

Artificial Intelligence — Trends and Implications to the Society

- by Mr. Mausam, Research Scholar, University of Washington, USA

The idea of 'Artificial Intelligence' has been popular with computer scientists and laymen alike. At the same time, AI is one of the least understood phenomena of the modern times. Most associate AI with only the all-powerful robots determined to take over the world. And to almost all, AI is an infatuation, divorced from reality, a dream that will never be realised – the dream of making the machine intelligent.

Indeed, the skepticism is not unfounded. In the 80s, AI became notorious for promising much more than it could achieve. Most researchers, then, worked on building large systems to solve the general AI problems. General AI problems are, unfortunately, too hard to be solved even by today's standards. However, the research trends changed in the 90s as AI reinvented itself by focussing on specific applications. For these intelligent behaviour could be achieved and also added value. Today, with several successful applications deployed, AI looks into the future with some exciting innovations to offer and also a well-founded promise to improve the overall quality of life of one and all. We take a short journey through some successful applications of AI towards the exciting developments happening in the field today, and their implications to mankind at large.

What is AI?

It is right to say that AI endeavours to make a machine intelligent. However, this definition is vague – 1) it does not specify what intelligence is, and 2) it ignores the exact manifestation of that intelligence in a machine. Some equate human thinking to intelligence, while others argue that logical and rational analysis amounts to an intelligent thought process, be it human or otherwise. On the other hand, a machine may be "thinking" intelligently, or it could be just feigning intelligent thinking by merely "acting" intelligently. Based on these we can have four forms of AI – machines that think like humans or act like humans, or machines that think rationally or act rationally. All these are valid kinds of AI and have been explored by different researchers. For example, the 'think like humans' group typically focusses on understanding how humans think, or in other words how brains work. The 'think rationally' aspect of AI is pursued by building logical systems and ascribing a computational model to rationality. While these are fundamental perspectives necessary to move the field forward, the AI that focusses on "acting" intelligently has recently shown much success. This research does not care whether the internal algorithms are mimicing an intelligent thought process or not, as long as it is able to obtain an outwardly intelligent behaviour.

Successes of AI

The focus on intelligent behaviour in specific target domains, the availability of powerful computational machines and the maturing of AI technology – all these have led to a never-before synergy. Today we find many successful applications of AI in different walks of life. Arguably the most prominent amongst them has been the Web-search technology. The rise of Internet and World Wide Web is itself fascinating. But its real impact was not realised until the search engines like Google came up with an information extraction technology that worked! At the core of it, Web-search is just keyword based with some additional heuristics, but in its behaviour it is super-intelligent. It is intelligent to the extent that some times one wonders if the computer 'understands' what one is looking for. Slowly, other forms of natural language technology are also becoming ubiquitous. For example, email clients now display various relevant

advertisements based on the contents of the email, Google news is able to combine all newspaper articles referring to similar content and displays it to us in a summarised fashion.

Game Playing, another traditional area of AI, saw its light of day when Deep Blue defeated Garry Kasparov, the reigning World champion. Deep Blue is nothing more than a traditional AI search (not to be confused with Web-search) engine with powerful heuristics. However, as computers became faster, the technology became powerful enough to defeat the world champion. It is an interesting philosophical question as to whether Deep Blue really understands chess or whether search engines really understands the concept being searched for. A full length debate is out of scope of this article but the reader is welcome to ponder over Garry Kasparov's remark. He says, "I could feel – I could smell – a new kind of intelligence across the table".

AI in the future

While some of the AI techniques have already seen successful real-world deployments, there are many more on offer in the future. One of the most important one is Data Mining. Data Mining, a cross between AI, Databases and Statistics, is the process of searching large amounts of data to extract non-trivial patterns. With applications in Bioinformatics, information extraction, recommender agents, computational finance, e-commerce, etc., data mining has already become a tool of high utility. With more and more application oriented research happening all round the world, we can easily expect a full-scale medical diagnosis engine, a stock market predictor, personalized user interfaces, personalized tutoring systems for education and sports, adaptive websites,

and much more. We may also be able to obtain a long term impact on understanding the personal, interpersonal and social behaviours of people by mining different behavioural patterns. Data mining is indeed destined to be immensely successful in advancing almost all fields of study -- art, business and science, alike.

