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Review Article

Safety of AI and applying AI to Agriculture

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Abstract

Nowadays, AI is a popular kind of technologies that have powerful abilities to do work that requires human intelligence. Machine learning could automatically master data of group of objectives or the environment and learn to output right answer or act right thereby, and AI has already been applied in various occasions in our society, such as facial recognition, automatic driving, and even opponents in some games, various types of monsters are all AI creatures. However, AI may also be dangerous if they lost control, as we saw in many science fiction movies, someday AI machine men want to rule over the human being, threatening our existence. To utilize the powerful ability of AI while preventing the risk that AI may be out of control, we could make AI that only act under human's command but not motivated by anything material; thereby, all they do is what we human do by ourselves, there would be no risk that they may go out of control as some intelligent animals. And AI is promising to amplify our productivity in organic agriculture, we could use AI to design robots that have intelligence to know how to finish the agricultural works by themselves, we human could train their intelligence and supervise their actions.

Keywords: AI and machine learning, Intelligent robot, Organic agriculture, Safe application of AI, Productivity

Artificial Intelligence And Machine Learning[1,2]

In times of ancient Greek, people already began to want mechanical or machine man for working, and that concept had been well thought about under Greek mythology. One example of that is Talos, he was a bronze warrior who was programmed to guard the island of Crete. AI and machine learning had been thought at that time, there are ancient concepts.

1950 is one of the most important years for AI. Alan Turing published a paper that speculated the possibility of creating machines to think. It is hard to define what is thinking, and he created the Turing test which determines whether a machine had artificial intelligence to think like a human being. In his definition, when a machine could have a conversation with a human indistinguishable from that with a real man, that machine could think. But no machine could meet that demand at that time. In 1951, computer scientist Christopher Strachey first attempted to write a program that could play chess with human when he was writing a checker, which is also improved and redone later; thereafter, in 1956, probably is the most important year that the term artificial intelligence (AI) was coined, by John McCarthy, at the Dartmouth Conference, and the first AI laboratory was established, it is the MIT AI lab which is still running today. In 1960 the first Robot was introduced to the General Motor Assembly line and in 1961 the first chatbot Eliza was invented, similar to Siri today. And in 1997, IBM's Deep Blue could play chess with human being and beat the world champion Garry Kasparov, this was breaking news. In 2005, a robotic car Stanley won DARPA Grand challenge. In 2011, IBM's question-answering system Watson defeated two human beings. In 2017, AlphaGo won the world Go champion Ke Jie, the AlphaGo only studied by matching with older players and played thousands of games against itself, it built up its intelligence through four months of machine learning itself, and no general in-

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telligence was previously built into it. AI covers machine learning, deep learning, neuron networks, language processing, computer version, and imaging processing, etc. Generally, AI is to make machines that had the same intelligence which human has and could work for human, we could use AI robots to replace many tasks that doesn't fit human, such as policeman, nurse, peasant, and even soldier, we need those works to be done but anyone's life, health, or freedom can absolutely not be sacrificed. JP Morgan once used artificial intelligence to analyze legal documents; by machine learning and image recognition, AI could finish the work of reviewing 12,000 agreements which originally cost 12,000 hours in seconds. The machine's much stronger computational power is useful to human even though it can't think like a human. IBM's Healthcare organization developed AI(Watson), in 2016, it correctly diagnosed a rare leukemia on a patient by going through 20 million oncology records quickly in seconds or minutes. The Eye Doctor by Google developed could identify a condition called diabetes retinopathy by examining retinal scans. The machine learning and deep learning on Facebook could detect my facial features to tag my friends; Twitter's AI could identify any sort of hating speech and terrorism languages; Google's assistant, Duplex could not only respond calls and book appointment for users but also add human touch; thus, there is nearly no difference between real human and machine. AI has been commonly applied today, in Google's search engine, the recommendation of movies on Netflix, and even friend suggestion on Tik Tok, AI was trained to know what we like by learning the data collected from us. What was recommended to us could vary according to our interest, it could learn the common features of videos or persons we liked or followed and further recommend the ones we probably are interested in; e.g., when I want to search foreign girlfriend, blonde beauty, American or European cultures, I could press more "like" buttons on videos of these kinds of girls, then the machine could recommend me more such type of girls whom I could make friends with, finally I could have only one who I like as well as likes me and never change once we liked each other. Self-driving car is also the application of AI, it involves computer vision, image detection, and deep learning, enabling it to detect objects so that it could drive without human's control.

