Robotics

Artificial Intelligence

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Robotics Overview

Robotics is a body of work which brings together different area of studies and skills. These areas include computer science, mechanical engineering and electrical engineering. It is a field concerned with creating robots that can move and react to sensory input [1]. The term robot was coined by a Czech novelist called Karel Capek in one of his play entitled Rassum’s Universal Robots [2]; also the term robot in Czech means worker or servant. Also robots are considered to be intelligent if they can perform their tasks such as moving in a safe interaction with an unstructured environment while achieving other specified tasks. Over the years extensive research have been done in the field of robotics to further develop and enhance these technologies so that automated machines can better mimic human behaviors and to essentially take their place in dangerous field of work where human would normally operate such as processing and assembly plants [3].

In 1954 the first programmable robot was designed by George Devol who came up with the term Universal Automation which he later changed to Unimation (UNIMATE) [4]. This system, automated the manufacture of television picture tubes. Autonomous robots are described as “intelligent machines capable of performing task in the world by themselves without explicit human control” [5] or independent of any controller. These systems adapt to information it gathers from a constantly changing environment; this is achievable through the learning process. Within these systems various artificial intelligence techniques are implemented. These techniques and how well they are carried out is essential to how effective these systems can carry out a particular job.

Artificial Intelligence Techniques in Robotics

One particular area of A.I involved with robotics is knowledge representation. It’s a sub-area of A.I which covers how information about the world is being represented in a format that computer systems can use to decide what to do next, to plan future activities and to also solve problems in areas that would normally require human competence. It also involves information from psychology on how humans solve problems and represents knowledge.

Another sub-area involved in the relation to robotics and A.I is understanding natural language sor language processing. This area of A.I also involves machine reading comprehension as well. Its main aim is to interpret a given input through its sensory receivers. The entire process can be seen as a translation of the input from natural language to represent a more formal language. This can further be used to perform various tasks implied by a user request.

Learning is another A.I technique involved in robotics. Robot learning entails learning techniques that would allow robots to obtain certain expertise and be able to adapt to an ever so changing environment. The learning aspect of robotics targets certain skills such as sensorimotor, interactive and linguistic skills. Planning is also another area of A.I in which robotic systems uses as well. Planning involves decision making carried out by robots or computer programs to reach or achieve a particular goal or state. This is achieved by selecting between various actions that will eventually alter a state of the environment the system is in so that a particular goal can be reached.

These are just some of the AI techniques implemented in robotic systems. It also shows how closely related AI and robotics are and the role AI plays in robotics. It can be assumed that with the level of work and advancement made in A.I that it’s the main reason for the progress made in robotics. However, this is not the case as robotics is the reason for some of advancement made in A.I. This is evident in online search engines which utilizes techniques developed for robotics. These systems implements autonomous programs which are able to interact with and adapt to their environment. These programs are called software agents.

Initially robotics was a sub field of mechanical engineering which had research projects more geared towards developing robots capable of carrying out various tasks. The control system was mostly initiated by various algorithms with no form of AI involved. As these systems started to become capable of doing so much more the need for AI techniques became more evident. Cognitive robotics was therefore developed which is fast becoming an active subfield of AI. Cognitive robotics which includes AI based control structures, basically provides robotic systems with more cognitive capabilities. Another developed area is developmental robotics which combines three core areas. These core areas include robotics, machine learning and developmental psychology. Its main aim is to allow robotic systems as humans do to continuously learn. This area of AI is supported by the IEEE Technical committee on Autonomous Mental Development.

