

Millennium Robotics; Powered by Artificial Intelligence and Cloud Engineering

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Abstract: Early twenties' century, along with the industrial revolution, humans had started the new age of automation of things and jobs that used to be done manually such as repetitive jobs in factories, sewing machines, painting, and more. Humans were the smartest species on planet Earth to lead these efforts and indeed they have reached their goals, however with success comes with unlimited ambitions to the future, the age of Artificial Intelligence that superseded the capabilities of the humans themselves. Technology did not look back but it combined the Artificial Intelligence (AI) with robotic automated systems that have advanced rapidly from helping humans to replacing humans completely, and in addition become self-aware from driverless cars through airplanes to smart cities through traffic lights. Factories operate on solar panels and it understands if things are working, it can foresee a problem on the horizon and consequently going to take measures to compensate or recover from.

The percentage of intelligence that is not human is increasing and eventually we humans will represent a very small percentage of intelligence, Elon Musk.

Keywords: Robotics, Exoskeleton, Industrial Robots, Complementary Robots, Cobots, Self-Aware Robots, Robotics Cloud.

I. INTRODUCTION

The development of intelligent robots could help us achieve things that we currently find impossible for example in such dangerous, distant, and daring environments. Artificial intelligence is a disruptive technology and is the next breakthrough in numerous technical fields such as automated factories, economy, and transportation but also into non-technical fields, such as healthcare, disability, and finding cure for complex brain diseases.

There is a legitimate worry that machine learning and artificial intelligence is going to pose an existential threat to human society in the near future but the appropriate productive way to find out is to understand both sides, how we humans are thinking of the next generations robots, will it imitate humans or outsmart them, how technologies like exoskeletons could help with disability or robotics implants are the solution, and where we want Artificial Intelligence to focus on tomorrow.

This research paper will touch base on these technologies, from the human brain project and Artificial Intelligence to industrial and self-aware robots. The paper will also discuss how robotic technology could help with human disability, and how connecting robots to the cloud based on AI could accelerate our future developments. All in all, breakthroughs continue to happen each and every day in the technology world.

II. HUMAN BRAIN PROJECT

The scientists at Heidelberg University are working on a different part of the Human Brain Project. They're using the brain maps to build computer hardware, they hope will help AI learn How human's brain works. This new hardware is called neuromorphic which means formed like neurons or like the brain. At the heart of the system, a piece of hardware that is fundamentally and radically different from the chips in the ordinary computer, and that is the neuromorphic heart of the system. The microchips on these wafers look nothing like the entangled web of neurons that we have in our heads but each component communicates like an individual neuron by sending spikes of electricity to their many partners, (See Figure 1) [1].

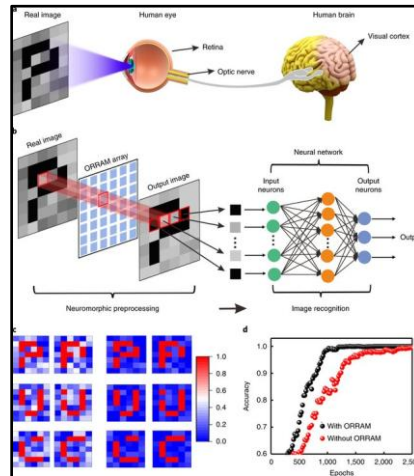


Figure 1: Human Brain vs. Artificial Imaging

This neuromorphic hardware generates results 10 million times faster than conventional hardware. It will eventually become a big thing, with applications for systems of everyday tasks such as face recognition, speech recognition, and the ability to read texts, with the ultimate goal of course is to create true artificial intelligence. The four million artificial neurons packed into this neuromorphic computer are just a tiny fraction of the 86 billion neurons in the human brain. If the Human Brain Project is successful, it could bring this knowledge together and encourage research and collaboration across different scientific fields. It helps developing new tools to diagnose and have better therapies for the various brain diseases (See Figure 2).

