(Intelligent) Robotics

Omar Alenezi

Montana Tech at University of Montana

Abstract

This paper covers robotic history and their advancement and contribute in various of fields. Then talked about some algorithms that helped taking the robotic AI world to the next generation. That rose a lot of fear that needs to be handled on both sides to not fear AI and have an alternative plan in case of rebellion. However, they can’t reach that level of intelligent yet because a lot of limitation from of current science laws and technologies. Therefore, a more powerful future technologies, and better algorithms might have the chance of creating a robot with consciousness.

Robotics

Robots are becoming an essential part in the human evolution. Robots or “machines” can calculate faster than any human could. Making then very efficient in doing “anything”. Of course, robots can’t do most things human do like having emotion or act on the environment by himself without an input or output. Although this barrier could have been caused by humans not robots. Because the science and humans not fully understand how emotions work, we can’t implement or design a concept for feelings and or how it thinks and act by it-self. Also, keep in mind the human body mechanics and how complex it is, where no Human or company yet can create a robot that have half what the human body has. This causes the robots to have so many limitation on what it could do. However, even though with this limitation, there are many jobs and things that humans can’t be possibly do without robots. Some of the areas that uses robots mostly are like car production, food production, commercialized agriculture, investigating hazardous environments, underwater and space exploration, and now it’s even been used for military services.

First, car production in used to be strictly by hand. Where humans used tools and hands to assemble the car, body, and parts. Yes, it can be made by humans, but not for all humans, only those who afforded it. Because of the amount of work and the number of humans needed, cars used to be very expensive, a used car would be the price of a new car today (History of the automobile). However, robotics came to life, making sure the life of automation to exists too. In the

early 1900s, the automotive industry introduced robots to do a lot of tasks instead of them like installation, painting, and welding. Each robot is specified to do a specific job with the tools and sensors needed all built in it (look at Figure 1 in the appendix). Only having to communicate with the last robot and the next one to know when to start the job or if the administrator closed the jobs. Robots can work at a pace and precision that no human could. Furthermore, they also wouldn't complain to do any dangerous or difficult job without asking for a health insurance, but maybe an electricity insurance though. This made robots an ideal replacement for the automotive manufactures workers and irreplaceable, where it would cut down a lot on the manufacturing cost, and would put the efficiency and production high to the roof.

Next, food production wouldn't be the same without the robots to help in producing them (Figure 2). While the reliance on human labor has been steadily declining in the past few years in food manufactures, the installation of robots has been increasing (*Brumson, B., 2008)*. With automatize robots to handle picking, packing, and palletizing, the food lines in the manufactures can produce food in high speed avoiding injuries and lower the mistake probability by a huge margin. Humans are growing in numbers reaching as of today close to 7.5 billion (World population clock), feeding them would take a lot of task force and labor. Robots can take over us in most of those tasks, that causes lowering in the cost of production and the need of human labor decreases as well. More technologies and algorithms are

being developed each day, with robots being able to do more, manufactures would replace its labor for cost and efficiency.

As mentioned before, robots are willing to perform and explore any dangerous or difficult task. That's when we can't afford to lose or risk a human life, here the robots come in handy in multiple of fields like investigating hazardous environments, deep sea or space exploration, or on the military. If encounter a possible radioactive land, it's very dangerous for any living being to come close that land, but for a scrub of metal and electricity, it's fine, didn't you see Terminator? It's safer to send a drone or a rover to that area to investigate. Pre-programmed with how to overcome an obstacle and move around, all what an operator needs to tell him is where to go. This feature became so useful to where most of the military is using for several projects like Daksh, Goal Keeper, PackBot, and MARCbot (Figure 3), all mostly used for discovery and defusing suspicious objects safely and remotely, Daksh can even climb stairs (Military robot). All what a robot needs are electricity, which now can be obtain from the sun, or charged in a big battery, and be sent on its way. Unlike us, where we need air, food, water, and a place to live, robots don't require any of that making it simple to design and send a rocket ship or a submarine. That's why robots reached Mars and the lowest point of earth and human couldn't (Figure 4).

