely on continual economic growth!

In the much too little considered paper (C. Calude et al.), the problem of non-causal correlation is analysed very clearly. The work continues that of (M. Fricke) very much.

# Digital Libraries

## Presenting a specific scenario

In this part, we describe essential aspects that would be possible and desirable in future libraries, especially those that rely heavily on digital journals and books.

The tools for such a scenario are already available today or can be derived from existing ones with little effort. The more significant problems are of an economic and legal nature, as they arise from the cooperation with many publishers and thus create economic constraints.

## Initial situation

We assume that in the future, every library will have a comprehensive computer system for the entire administration of the library, its users and its holdings. In addition to the traditional physical borrowing processes, it is becoming easier to find out what material is available in the library via the Internet. Registered users can usually access digitized books (including brochures, journals and others) directly over the Internet (or at least from stations inside the library), but downloading content is generally not allowed or allowed only for personal use.

For example, all students and members of the Graz University of Technology can read in the most important scientific journals that are necessary for studies at the Graz University of Technology. It would be desirable that this is not bound to one location (but to a necessary identification) and that access also applies to conference proceedings and books. Of course, corresponding agreements have to be concluded with the publishers, and initially only part of the collections will be electronically readable.

Access in this sense is permitted by the (Web-Book) collection of Austria-Forum.org. In fact, almost all books, conference proceedings, brochures and journals are freely readable, but most of them are not downloadable (not even page by page). The basic ideas have already been laid down in (H. Mueller et al.).

## Extending without intervening into the collections

Many important libraries provide part of their materials in digitized form, but most of them don’t evaluate their usage statistics. Since those are already present and in hand-reach, this looks like a mistake to us. Even fewer are trying to receive user feedback.

For example, it would make much sense that the library's computer system may well be designed to keep accurate statistics on which books have been borrowed and for how long, or how long an electronic version has been read. If printed works are loaned physically, it would be particularly important to know whether other people were interested in the material during the period of the loan. Upon return, one could try to get the reader to answer some questions at the terminal in the library: How valuable is the content of the book, which was loaned? For whom would you especially recommend this book? Did you discover a mistake? Such additional information provided by the user could be useful and vital, but they have first to be recognized as such by the library. Some users might find it useful to get an email notification from the library when new works on a subject of interest become available.

If an article is consumed electronically, many people will hardly refuse to fill out a simple questionnaire at the end of the session. But even more important: Why isn't there a possibility to give feedback at every page/point, anonymous if desired, as suggested in (N. Delilovic et al.)? With little effort, the libraries could receive valuable user feedback, accordingly react to it, and thus improve the overall user experience and satisfaction.

Using the above recommendation, libraries would not only have the classical role of content providers, but they would also be essential for further content creation/improvement. Information gathered from their readers could be redirected to the authors who for sure, can only benefit from such information.

## Other extensions

We consider it questionable to allow a particular "group" to access some knowledge, but others not. We have mentioned that as members of the Graz University of Technology, we have access to many exciting journals, but in order to read them, we have to use a device connected on the university's local network, which means that we can't use it from home. We consider that a user identification system (username/password) would be more appropriate.

With such agreements, we might be able to read some new materials from the University of Graz, or from the Music Academy, journalists, politicians and such. All known figures indicate that this would not lead to some vast and unexpected numbers of users, as far too many people today already enjoy content with little or no qualitative value and hence consult serious libraries less often than they should.

Identified users suddenly would have many additional possibilities: They could bookmark interesting pages and quickly return to them at will. Bookmarks could, for example, have their own notes and comments or contain links which would point to other sources. For this, no consent of the publisher is required as these features are implemented a layer above the content (books, journals and such). Even more, it would be possible to set the comments visible for friends and colleagues who are interested in following the discussion. If the library decides that some comments, discussions, links and such are appealing for a wider audience, they could unlock them for the public. The library could, of course, create its own discussion thread or quizzes with the correct answer.

As said before, this happens in a layer above the original content, but this has to be implemented in such a way that it doesn’t compromise the user's privacy, author’s copyrights, publisher’s revenues and such.

## Let us think even further

The essential step would be to make the searchable text of the works available to the libraries, or at least the publishers themselves should offer the possibilities described below (for which they could request some additional compensation from the library).

Such information would make a recommender system very sophisticated and would require a lot of AI; for example, we could filter by:

* The author name, title, or some partially remembered text from the document/book.
* An area of interest and our level of expertise, this would provide us not only book titles and such but a list of relevant information and snippets about it. Example: Global warming provides us with 50 snippets arranged by actuality and reliability of the source, in the WWW or from a publisher.

In order to make such content filtering possible, metadata must be assigned not only to entire books but also to book pages that deal intensively with a specific topic. This automatic indexing of book pages is in general still an unsolved task, but methods that are reliable in many cases are well known.

In the example mentioned above, a library could potentially be better than any search engine. This is not only possible in the far future but is already in development for the next version of the Web-Books in Austria-forum.org.

But a digital library can do much more: e.g. as with the (web books) offer a page in several fonts or languages. Even the simultaneous collaboration of two people who have opened two different book pages on the same screen is no longer an issue.