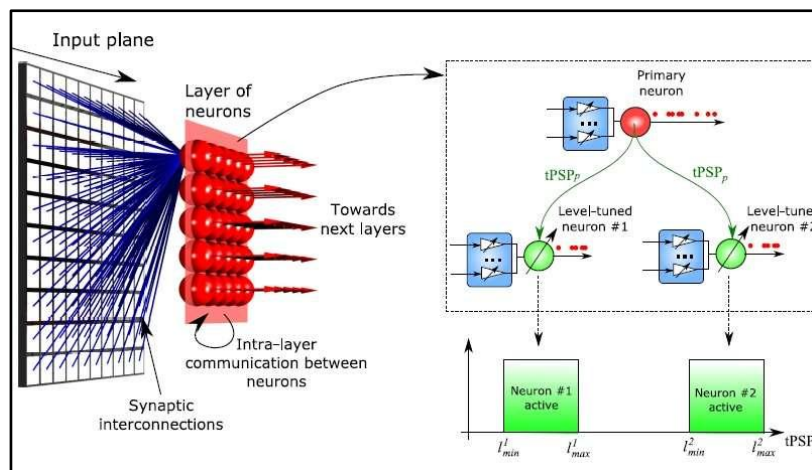


Figure 2: Artificial Imaging Flow

Naturally, the human brain will decay and disappear forever after death, but untraditionally, scientists are working on technology that could download the brain and possibly the consciousness and upload them to the cloud. The information in the brain is encoded in the synaptic connections between 100 billion neurons and each of those neurons has tens of thousands of connections, so approximately hundreds of trillions of those synaptic connections, each of which have been tuned by the person life's experience. So, in order to download the brain, each one of these trillions of connections would have to be precisely scanned, mapped, and digitally reconstructed on a computer as an emulated brain retaining the thoughts and memories of the person whose brain was scanned with the desire is to scan and map the entire human brain ultimately. Researchers want to understand the brain better in order to combat disease and mental disorders, and hence we would be able to better treat tumors, epilepsy, addiction and learn more about how we evolved, [2].

At Allen institute in Seattle, scientists have scanned and digitally reconstructed a cubic millimeter of a mouse brain. A cubic millimeter is equivalent to 100,000 neurons and over a billion synapses. Our thoughts and memories are basically data, and in theory we should be able to copy that data over to a computer, the copy or the image of the brain could be installed into a robot, (See Figure 3).



Figure 3: Human Brain Digital Reconstruction

III. EXOSKELETON

The Biomechatronic group at MIT, USA developed wearable robots, robots that attach to the body mechanically and neurally, trying to push the limits of what is actually possible to get as close as possible or even better than biological performance, [3].

Exoskeleton is not a science fiction, it is a science fact now and is promising with a superhuman strength. One of the pioneers, researchers, and inventors for the exoskeleton is Sarcos Robotics, and their latest product is Guardian XO as shown in figure 4 below, [4].

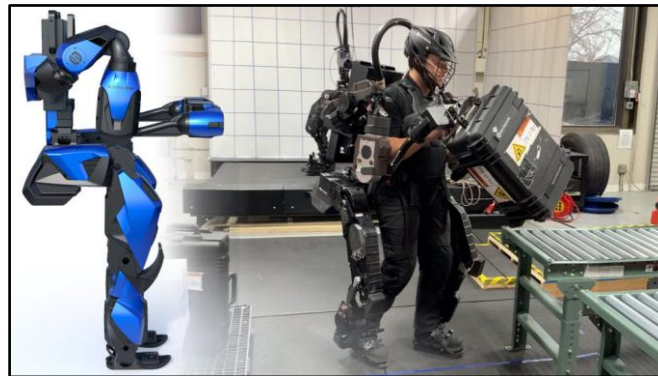


Figure 4: Exoskeleton

Exoskeleton is a wearable robot to help humans safely lift up to 200 pounds without strain or injury it can amplify the human strength by a factor of twenty, so, a hundred pounds will feel like five pounds. Human has the intelligence, instinct, the reflexes but machines are very good at doing something with a lot of precision better than humans. With exoskeletons we will have the precision of a machine partnered with the intelligence of a human. The exoskeleton is a candidate to help out where humans are having to do physically demanding work such as construction, manufacturing of automobiles and planes, and warehousing. It is worth to note that the exoskeleton has its roots in the military because the military helped with some of the funding.