On same note, the idea of "A robot can and a human cannot", where someday the robots will become more intelligent than human to where they will want to replace humans. Again, robots only need electricity

and the chips it's made of, it's choices of planets and places to live is far beyond ours. It can simply move away and leave human behind. Besides, human can make the internal component controllable or to be diffused remotely by multiple of technologies either with internal chip or electromagnetic pulse. The Robotic Surgery scientific journal stated that Isaac Asimov, was an American author and professor of biochemistry at Boston University, had three laws that rules the robot's behavior:

1- A robot may not injure a human being or through inaction allow a human to come to harm.
2- A robot must obey orders given it by humans except when doing so conflicts with the first law.
3- A robot must protect its own existence as long as this does not conflict with the first or second law.

Robots nowadays have higher intelligence than ever before thanks to various of algorithms. Those algorithms helped robots to be more efficient and better at problem solving. Of course, I can't possibly mention all the algorithms used by robots. Where most of the algorithms used by the robots aren't really "intelligent". Yes, they can perceive and act, but that is not enough to be called intelligent. For example, a robot can have sensor and a way to act like moving or talking. However, its algorithm can be just avoiding or moving around an object randomly.

Now is it "intelligent" or can we say this AI model is successful? Yes, even though it's doing something not efficient or

stupid in a human eye, it's what we programmed it to be, it's only going to be as good as the model is. Any more goals and achievements going to be unrealistic. We can't possibly have Siri to drive a car. But, Siri is good in sending messages though, to some extent. In car manufacturing for example, the robot building the car only have the notion of itself, how to do the job, the previous one, to know when to start the job, and the next one, to tell the next one that his job is done. They don't communicate with anyone but them-self and work in stationary place where the only thing that moves is their arms with the tools installed in them. Is this robot intelligent? Yes, they handle noisy readings from sensors and other robots, and communicate with one-another to finish a task. Even though it hasn't reached human level of intelligence, it can beat and outpace any human in building the car. Unlike us, those robots are built to master this specific job where we spent the time in learning it. This causes a huge advantage for the AI, wouldn't be fair if both of us started to learn than executing commands?

According to Lipson in the Cornell University research "self-aware robots", where they build robots randomly and based on the rules of natural selection to where robots in different shapes and sizes learn to move and act on their own, then pass those data as genes for the next generation robots. In creating a spider robot that has absolutely no notion of itself or how to move, given those "genes" to it, and monitor what happen, the spider started to move randomly until the robot decide what he looks like then starts attempting to move forward. Lipson stated, "We were hoping that it wass going to have a

kind of evil, spidery walk, but instead it created this pretty lame way of moving forward.” Again, it’s a robot, it doesn’t know what a spider is or how it supposed to move, all what it cared about is to move forward to be able to replicate itself as a reward. This behavior of the algorithm now rises another question; is the things the machine learns are correct or wrong? In machine learning, there is no way for us to know what the robot is learning. Just like our brains, there’s no way you can read what someone thinks without he shows an expression or if he talks. From this, we can conclude that the test for the machine learning algorithms should be evaluated by the action taken. For the previous spider example, he could move forward. Not how efficient a real spider walks, but it moved forward and reached the destination. This shows that the action taken could result in a totally different expectation than what initially planned for. To evaluate the robot’s algorithm more efficiently, a person would have to have a preset dataset, where the entire outcomes can be counted for as a human, for the robot to learn from. Ensuring the evaluation function or method used has more accuracy and better view on what the robot will try to learn.

Another concept helped robots become more intelligent is probability. Probability is the likelihood of a given event occurrence. For example, for a coin flip, you have a probability of ½ to get tail and ½ to get head, adding up to get 1. For a dice roll, you have 1/6 probability to get any number. Now consider a IR sensor attached to a robot, the chance of it to get a correct reading is very minimum; however, if it counts the probability of whatever the thing

it's looking at and match it to some learned equivalents, then the thing the robot is looking at is most likely the one with highest probability.

