

# Help me, Machine!

Is this the next step in humans' evolution: after hand axe, wheel, and electricity humans create self-thinking machines as their new helping hand. Is this kind of super-invention the solution for such a high amount of problems? We spoke with Jiayu Zhou not only about promises and benefits of our new assistants, but also about their limits and risks.

Jiayu Zhou has been working on machine learning theories and methodologies, including multi-task learning, feature selection, sparse learning, matrix completion, numerical optimization and their applications on healthcare analytics. He currently works as an Assistant Professor in the Department of Computer Science and Engineering at Michigan State University.

**In which sectors of a human being can machines work better than humans?**

When defining "better", there are two dimensions. The first dimension is "faster", and the other dimension is "more accurate". We know that in many automation domains such as production, service domains, and warehouse management, a machine can do much faster and thus better than humans. On the other hand, many procedures require complicated decision making that is much more complex than automation, such as most medical diagnosis or operating vehicles. And in these cases human is still much better than machines are.

**In 1748 Julien Offray de La Mettrie published his scandalous book L'homme machine (Translation: „The man as a machine“). What do you think about this trans-humanistic concept of a man being a machine? Where are the boundaries between human and machine with your definition of machine?**

I cannot agree with this statement, with my definition of "machine" as a human-made apparatus, such as computers. I think two differences between human and machine are that 1) knowledge-driven intelligence and 2) emotion. The former differentiates human and machines in terms of intelligence (natural or artificial), whereas the latter defines the basis of natural intelligence.

**Why do machines need humans?**

The question will be a much meaningful question if asked the other way round. Machines are created by humans and for the human to accomplish specific tasks, automation, entertainment, assistance, etc. And the purpose of creating machines is to improve our civilization and improve life-quality. Machines, on the other hand, do not have a purpose and cannot do anything beyond what human told them to do.

**Can you imagine a world with machines and without humans? What do you think about ethical arguments about creating machines considering possible danger for human civilization?**

If there are no humans, no one cares what machines would do. There are lots of educational science fictions warning us against the danger of machines, and however and also unfortunately, the technology we have currently mastered can only make machines to help with simple tasks. After all, there have no machines passed a Turing test yet.

**How do you teach a machine to learn?**  
In the early years, humans taught a machine to learn by creating low-level instructions, in

the form of programs. Later on, humans designed programs for higher-level instructions (ask the robot to turn left, find a box, and move to the right) which were then fulfilled by machines. More recently, due to the advances of machine learning, especially deep reinforcement learning, the machine can infer rules by experiencing the environment in a trial-and-error manner.

**Is there a chance to create a machine which is able to teach other machines?**

Yes, there is, through a human-made language in a human-de-

signed way. Right now, developers have built micro-services which are talking to each other through machine-understandable formats such as JSON. By handing over experiences with each other, we can say the machines are teaching each other. However, I have to emphasize that human invents all the mechanisms, and therefore, they are not created by machines with any purpose.

**In 2018 you participated at the 1st Int'l Workshop on Big Traffic Data Analytics at San Diego. Can intelligent machines help to solve our traffic issues? How?**

Yes, intelligent machines can indeed help to solve our traffic issues. Machine learning scientists are now converting the traffic optimization problems into optimization problems (traffic prediction, traffic control, route planning, etc) and solving them in a data-driven way using the massive data collected in different sources.

Over the last few years, we see high-accuracy traffic estimation status using trajectory data, efficient fleet management status using share ride dispatch data, and data-driven traffic light control systems that dramatically reduce the traffic in intersections, and many more to come.

**Your researches take part of biomedical questions. Are there particular needs for using machines in medical contexts? Which are they?**

Most of the current machine-assisted medical research takes advantage of medical data available from sources like mobile sensors, electronic medical records, cohort study data from clinical trials. Machine learning scientists like me use the data to build computational models by solving a data-guided large-scale optimization problem (e.g., classification, regression, or clustering). We heavily rely on machines' superior computing power to solve these (again human-designed) optimization problems. The procedure above shares the same spirit as those recent deep learning advances in other domains.

**A vision: The tomorrow's gynecologist uses his computer to analyse the foetus. Artificial intelligence can recognize future prospects. Maybe the gynecologist can show us the whole foetus' life in a virtual preview. With the use of DNA-“correction“ we can intervene in human's genesis. What do you think about it?**

This vision was based on the assumption that a virtual preview is possible, but I don't personally think this is possible at the current computing resource and modeling technique we have. Common knowledge instructs that the development of a fetus is dependent on two aspects 1) genetics and 2) environmental interactions. Indeed we can profile the genetics and predict many risk factors, but many many other factors depend on the environment, which is too complicated to be modeled even for a short period amount of time of a small cell, not to say the entire lifespan of a fetus. Nevertheless, if someday we know for sure that some genes will definitely be giving an infant a liver cancer in her 70s, why not removing them? But given that the human development is such a complicated system, most likely we are going to play the trade-off game: do we want to get rid of genes and meanwhile take the risk of getting another disease in another period of her life.

**Let's talk about science. What's the role of academic science in a world with artificial intelligence? Do you de-**

**scribe artificial intelligence in the meaning of understanding or do you produce artificial intelligence?**

As the mainstream of artificial intelligence nowadays is, in fact, advanced machine learning that combines superior computational power and the vast amount of data we have (or can acquire), industries played an important role that is sometimes considered to be more important than academic science. However, our understanding is advanced machine learning supporting AI nowadays is somewhat limited and is much less than that of earlier machine learning algorithms. Academic science is carrying a critical mission in AI to advance such fundamentals and understandings. I would say this understanding is one of the most crucial steps toward producing artificial intelligence.

**Is there a possibility to integrate machine's thinking in everyday's life? Can our smartphone be our artificial intelligent solution for everything?**

I am not aware of machine's thinking. I do see human plots that are infiltrating every aspect of our lives through smartphones. We are interacting with Apps and websites every day, whose owners end up collecting all the behavior data from us and turn them into "intelligence" that ultimately becomes the source of their profit. How do big companies like Facebook and Google make money otherwise? Of course, I would like to thank them for the excellent free services they provide.

**Machines are complex-organized containers full of data. In a world full of data – is there any chance of „private“ and „secure“ data?**

Yes. If your data is not exposed to the internet, then it can be mostly thought of as private and secure. But it is really challenging to be as we are living in an ever-increasingly connected world.

Interview: Hannes Mittermaier

## Prof. Jiayu Zhou

Prof. Jiayu Zhou is an Assistant Professor in the Department of Computer Science and Engineering at Michigan State University. He received his Ph.D. degree in computer science from Arizona State University in 2014. He has a broad research interest in large-scale machine learning and data mining, and biomedical informatics. He served as technical program committee member of premier conferences such as NIPS, ICML, and SIGKDD. Jiayu's research is supported by the National Science Foundation and Office of Naval Research. He is a recipient of National Science Foundation CAREER Award (2018). His papers received the Best Student Paper Award in 2014 IEEE International Conference on Data Mining (ICDM), the Best Student Paper Award at 2016 International Symposium on Biomedical Imaging (ISBI), and Best Paper Award at 2016 IEEE International Conference on Big Data.