IV. ROBOTIC TECHNOLOGY AND DISABILITY

Exoskeleton majorly was used to revolutionize the world of neurorehabilitation. California robotics start up SuitX has claimed that wheelchairs might be obsolete in just a few short years. The company revealed a new exoskeleton called “Phoenix” designed to help disabled people get around without the help of wheeled mobility devices. It is definitely not the first suit of its kind, but it also happens to be cheaper, lighter, and easier to manufacture than most other devices of its kind, which is a pretty big deal. For the most part, the Phoenix works just like most other exoskeletons do. It’s essentially a wearable robot that augments and enhances the wearer’s movements — but it’s also got a few innovative new design features that make it more user-friendly [5].

The Phoenix system is also designed to be modular, so it can easily be rearranged as needed to suit a wider range of people and disabilities. Most other Exosuits are typically designed for people who have mobility issues in both legs, but the Phoenix’s design allows it to adapt for example in case of a tall person who only needs assistance for one knee. Additionally, the Exosuit’ parameters can be fine-tuned via a mobile app so that the assisted walking motions feel more natural and comfortable to the wearer, (See Figure 5).



Figure 5: Exosuits and Disability

And the best part, the Exosuit's minimal design makes it relatively cheap to manufacture, so SuitX can sell it for just \$40,000. Of course, that's still ridiculously expensive by most people's standards, but in comparison to other exoskeletons that are currently available (which typically cost around \$70,000 to \$100,000), that's a tiny sum. SuitX hopes that this will make exoskeleton technology more accessible for people who those who need it, [6].

V. ARTIFICIAL INTELLIGENCE

AI is capable of vastly more than almost anyone knows and the rate of improvement is exponential. Google acquired DeepMind several years ago, DeepMind is absolutely focused on creating digital super intelligence, an AI that is smarter than any human on earth and ultimately smarter than all humans on earth combined. When Google put it to test the capabilities of DeepMind reinforcement learning system with computer games, the outcome superseded all expectations; Superhuman, it can learn the Atari game in less than a minute, it can win it in few minutes, it already beat all original Atari games.

AlphaGo which went in probably six to nine months from being unable to beat even a reasonably good go player so then beating the European world champion then beating everyone while playing simultaneously. The successor AlphaZero has crushed AlphaGo with a score a hundred to zero, (See Figure 6) [7].

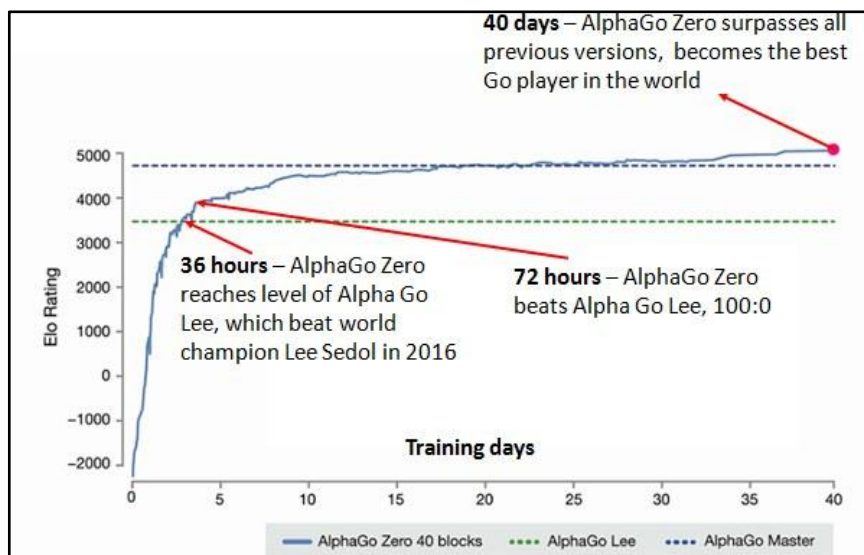


Figure 6: DeepMind AlphGo Progress

AI with the machine and deep learning capabilities in the cloud, it will correlate all information and data from different systems in real time to serve a futuristic goal with precision and accuracy such as traffic lights, speed limit, GPS system, to support driverless cars then everything is becoming predictable. They can drive much faster and can take any rational initiative that can speed them up if needed. So instead of rigid traffic rules, flow will be regulated by a mesh of dynamic and constantly self-improving algorithms. Self-driving becomes hundred to two hundred percent safer than a person. Tesla's autopilot version 1 which is relatively primitive had 45% reduction in highway accidents, the following versions are expected to be at least three times better, (See Figure 7), [8].



