

Machines & humans: a promising learning community

#Inspiration

Which characteristics must humans bring into the age of machine learning, in which situations are humans unbeatable and in which are machines top, and how long will a human workforce still be needed? Six astute people present their diverse perspectives on artificial intelligence and machine learning.



Increasing numbers of software programs surprise us with intelligent tips every day: Google Maps calculates the fastest route to work, Amazon suggests appropriate books, while Facebook warns of rain showers. However, not only in mundane matters, also in medicine, the legal world and in the office, machines are taking on more and more duties. They relieve us of routine tasks, process large data volumes and recognize patterns. How practical the solutions are depends today on how intelligently the rules for these decisions have been programmed. Deterministic algorithms are automatically executed by computers. The same false decisions are repeated numerous times. However, researchers have long since been experimenting with self-learning systems – which means that they do not stipulate how a problem should be solved, but instead program learning methods. The initial results of the paradigm shift from artificial intelligence to machine learning is now beginning to impact our lives and will significantly change how we work, communicate and manage relationships.

Gerd Folkers is a professor for pharmaceutical chemistry at the ETH and president of the Swiss Science and Innovation Council.

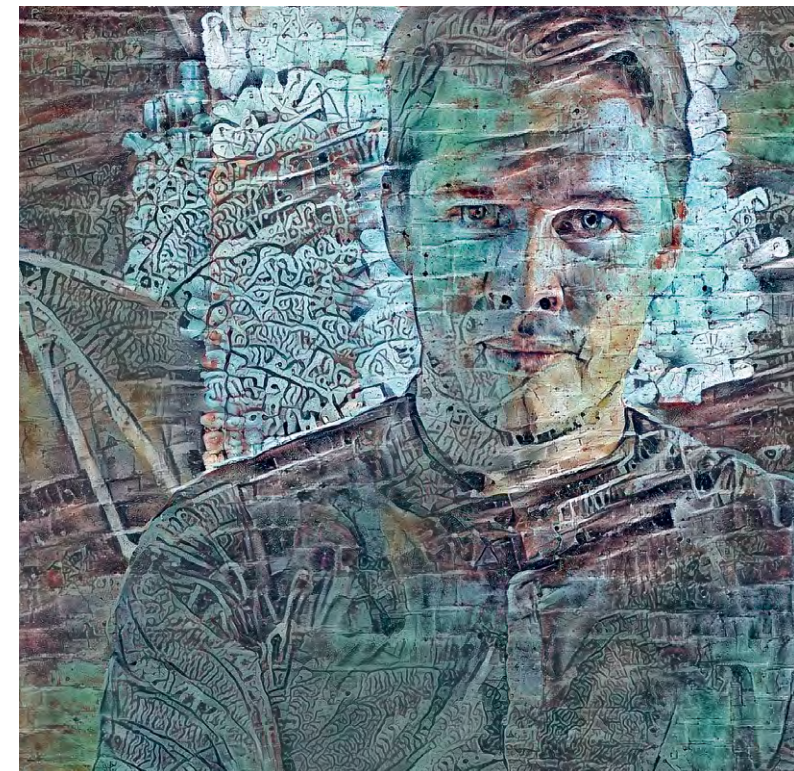
The chemistry professor on the invincibility of humans

What can humans, those error-prone, forgetful beings, offer to counter a 24x7 learning machine? “Critical thinking!” answered Gerd Folkers spontaneously. The ETH professor for pharmaceutical chemistry and president of the Swiss Science and Innovation Council, is convinced that humans are unbeatable in their ability to do the “unexpected.” When it comes to remembering, not forgetting and blending out, machines beat humans. We will therefore situationally outsource decisions to machines in the future: “A brain operation without a robot, imaging procedures and simulation technology are already nearly unimaginable today without machines. The advice of a doctor is not always free of side effects – there is no such thing as absolute objectivity. That is why a machine could know more about me as a patient than the doctor does,” according to Folkers. For example, a patient neglects to tell the doctor that he frequently forgets to take his pills or simply refuses to do so. A machine, such as an Apple Watch, would be able to analyze the behavior and then inform the doctor. “This offers a positive aspect for my health and a negative one for my self-determination. What is better? I don’t know!”

So who should one trust in case of doubt? Do machines make better decisions than humans? “If the opposing attorneys could broadcast advertising spots to influence juries and judges, then I would rather be judged by a machine. If the artificial intelligence of the future watches advertising spots on television, then it would no longer make a difference,” asserted Folkers, taking the idea further.