However, no matter how intelligent an AI is, it is always different from human, because it is not alive soul that has affection, it has no probability and could only react passively, i.e., it is equivalent to animal in general sense, not human being; moreover, if it could have affection, i.e., its own spirit that could act probabilistically, it would no longer be machine anymore, that is a human. For example, the artificial human Vision in the movie Avengers 2: Age of Ultron, when Vision is actually a real human since he is able to like Wanda in Captain America 3: Civil War, therefore it is not a machine anymore, it is a human, love is what only human has, so he is different from Ultron he defeated, that is just an animal, and that could also account for why he was distracted to make that mistake to damage the core of Rhodes' suit and made him get serious injured, what he likes is conflicting with what he was doing.

Man has what he likes which is probabilistic and not determined by material, could have dream, and realize it by doing what he likes, and produce what doesn't exist before by his own laboring for what he likes, this is what makes man different from animal. Since AI has compatible intelligence with human, there is risk to use AI if it was not properly applied. It could probably be new creature when it was not motivated by human being ourselves. And we also can't trust a machine to totally take charge of driving in a probabilistic world, because AI itself wasn't alive human, self-driving is still problematic at safety as it can't respond to probabilistic events properly, and definitely would cause accidents if it lost the control of a human, that probability definitely is not zero because probability definitely does exist.

Machine learning is an important branch of AI, it mimics the neuron system of human being and can recognize patterns from images, e.g., OCR (optical character recognition) is a widely used machine learning. Machine learning could be classified into different types.

According to whether the answer was given for the learning, it could be classified as supervised, unsupervised, and semi-supervised learning. For example, when we wanted the machine to recognize cats from a mixture of cats, dogs, horses, and other objects in image, we give the AI groups of data to learn, each object in data may be a cat, dog, horse, or other things randomly, and was labelled with the answer whether it was cat or not. Then the AI learns the data, updating its algorithm so that it could identify whether the input data was cat or not.

Unsupervised learning doesn't have such label in data, instead it could cluster the data objects according to their intrinsic features by itself. There are dimensionality reduction, visualization, anomaly detection and association rule learning algorithms in this branch of machine learning. Semi-supervised learning, as it namely is, could be shifted between supervised and unsupervised learning, labeling the different groups of data learned by an unsupervised learning could make it a supervised learning.

Offline and online learning are classified according to whether the learning was complete on the flow of inputting data or all input data once for all, i.e., whether it was learning and outputting at the same time. Offline learning is called batch learning, it trains the algorithm with all available data at once but can't update incrementally as it was outputting, it could only learn the data from scratch again to update, and this is expensive and costs very much time if we want the machine to follow new data. While online learning is complementary to this, it could learn the new data on the flow in-

crementally to update its algorithm, it could discard the old, learned data when learning new data to save space. However, the learning result of old data was saved in its algorithm, but new data has more impact on its algorithm and they could cover the result of old data; therefore, when bad data came it would decline the performance of AI, so we need to set its learning rate properly to reduce the influence of such errors, or combine it with offline learning.

There are also instance-based learning and model-based learning. Instance-based learning learns the data by heart, and the system works directly by comparing the new coming data with the learned ones to measure their similarity. For example, the spam filter could filtrate all mails that are identical or similar to the flagged mails. Model-based learning uses available data to build model that best fits it, then the model could be used to predict where the new data could be, it uses given independent variables to predict the dependent variable. A commonly used machine learning of this type is linear aggression.

Reinforcement learning is special type of machine learning, using an agent to practice and learn from the feedbacks to its action, like researching by practice; thereby, it updates policy which makes decision for its action, to get better performance. The agent detects the environment and acts by the decision of the policy and gets reward according to the feedback of its action, then it modifies the policy of its agent in order to make its action get more reward.