Probability helped robots even in searching. Given a house as a search area, and asked the robot to search for a plate. Without probability, it will go ahead a start searching through various ways, either with the closest first or maybe each room at a time. However, with the probability the robot would have a notion of where the goal might be and start to search where a plate might be rather just searching. This creates a better logic for the robot for searching or make more "intelligent". We, humans, go through calculating probability in our brain in everyday life and make assumptions of what the outcomes would be just by observation. For example, if you go out and saw it's a cloudy and humid day, you would assume it will rain today and it might be true. This assumption was based on a noisy data of where it based on previous event. If it rained, you would be glad that you brought an umbrella with you, if it didn't rain though, your hands would be tired holding the umbrella. In result, probability can give you where to look and make assumptions of what the outcome might be.

What if we want to know exactly what the outcomes are? Here, the rules of math, physics, and logic come in handy. Let's go back to our coin flip example, you got a ½ chance in either choice and adding another half if we want to calculate for the next one and so on, but the result would be an assumption not a fact. Based on Newton laws and

mechanics, if we know the initial condition and exactaly what would happen between the throw and when the coin land, theoretically, we can calculate on what face the coin will land on. Randomness is everything that we humans cannot perceive or calculate. Right now, the best random generator out there is in www.random.org where they use the atmospheric noise to generate the random number. However, if there is a way to read back the atmospheric noise, we can reverse engineer to get the exact generated "randomly" number. Therefore, we can build a robot that can consider and calculate more physics and math laws to increase the probability of a condition to happen. The more we put to count the more accurate our calculation will be.

So what's next? Why can't we build a robot with a human level intelligent yet? There is still some limitation. One of those limitation is mechanical; the human body has so many sensor in every cell in has on its body where the robots only got camera and some IR sensor to know what's around him and where it is. There is no known material as of today that can have a sensory input like the human skin and the other human senses. This causes a limitation for the robot of how much of data it has to decide what is going on. Another limitation is the computational power needed for that AI. Human brain controls the body even unconsciously at moving, talking, or planning, where it's the most complex thing in building a robot. In order to create a human level AI, it would require time, developers and multiple tools, all of which costs a lot of money to where a company should fund the project at least. Also, there would be a political conflict

internationally about those robots, a company must know the liability of creating of such robots.

On the other hand, robot doesn’t have to be conscious to be intelligent. In fact, most of the robots in the manufactures are not conscious but still intelligent. Those robots work better than the conscious ones. As of where it been programmed to solve a certain task efficiently than to learn the different of ways to solve the task. However, the domain of problem the machine learning algorithm is bigger. Each robot would be useful in a certain task. If the person needs an assistant robot, it’s better to have him to learn rather than to program his way in it. The world might be considered static if we, humans, are in it; however, because we create dynamic interactions, that brings chaos to the domain, causing the outcome to be totally “random”.

In my Opinion, Robots is reaching a limit again because the limit of our understanding of the algorithms needed to compute logic and human consciousness. Brain cells are inter-connected and communicate with one another to achieve the task or calculate a thought. A robot with parts that have a swarm behavior that self-aware can have the potential of the most realistic approach to a human-level AI robot. However, just like in Lipson study, it could result the robot taking a total different approach than what I expect. It could be the start of AI revolution then.

Conclusions and Future Study

Robots have swarmed multiple industries with the promise of efficiency and productivity. This makes the needs of robots in the following years more essential in most factories as of the human population are increasing exponentially as the time pass by.

Thanks to newly found algorithms the robotic world became more automatic. However, there is still a lot of limitation to the AI and the robotic field that needs to be solved first before continuing developing a new robot body.

Since the power given back to us from the robots is enormous. The fear of the AI disobeying us humans scares a lot to where there should be some international rules for the robots' design in which it must have a kill switch and if corrupted or triggered it destroys the data within the machine. This makes sure, the power the government needs still has it, hoping that the AI doesn't find a way to take out the kill switch of course.

A more powerful machines and storages units needed to be designed to handle the computational power needed to create such AI. Having more powerful machines can let us calculate more in less time to where we can live to see the study, not wait for 30 years for a machine to learn how to walk by itself by self-learning evolution. The existence of more powerful machines means the older generation is degraded now and cheaper. This causes computer parts to be cheaper and more powerful as the time goes.