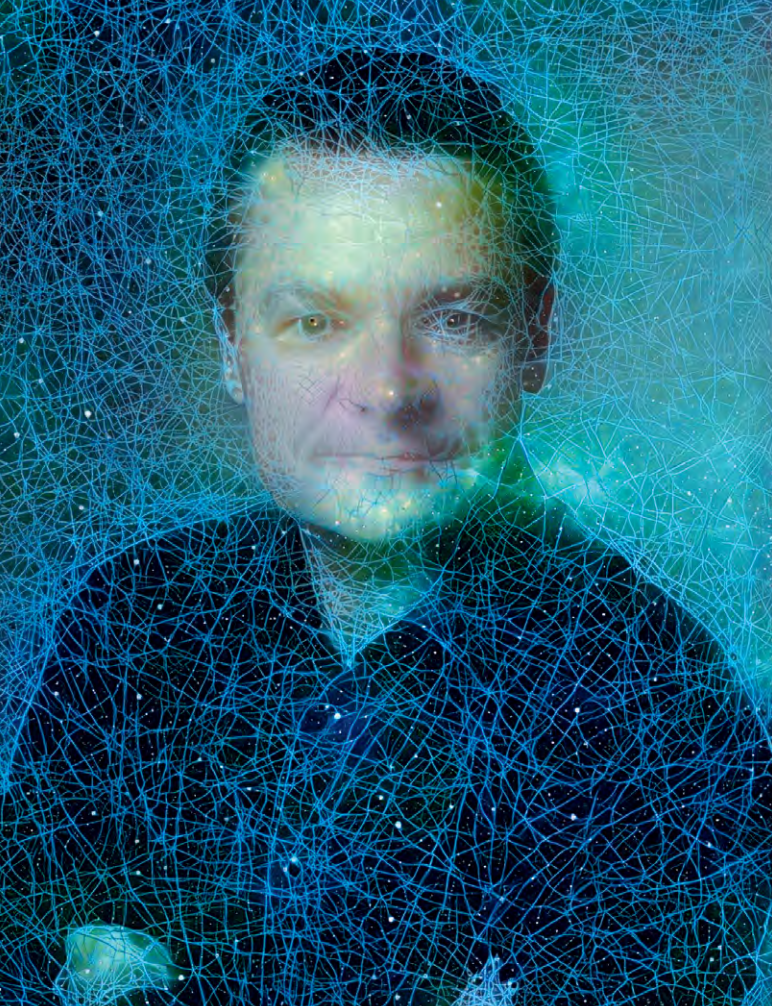
The innovation expert on the added value of humans

Which tasks will humans carry out if machines can take on routine tasks and everyday processes? “The range of tasks to be completed by humans will increasingly lie where systems or software do not provide added value,” opined Stephan Sigrist. The head of the renowned Swiss think tank W.I.R.E. is convinced that humans are unbeatable when it comes to recognizing complex associations, finding solutions or the development of surprising ideas in areas in which no experience yet exists. The scientist



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also attributes empathic abilities and trustworthiness to humans: “Counter to expectations, automation will not only impact people with low levels of education, but all professional groups. Even for CEOs, up to 30% of activities could be eliminated.” Conversely, particularly “simple” work – such as garden work in difficult terrains or caring for people – will continue to be performed by humans in the future. The complexity of the required skills does not correspond to the strengths of the machine. Stephan Sigrist assumes that in the future both the preparation of decisions and simple decisions will be outsourced to machines: “We will thereby gain more time or the freedom to dedicate ourselves to other things. By the same token, we will rely more on data when we make decisions,” according to the innovation expert. Whom would he tend to trust: the machine or the doctor? “For



Eberhard Scheuer is a qualified psychologist and e-health expert.



Christian Laux is a lawyer specialized in IT and digitalization.



Regula Rytz is a National Council member and President of the Green Party Switzerland.

screening for skin cancer, I would use software-based pattern recognition in an initial test, but then in a further procedure would want to discuss the results with a doctor. The goal is not to set humans and machines against one another, but to develop a system in which interfaces are created with which combined added value is created for companies, humans and society."

The doctor as "human interface"

Eberhard Scheuer knows that machines can already deliver better diagnoses than humans. The qualified psychologist and e-health expert even assumes that the tipping point has already been reached in medicine. "When it is a matter of clearly defined questions with a good data situation, then the machine beats the human every time: it is faster, less prone to errors and always reaches the same conclusion," according to the founder of the forum "Digitale Gesundheit" (digital health). Nevertheless, he does not believe that it will be possible to replace the medical profession with machines. "Pure rationality is just part of what it takes to be a doctor. Humans in combination with machine learning will

be the model of the future. The doctor can be the interface for the conveying of therapy recommendations made by the machine." In order for machine diagnoses to really be "useful," they must be transparent and forgery-proof. The expert recommends using two separate independent systems, and to consider the result only when they match; which is where the doctor in his role as empathic intermediary truly comes into play. And what does the lawyer think of this?

The lawyer: "Human judgment is better"

The lawyer Christian Laux, who is specialized in the fields of IT and digitalization, says that when it comes to legal rulings, the judge's decision must "only" (but nevertheless) be convincing. They may not violate the principles of law and an established methodology. "But it can be said that a result is never correct if the superior judge is not convinced. This shows two things: Law is a dialogue and decisions must be convincing." The lawyer does not assume that judges will be replaced by machines in the future. "However, it is possible that the 'scope' of the judges will grow smaller." With this statement, Laux hits at smart contracts: digital contracts

which automatically check and carry out the contract conditions. For legal questions that are more significant, automation may be conceivable, but more for simplifying findings and legal applications, not to replace them. "The decision must ultimately be made by a judge. That is because humans have better judgment than machines. Especially when a machine is used to make decision-related knowledge more quickly and reliably available."