Relevant Systems

Various robotic systems which utilize these techniques include systems such as Cice Robot. This system implements a robotic architecture that takes into account several suggestions from cognitive science. The architecture was developed by the Robotics Lab of the University of Palermo; its main goal is to integrate perception, action and symbolic knowledge representation. The architecture was implemented in the Cice Bot and tested with various tasks such as providing guided tours in an archaeological museum. The robot is able to provide tours to visitors in a prearranged and interactive tour. Within this system knowledge representation is shared among three areas. These areas include linguistic area, conceptual area and the sub conceptual area. The Cice robot basically gathers information from its environment and builds a plan in which it will carry out through the use of components in these three areas. The system has a Simulation and Refinement Module which verifies the applicability of the plan created by the bot and will modify the plan if there is a need to do so. The bot will not carry out its plan due to the presence of unknown moving obstacles and also may be due to sensory motor errors. Other controls are implemented in the system in order to deal with this issue if it arises.

Another robotic system is a robot that learns, thinks and acts. This system was developed by Japanese scientist at the Hasegawa Lab of the Tokyo Institute of Technology. The robot reacts to its environment by making educated guesses based on past experiences. The robot implements a mechanism called (SOINN) self-organized incremental neural network. It’s takes in information and allows the robot to estimate future patterns and networks. According to the researchers most industrial robots are able to do specific tasks quickly and accurately. But if their environment changes these systems won’t be able to respond. But with this developed system it remembers basic knowledge and will be able to apply it to its current situation.

Work has been done by two researchers at the Cornell University in New York to create a system called Robo Brain. The Robo Brain is a large scale computation system that learns from sources available via internet. This system is used to teach robots on how humans behave. This will also help robots to learn how to do various tasks such as pour drinks, find keys etc. If the system finds a situation it’s not familiar with it would go to the Robo Brain data bank to help solve this problem.

Effects on Society

In the near future intelligent machines will completely replace or enhance human efficiency in many areas. These machines will affect humans in many ways; as such it is important to determine the impact AI will have on society now and in the near future. As with most area of study, there are advantages and disadvantages associated with this field as well. Some of the advantages AI will provide to society on a whole, for one it will make knowledge widely available. Whereas a wide range of expert systems will provide services in aiding with medical diagnosis and prescription. Also provide advice or information to working professionals such as scientists, lawyer’s etc. AI will soon be able to keep people safe by protecting them from various threats. Various government agencies incorporate AI software into their monitoring systems, which is capable of intercepting communication links. These systems will be able to go through large amount of data and will be able find potential threats quickly.

One advantage with relation to AI robotics is Artificial Assistants. Artificial intelligence companies such as Google Director of Engineering Ray Kurzweill have indicated that anyone with smart phones, tablets etc will be using cognitive assistants by 2017. Large tech companies such as Apple, Intel are investing large amount of resources into cognitive assistant research and development as well. Another aspect is that it will affect productivity which is truly an economic issue. Productivity is defined as the ratio of output units compared to the units of labour inputs. Robots geared towards improving productivity will essentially increase productivity which is evident in a lot of industries such manufacturing plants, on dairy farms etc. The increase in productivity and the reduction in manual labour over the years have resulted in the reduction of product prices which will eventually affect how individuals live in society. Other advantages include improved safety and shorter workweeks for labour. One of the reason for the need of automated robots in industrial work area is due to human safety thus removing workers from these areas to protect them from work place hazards.

The main disadvantage related to AI robotics and how it affects society is worker displacement. This has resulted in some technical fields becoming redundant. In most cases job loss as a result of work area becoming automated has resulted in workers to undergo a period of stress. This has even resulted in workers to commit suicide or becoming an addict to compensate for the stress of the job loss. Family relocation has also happened due to this and can be seen in and around areas of Europe where workers who have worked in motor vehicle assembly plants have been replaced by robots. Another disadvantage is moral destruction as human could become less human due to their dependency on AI robotics. Basically slaves to these systems and that it could potentially endanger human civilization. Also that within society humanity will be loss just for economic well-being.

Considering the potential benefits of AI robotics and what it could do for society, that’s if used wisely, can be something great. It can enhance human life and potentially save life with the vast amount of technologies being developed. It can greatly improve social and economic conditions where living standard can be improved for a large amount of people. With the level of research and the development with the field the future for robotics and the impact it can have is very much alive.

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