Figure 7: Driverless Cars with AI Core

Neuralink is trying to help in that regard as well by creating high bandwidth interface between AI and the human brain. Does that mean we are going to be Cyborgs connected directly to machines and cloud, the answer is we are already a Cyborg in a sense that your phone and your computer is a kind of extension of you low bandwidth input-output. Technology is not stopping, flying cars are finally moving to attractive business-case territory, (See Figure 8).

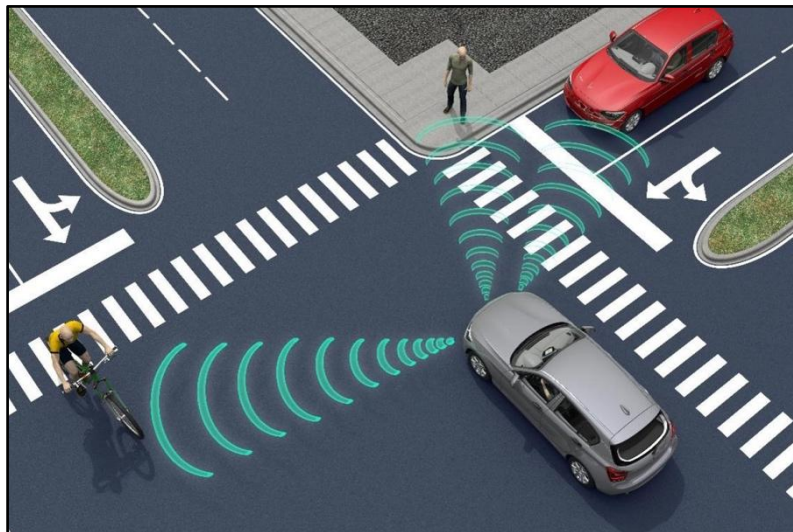


Figure 8: Autonomous Cars Integration

The goal should be is to figure out some way to ensure that the advent of digital super intelligence is one which is symbiotic with humanity and develop AI safely. Without reasonable regulations, it could be far dangerous, Elon Musk has said "Mark my words, AI is far more dangerous than nukes".

VI. ROBOTS' BREEDS

Industrial Robots

At mini's car plant on the outskirts of Oxford, UK, this is a land of robots, more than 900 of them filled the bodies of 1,000 new cars every single day with barely a human in sight. Manufacturing methods have been heavily dependent upon manual labor and skills, today, it's more about the automation, it's all done on the computer, its programming work, its observation, it is setting up sensors for everything, it is artificial intelligence and with powerful predictable robot arms and highly skilled people managing them. The manufacturers believe they can produce better quality cheaper cars, it is a pattern repeated in factories all over the world, (See Figure 9).



Figure 9: Industrial Robots at mini Car Plant

Robot dinosaurs are able to lift car-bodies weighing up to 400 kilograms and with up to 6,000 spot wells on a car they are kept busy, no fatigue, no lunch hours, not going home, not only working 8 hours per day like humans. Robot arms have replaced humans on the factory floor, they perform pre-programmed repetitive tasks much more reliably than humans. The workers used to do the labor job are replaced by robots, however programmers, observers, quality controls, assurance, and supervisors the robots' jobs are added as well, (See Figure 10), [9].



Figure 10: Industrial Robots Productivity

Add-On Robots

Zoox has decided that it makes sense to try and compete against the autonomous vehicle's companies such as Waymo the Google self-driving car project, Cruise Automation, Daimler, Baidu, Uber, and Lyft, by adding self-driving technology to existing cars which is a system of completely autonomous robotic vehicles. The AI and mobility will take us out of the age of the automobile and into the next mobility age which for us is robotics autonomous transportation, meaning giving a complete control of human life over to an AI. These AI robots crank through the course at seventy-five miles per hour, with a choice of all wheel steering, two-wheel steering, crab steering, and dual motors, (See Figure 11).