The politician on bots as opinion mercenaries

Machines are being increasingly used in politics – in part with unforeseeable consequences, confirmed National Council member Regula Rytz: "Machines select, filter, like and 'speak' online – all with the goal of spreading pre-programmed opinions and to oil the advertising machine." The president of the Green Party considers this development to be dangerous: "Bots are digital opinion mercenaries and therefore represent a threat to democracy. This means that it is more important than ever to encourage critical thinking and independent media with journalistic quality!" Nevertheless, in view of the latest developments, we may now and then get the feeling

that better decisions can be made with the help of machine learning than may be the case in a democracy – ultimately, a system could combine all the experiences related to the respective situation to achieve an optimal solution. Regula Rytz was only willing to go along with this idea so far: "Machines can support people in forming opinions. Democratic decisions, however, are always multidimensional and cannot be reduced to the binary world of machines. Human politics requires a head, a heart and a backbone!"

A look into the future

The ethics professor on the unique characteristic of morality

The ethics professor Peter G. Kirchschräger from the University of Lucerne doubts that machines can develop moral judgment, a conscience or an understanding of the spirit. "In my opinion, what especially differentiates humans from machines is their morality." In this, the ethicist counts an attitude based on respect for human dignity, autonomy and reasonableness: and emphasizes the ethical rationality that is based on the human understanding of spirit, in contrast to the technical rationality, which derives from data and focuses on purpose. At the same time, the ethicist suggests that machines are already superior to humans in various fields of intelligence. It is to be assumed that further intelligence fields will be added to these. "Therefore, humans should already deal with the possibility of 'super intelligence' in order to establish a standard framework that guarantees a dignified life for all humans in the future." Peter G. Kirchschräger sees the potential of machines primarily in the decision-making process: "Current pilot projects involving 'machine judges' are failing, in part, from a lack of the legal tradition of mercy. Therefore, a partnership between humans and machines with clearly defined task fields would be practical, in which the interpersonal must always be central and the responsibility must always remain with humans due to their unique human morality."

Moral machines?

Can machines also learn morality? MIT has launched a learning platform towards this end, to teach morality mechanically: moral dilemmas are shown in which a driverless car must decide for the "lesser of two evils," such as having to choose between killing two passengers or five pedestrians. The platform users evaluate which outcome is more acceptable in their opinion. At the end, the answers are compared with those provided by other participants. In this way, the machine should learn how to decide like a human. *Claudia Gabler*

Recommended content

"Moral machine" for capturing moral decisions
moralmachine.mit.edu

TED Talk "Machine intelligence makes human morals more important" by Zeynep Tufekci youtu.be/hSSmmlridUM

W.I.R.E. study "Zukunft digitale Schweiz" www.thewire.ch

Algorithm that converts a photo (e.g. as the portraits in this keynote) into a work of art deepart.io



Peter G. Kirchschräger is ethics professor at the University of Lucerne, Switzerland.



Christian A. Rusche,
visionary software
engineer at BSI

What differentiates machine

learning from algorithms? Machine learning (ML) is a learning tool. Usually a neural network that changes and optimizes itself: an ML "sales person" sets the product price for a customer according to its learned experience from previous offers. An ML "marketer" composes an e-mail with individual contents and tonality based on the customer's reaction. An ML "doctor" is not an expert system programmed by people, but one that prescribes medicines and dosages based on learned success probabilities. An ML "politician" learns from thousands of cases how he can reduce the number of traffic accidents through setting fines at the right height. That may sound like science fiction, but it is entirely an imaginable future.

Are flesh and blood sales persons, marketers, doctors and politicians still needed? I certainly think so in the medium term, and as a monitoring point in the long term.

When are humans unbeatable? And when is the machine top?
Human: will.
Machine: flexibility.

What characteristics must people bring into the ML age?
Humility.

Will we outsource decisions to machines or just the preparation?
We will outsource decisions. Our new product, BSI Studio, will make decisions regarding contents, channel selection and salutation, for example – for each individual customer. Each customer story consists of intelligent steps that, based on the data situation, decide whether to proceed left (send an e-mail) or right (send an SMS).

Does a decision have to always be 100% correct? Or does 70% suffice?
That must be decided upon for each individual use case, according to the quality and costs of the (human) alternatives and the consequences of false positives and false negatives. When it comes to sending out a newsletter, for example, an incorrect decision is not life-threatening. Furthermore, ML only makes sense if the system receives enough data to learn or receives feedback to its decision through a control loop. Self-learning systems – even those that define their inner structure themselves through evolutionary methods – will surprise us. |