One of the most prominent applications of large scale data mining is mining over internet. The KnowItAll project at University of Washington is an attempt to develop an omniscient agent, which will be capable of answering user queries, sharing its wealth of information as required, summarising the opinions of different people, etc. We can also hope that soon we will also have an access to an intelligent, ontology driven search engine where webpages can be returned based on the context of the search queries.

Assistive technology is another area where AI is finding its place in a big way. A sizeable fraction of applied AI research is geared towards assisting the elderly, disabled and the unhealthy. The NurseBot project at Carnegie Mellon University aims at providing a robot friend and a care taker to the elderly in the old age homes. This robot can remind the inmates about their regular medication, keep a watch on their well-being, and contact a human care-giver if anyone needs urgent assistance. The Assisted Cognition project at University of Washington aims at assisting the Alzheimer's patients in their day to day activities, as they start getting into the phase of forgetting simple things. Other projects, for example, Autominder at University of Michigan aims at reminding the elderly about their regular activities.

A recent mega-success in the field of Autonomous Navigation has shown the way towards more aggressive research in the field. The DARPA Grand Challenge 2005 consisted of navigating through the 131.6 mile course in the Mojave Desert in Utah. 5 teams succeeded in the mission, the winner being Stanley, an autonomous vehicle developed at Stanford, which drove at an average speed of 19.1 mph. The race course was on a difficult terrain in a hilly region, with the only respite being the absence of traffic. A successful completion of this difficult course by not one but 5 teams is being considered a major success of AI research. More advancements are expected through the next challenge, that of urban navigation, where the autonomous vehicles will have to deal with other moving vehicles as well. We can also look forward to more intelligent prototypes of autonomous underwater vehicles, and unmanned aerial vehicles useful for oceanography research, disaster management and surveillance.

Space missions offer exciting avenues for AI research. NASA's rover on Mars carries out the scientific explorations with limited support from earth.

Autonomous telescope schedules its experiments by itself based on the various observation requests. With some success on these two missions, more adventurous missions have now appeared on NASA's radar. For example, one of them involves sending a robotic agent to one of the moons of Jupiter, called Europa, which remains frozen for 9 months at a stretch.

Finally, a section of AI researchers is working on robotic soccer with the vision of defeating the World Cup Soccer champion by the year 2050. Every year a RoboCup Soccer Tournament is held where the progress towards this vision is evaluated. Last year (i.e. 2006) was the first year when humanoid robots were introduced in the competition. While this is still a very futuristic research, the techniques developed through this might prove to be useful in other robotic applications even before the soccer champion is defeated.

AI and Society

As time progresses, AI will have more and more role to play towards the society. A large part of AI can be summed up as 'automation of human activities', for example, autonomous navigation, robotic care-givers, etc. This automation may have a huge societal impact, especially in domains where either an expert is unavailable or the tasks are dangerous to humans. Fighting in wars, coal or oil mining are some of the activities that are essential, but very dangerous for humans. If robots can take over these then it will be a huge asset to the society. Similarly, tutoring agents, remote-doctors, and many other applications could serve as a boon to the developing world where the presence of expert doctors or teachers is limited.

Autonomous navigation could make blind and other disabled people even more

independent. At the same time, other assistive technologies may eliminate the need for a human presence and may make the patients feel more self-reliant. AI with its successful chess software and maybe with its soccer team may be able to coach the players and improve the known skill levels in these games.

AI may go a long way in pushing the frontiers of the overall intelligence and skill-levels of the human race. Indeed, if robotic agents can do many of the tasks for us, then we can focus on other creative processes out of the reach of today's mankind. Applications are aplenty, the technology is moving ahead fast, we just have to wait a little and soon we might find ourselves as a part of a new reality, a reality that was only confined to the science fiction novels and probably in the minds of a few AI researchers once. We are surely in for some really exciting times ahead!