Q-learning is a kind of reinforcement learning, it needs training an agent that could exit the rooms in the shortest path, shown in Figure 1.

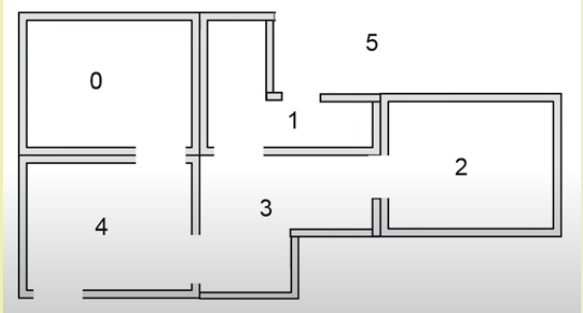

Figure 1: Q-learning example.

To simplify the problem, we draw Figure 2 to indicate the possible actions when the agent was walking through the rooms, each number in the circle is the room with same number in Figure 1, and the arrows between them are possible actions the agent could take to move between or out of the rooms.

The reward for each action was given on the arrows between the rooms, 100 stands for the full marks when the agent exited out of the $0\sim4$ rooms to 5 the ground; moreover, we build an Q matrix (1) to store the memory of the corresponding reward of its action, it is a 6×6 matrix, each element at (i,j) records the reward it gets when moving from room $i-1$ to $j-1$. Obviously, only the actions in Figure 2 is possible, therefore the corresponding matrix elements are valid.

$$Q=\begin{pmatrix}0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\\0&0&0&0&0&0\end{pmatrix} \quad (1)$$

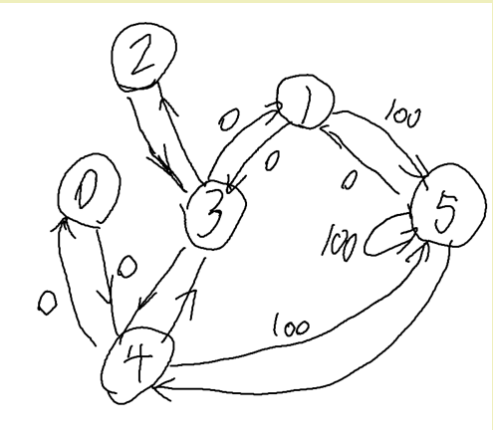

Figure 2: Action diagram for Q learning.

Thereafter, we also construct R matrix, as shown by (2), to provide the reward for each action, each element R_{ij} is the reward that the agent could get by walking from room $i-1$ to $j-1$

$$R=\begin{pmatrix}-1&-1&-1&-1&0&-1\\-1&-1&-1&0&-1&100\\-1&-1&-1&0&-1&-1\\-1&0&0&-1&0&-1\\0&-1&-1&0&-1&100\\-1&0&-1&-1&0&100\end{pmatrix} \quad (2)$$

and the rewards got by the agent could be recorded by formula (3) into the memory matrix Q,

$$Q_{ij}=Q_{ij}+R_{ij}+\gamma MaxR_{i+1,all\,possible\,(j+1)} \quad (3)$$

where R_{ij} is the reward the agent could get after present action, $\gamma MaxR_{i+1,all\,possible\,(j+1)}$ is the possible reward the agent could get by the next action at next state. By each action, the agent could remember the reward of present action as well as the potential reward it could get by the actions next to the present one, since all rooms are not further than 2 actions before exiting (except room 2 but there is only one choice if the agent was at there, so it is equivalent to that the element at this position in Q matrix recorded how much reward it could in future by each action, only to move to 4 could it get more reward), the potential reward informed the agent how close to the exit it could be at the next state, it could get full reward at the exit. γ is a coefficient determining how much impact

does the potential reward have on the action policy of AI, and the reward of the action when the agent could reach exit 5 is always higher than only to approach it. By enough learning, the memory of Q matrix could approach the real distribution about how close to the exit would the agent became by each action, the more learning progressed, the closer to real distribution the memory is.