Figure 11: Zoox AI Powered Autonomous Vehicle

Zoox does most of its software testing in these modified versions of "Toyota Highlander" which has an advantage of being street legal. AI is utilizing and correlating three factors VRL; V means Vision through using cameras which are really good at seeing what things are, R means Radar which is really good at seeing where things are in terms of how far away they are, and L means LIDAR which is really good at telling where things are in 3-D at pretty high resolution and pretty high accuracy. Fusing those three sensors together in real time to form one coherent view of the world is the robotic ride of the future, (See Figure 12).



Figure 12: Add-On Autonomous Vehicle Robot

Cobots

Cobots are designed to share a workspace with humans, making automation easier than ever before for businesses of all sizes. All of these benefits have made Cobots a game-changer from assembly to painting, from palletizing to screw-driving, from packaging to polishing, from injection molding to welding, or whatever processing task we can think of to help achieve greater productivity to compete in a global market, [10].

Moley Robotics have created the first fully automated and intelligent robots that can learn recipes, cook all kinds of foods with a remarkable precision, and then clean up after themselves. This futuristic looking workstation is equipped with advanced robotic arms and hands that can grip kitchen utensils, measure liquids, and crack eggs. MasterChef winner Tim Anderson was hired on as Molly's development chef and helped the robotics team teach the robots how to cook by using motion, capture gloves, and wristbands much like a videogame. Other possibilities are recording the movements of other famous chefs such as chef Gordon Ramsay and have a meal prepared for us indirectly, (See Figure 13), [11].

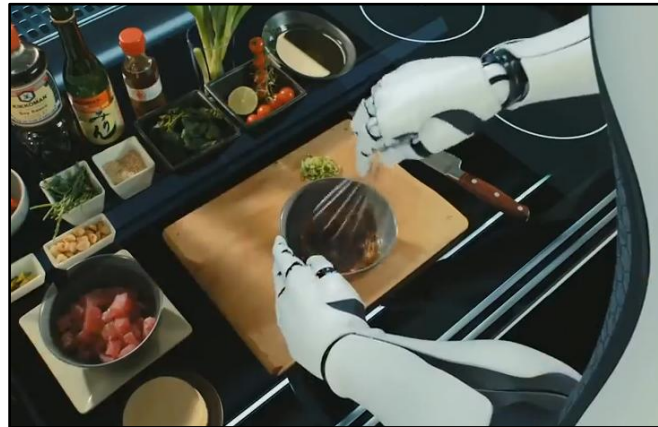


Figure 13: Add-On Kitchen Robot

The automation revolution is beginning to come into fashion which was among the first to be mechanized and still up to yesterday it required skilled human hands to guide and handle the materials. Today, the new cutting-edge technologies of robotics revolution will impact the developing world, machines that automate parts of the clothes making process, it is quite clear that the workers are going to be replaced by these. It is advancing to new types of machines capable of ever more complex tasks, [12].

Self-Aware Robots

Across the world we are creating advanced robots that are developing so rapidly, it is like the arrival of a new species. What has taken humans millenniums to develop, robots are achieved in just decades. They look like humans, move like humans, and they are beginning to think like humans. Robots now follow their own evolutionary path rather than mimicking humans; self-aware robots are constantly not only learning but developing their own behavior as well.

Today, at Boston Dynamics, outskirts of Boston, MA, USA, a robot maker is trying to take this emerging species in a completely different direction by liberating machines from the constraints of human form. Mobile walking robots have diverged from the evolutionary path and taken on a life of its own. Mobile robots are the ultimate combination of mobility, agility, dexterity, speed, and able to tackle the toughest terrain in the toughest conditions. They also come in different flavors to adapt to whatever jobs they will be tasked with, two legged humanoid robots, four legged robots that look like animals, or their latest incarnation combines biology with technology mixing and matching animals, (See Figure 14).

