

How close are we to a fully autonomous world?

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Introduction

Technology is rapidly developing in performance as well as being more abundant in different areas of the world. But what is the point of technology? The definition is: 'the application of scientific knowledge for practical purposes', and most practical purposes is to allow actions to occur with less work. This is where automation fits in (automation being the use of automatic equipment).

The initial use of automation includes using machinery to undergo simple manufacturing task. One would be the robotic arms responsible for assembling car parts called the *manipulator*. This poster will be exploring the growth of automation in sectors such as vehicles and biology as well as how robots work.

How do Robots function?

A robot is a technology that can move and function automatically. It can interact with an environment via sensors (I.e cameras and LIDAR) and is able to use algorithms to follow via a certain actions. For a robot to be able to autopilot itself, the environment has to be scanned and data must be collected. However, for a changing environment, this is very difficult to code for as certain models need frequent updates hence affecting the decision making for robots. However, they do use mathematical optimisation methods such as game theory where they tend to make a choice with a higher **payout/rewards** to react so there is less consequences.

Real life terminators may take over

Media has often portrayed robots in a negative manner as they always seem to be trying to take over the world. However, it is only recently that autonomous weapons have been in production. There are many ethical issues surrounding these weapons as they seem ethically unjust and also gives one side a huge advantage. However, some say it is better to deploy robots rather than humans and will decrease those with combat related disease such as PTSD. 'The Northrop Grumman X-47B is a demonstration unmanned combat aerial vehicle designed for aircraft carrier-based operations.' With not much human intervention, this could provide with many errors.

Why is there a desire for automation?

We are now entering a new age in automation. According to a study in 2013, 50% of jobs in the US will use automation in the next two decades. Early in the human timeline, we strived to make jobs easier and innovate as it increased productivity. This created new and better jobs. However, innovation now is not creating as many new jobs as before but is still increasing productivity so economically. It seems better

Robots follow certain algorithms acquired by data collection and processing however a huge roadblock is its decision making. Humans, when a random event occurs, can react to it whereas an autonomous robot, if the random event is not embedded into its algorithm, it is not able to react; it has not learnt how to.

Future with Autonomous Cars

With the insurgence of autonomous cars such as the Tesla, there seems to be a huge progression in vehicle automation. However, the autopilot system in the Tesla is only at **Level 2 of Autonomy** out of 5 levels.

Levels of autonomy:

Level 0 and 1: No automation to little drive assistance (I.e. cruise control).
Level 2 and 3: Partial/ Conditional automation (conditional being the car making its own decisions to steer etc but still requires a pilot)
Level 4: High Automation where the car can do all the driving if all conditions are perfect (not in snow or rain). Waymo is a good example.
Level 5: Full automation (the desired level) where a human can fall asleep in a car and still get from A to B without any problems so **no human intervention**.

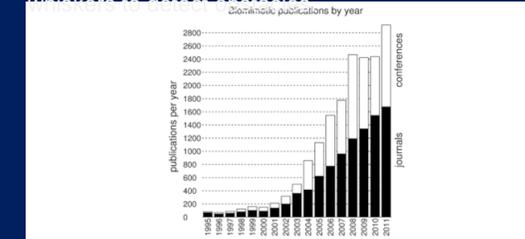
The first engine powered car was made in 1879 by Karl Benz and yet 2014 is the first year a level 2 automated car has been introduced to the public. Elon Musk believes level 5 can be reached in 2020 but there are many problems with that.

Autonomous cars create a massive advantage when it comes to accident prevention as it removes human error. The problem is that these cars are robots meaning they follow a certain algorithm. When the models are developed for a car to follow, they highly rely on conditions being identical to when the model is developed which is problematic in the

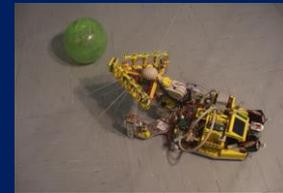
Nature and systems inspiring the robotic world

Nature and robotics seem to be polar opposites yet recently, top engineers are trying to gather inspiration from nature itself to create more robust, versatile and ever adapting autonomous machines. The end goal for the robotics world is to create machinery that can live harmoniously with humans and with minimal error.

Bioinspiration and biomimicry are new sectors in robotic where they investigate biological systems and try find answers to certain processes which then can be incorporated into a robots' algorithm. An example is the ShrewBot by Sheffield University which has



<The graph shows an exponential growth in research papers for biotech/biomimicry



A new branch of robotics is Brain-Computer interface. BCI is where electrical activity is measured in the brain and spinal cord and replaced into a synthetic that can replace/restore/enhance natural functions which is especially useful for those who have paralysis. Electrodes are connected to the brain where algorithms are again used to translate brain-wave activity into commands which means the brain has power to control machinery without the human even moving. Certain **brain wave activity** can link to a certain action and so in the future, robots may be able to self develop and learn how the human neurones work in order to overcome the obstacle of decision making for itself.

To conclude, there is clear evidence that automation is taking a turn for the better and machines are developing in a rapid rate in many areas of the world. The solution to problems now will create even more difficult problems that require new mathematical, computational or even logical techniques to overcome which is where the new scientists, engineers and mathematicians come in. In context of the question, we are not close to getting to a fully autonomous world but that does not mean we should discredit our achievements. From coal powered machines to being able to control machines with the power of our mind is a huge advancements but for right now, we can relax in our world of imperfect robots who trip over obstacles and the abundance of Level 2 Tesla Cars.