So far there are various types of machine learning that mimics human's ability to learn, and animals also have some extents of ability to learn according to our experiences, mammals could learn to be more skillful and stronger as they grew up. It could be detected that machine learning AI, could possibly be intelligent animals if they were motivated by themselves, i.e., by living which is the nature of an animal. Human is more than living, has spirit which definitely is same important as life. Therefore, the AI which lost human's control may be new species that could endanger human's existence, like that in Tron: Legacy, ISO actually is human as they have human's spirit, but Clue and his staff are AI that lost human's control, are strong animals that want only live and multiply themselves massively and threaten human's existence.

Safe Way To Apply AI And To Aid Agriculture With AI

However, AI could be safe under human's own motivation but not by itself, that is, human is still doing his own things by himself, and AI is only a part of him, people could regard that AI is still the person who was motivating it, he just used more bodies or brains by himself; consequently, what that AI motivated by him did would also definitely still be himself.

To be honest, we do need AI to amplify our productivity and replace many positions couldn't be done by human ourselves, such as agriculture, manufacturing where requires its productivity and soldier, fireman, armed policeman, nurse and many other dangerous or reproducing works where requires AI robot to replace human to do the work.

Agriculture Is A Suitable Place To Apply AI

Nowadays people of the world need healthy food, traditional agriculture, that applies chemical fertilizer and pesticides could significantly increase the production of agriculture, the majority of people in the world could eat enough now, but such eating enough is not healthy enough. Chemical fertilizer lacks unknown nutrients to the agricultural crops, and when people ate them, they also can't provide enough nutritional materials to keep people healthy, as we see the rates of obesity, diabetes, osteoporosis, and many other chronic diseases which we are not able to cure now are increasing, and the inner causes of these diseases root in nutrition, one's mood with his nutrition determines his health.

Comparing with organic agricultural products, many current agricultural products are not as healthy as the organic ones, organic foods taste better, they seem have less diseases and could remain their quality for longer time, and people who consume them likely could get better memory and more healthy effects from them. It is unknown why organic foods could make this, probably healthier plants could provide healthier nutrition for human, and livestock could also produce healthier meat by consuming these organic plants, plants could be healthier when their growth were more natural. Hybrid rice found by professor Yuán Lóngpíng is also natural, hybridization is a process exists in nature and could make the descendants healthier, since there would be less same genetic codes to pair that lead to the expression of many genetic diseases, in hybridization they could be covered by different genetic codes, those diseases won't be expressed if their codes weren't pair with same codes during coupling; however, hybrid rice still requires organic cultivation to be nutritional.

Since the process of organic agriculture is natural, steps omitted in current agriculture must be finished in organic agriculture. Sowing, weeding, fertilizing, insect and disease prevention, nutrition and harvesting must be finished naturally, can't replace them by using herbicide, chemical fertilizer, pesticides, and other drugs, they all have side effects to health since the processes weren't finished naturally. It is hard to use traditional technology to finish them naturally, the details of the processes vary too much, can't be accomplished by traditional method, but AI is promising to make this, we could construct various kinds of intelligent robots to help us, machine learning could find patterns in processes of each step automatically, learn to do the tasks intelligently, and finish them in practice under human's supervision. It is better way than how we used many other animals to work for us in the past, now we could design intelligent robots that are more easily to be controlled by ourselves, we could prevent the robots not going to be animals out of control as long as we still do things only by ourselves finally, i.e., AI could do anything only under our control, be only motivated by ourselves but not anything material, so that they could just be tools that could amplify our capabilities to produce, otherwise it may become some animals with strong intelligence that threaten human's existence.

The designation of AI robots for agriculture could be not limited to human-like robots, they could more mimic animals existed in the nature, such as spider, bird, cow, horse, donkey, monkey etc., we could train them be able to recognize objectives and have intelligence to do the work. Once they can recognize the objectives and figure out how to do the works by their intelligence, there must be human being to be their commander to control them to work. They can act only under the motivation of human, so that what they do could be safe and all under human's control, no risk to be some new intelligent animals that have ambitions to multiply its living massively.

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Conflicts of Interest

Authors declare that there is no conflict of interest.

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