References

Brumson, B. (2008, December 6). *ROBOTICS INDUSTRY INSIGHTS*. Retrieved November 12, 2016,from *Robotic Industry Association*, http://www.robotics.org/content-detail.cfm/Industrial-Robotics-Industry-Insights/Food-For-Thought-Robotics-in-the-Food-Industry/content_id/694

Hockstein, N.G., Gourin, C.G., Faust, R.A. (2007) et al. J Robotic Surg 1: 113. doi:10.1007/s11701-007-0021-2

History of the automobile. (n.d.). Retrieved 12 November, 2016, from https://en.wikipedia.org/wiki/History_of_the_automobile

Lipson, H. (2007, March). Building "self-aware" robots. Retrieved November 13, 2016, from https://www.ted.com/talks/hod_lipson_builds_self_aware_robots

Military robot. (n.d.). Retrieved November 12, 2016, from https://en.wikipedia.org/wiki/Military_robot

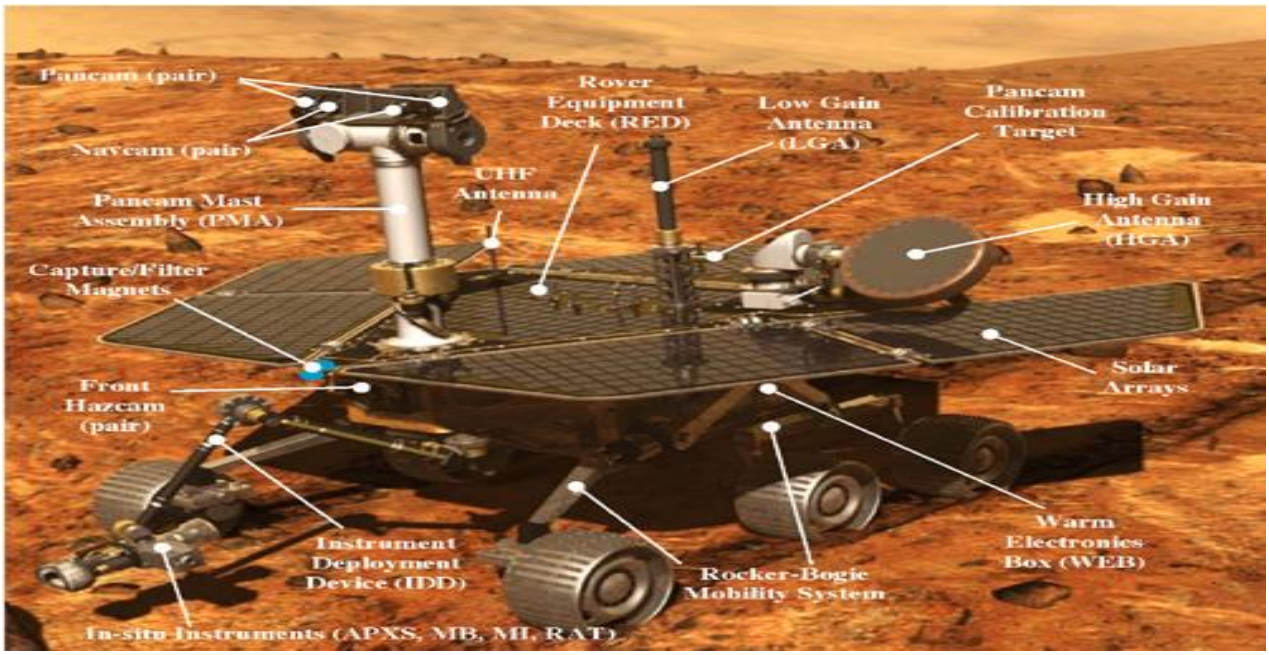
World population clock (n.d.). Retrieved November 12, 2016, from http://www.worldometers.info/world-population/

Appendix A

(Figure 1) Car production robots that takes turn in finishing the task then move one the driving belt to the next job.

(Figure 2) Palletizing robots pick up the finished food package.

(Figure 3) MARCbot investigating a possible mine without toughing the threat area.



(Figure 4) Mars Rover with what it is installed with it