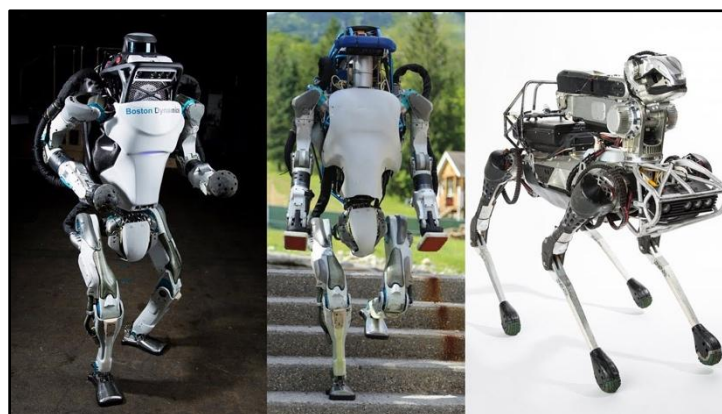


Figure 14: Self-Aware Robots

VII. ROBOTICS' CLOUD

Self-driving cars have a lot to learn but unlike humans they learn quickly. It is the "Cloud Robotics" which interconnect every robot with the internet, so if you are a robot and you learn something, all of the robots will know it immediately, that is learning and is very different than human learning. When those robots wake up because they have access through the internet, they have access to everything all human knowledge transform into something else, [13].

A new report by research firm Tractica forecasts global revenue for cloud robotics will increase from \$5.3 billion in 2018 to \$170.4 billion in 2025. The firm said that while the market is at a nascent stage of

development, more companies are understanding its importance about what the market is, how it works, and implications for business.

The report classifies cloud robotics as a combination of cloud computing and robotic technologies in the form of hardware, software, and services. The market is differentiated from general robotics through the use of teleoperation and cloud technologies, Tractica said. It also utilizes a cloud-based business model, which enables connected robots-as-a-service (RaaS) offerings for more rapid deployment of adaptive robotics solutions, (See Figure 15) [14].

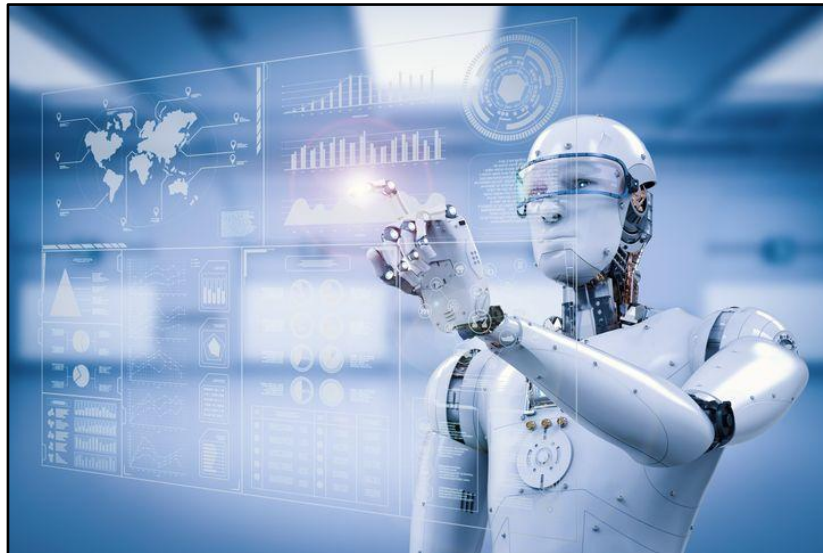


Figure 15: Robotics' Cloud

VIII. CONCLUSION

Technology is advancing daily and occasionally new approaches are invented offering solutions to problems and improvements to our lives but also come with new risks. AI and Robotics could be amazing and scary. There is an enormous amount of complexity with robotics on one hand and the unregulated use yet of AI on the other hand, there is an enormous number of things that can potentially go wrong.

What people worry about more than anything else is that Robots will steal human jobs and some experts predict that by 2030, robots could take up to 30% of these jobs. In reality, when we think deeply about it, this is not the whole truth, during the industrial revolution, the economists had the same prediction yet in general, it led to wealth and prosperity. The fact is without a doubt, some jobs will be eliminated but others and more advanced are created, Robot revolution should be embraced not to fear it.

The future has not been decided yet and definitely no limit how far human dreams can reach. SpaceX with an ambitious plan to send an unmanned capsule to Mars, Tesla's new model three, the most anticipated electric car yet, digging a vast network of underground tunnels that will change transportation forever, and tapping on the human brain to cure diseases, all that were dreams but become facts.

The most important thing to remember is the technology should be invented in a way to help humans with their capabilities, disabilities, and needs. New technological world also surrounded by many want us to fail but also many want us to succeed, so it is important to appreciate things are not working the first place but we are going to keep going together for the good of mankind.

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