A Literature Survey on Artificial Intelligence

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Abstract— **There is an endless exciting new research in the field of Artificial Intelligence; this review is far from a global summary of the progress made in the last decade. There also scores of fields within AI. Much of the research covered in this review could be applicable to developing strong AI. Creating a machine capable of understanding the concepts behind the words is important because it allows for more humanlike conversations as well as improved translation. There is also fascinating research into detecting human emotions through audio and video cues. In particular, this paper provides a full review of recent developments within the field of artificial intelligence and its applications. The work is targeted at new aspirants to the artificial intelligence field. It also reminds the researchers about some of the issues they have already known.**

I.   INTRODUCTION

The father of Artificial Intelligence, John McCarthy states a definition for AI which says that "Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs".

Artificial Intelligence (AI) is intelligence exhibited by machines. In computer science the field of AI defines itself as the study of "intelligent agents". Generally, the term "AI" is used when a machine simulate functions that human's associate with other human minds such as learning and problem solving.

In the last few years, there has been an arrival of large amount of software that utilizes elements of artificial intelligence. Subfields of AI such as Machine Learning, Natural Language processing, Image Processing and Data mining have become an important topic for today's tech giants. Machine Learning is actively being used in Google's predictive search bar, in the Gmail spam filer, in Netflix's show suggestions. Natural Language Processing exists in Apple's Siri and Google voice. Image Processing is necessary for facebook's facial recognition tagging software and in Google's self driving cars. Data Mining has become a slang for software industry due to the mass amounts of data being collected every day. Companies like Facebook and Google collect large amounts of statistics from users every second and need a way to interpret the data they receive.

Artificial Intelligence has already proven to be useful new tool in today's technology heavy culture.

II.   HISTORICAL PERSPECTIVE

During 20th century a brief history of AI can be given as:

1923 – Karel Kapek's play named "Rossum's University Robots (RUR)" opens in London, first use of the word "robot" in English.

1945 – Isaac Asimov, alumni at Columbia University, invented the term Robotics.

1950 –Turing Test for evaluation of intelligence was introduced by Alan Turing. Claude Shannon published detailed Analysis of chess playing as a search.

1956 – John McCarthy coined the term Artificial Intelligence.

1958 – John McCarthy invents LISP programming language for AI.

1964 – Danny Bobrow's thesis at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.

1979 – The First Computer controlled autonomous vehicle, Stanford Cart was built.

1984 – Dennett discusses the frame problem and how it relates to the difficulties arising from attempting to give robots common sense.

1990 – Major advances in all area of AI:

- Significant demonstrations in Machine Learning
- Case-based reasoning
- Multi-agent planning
- Scheduling
- Data mining, web crawler
- Natural Language understanding and translation
- Vision, virtual reality
- Games

1997 – The Deep Blue Chess Program beats the World Chess Champion, Gerry Kasparov

2000 – Interactive Robot Pets become commercially available. MIT displays a robot with a face name – Kismet that expresses emotions.

The two major approaches that has been developed for the regular AI system are: "top down" approach which started with the higher level functions and implemented those, and the "bottom up" approach which looked at the neuron level and worked up to create higher level functions.

III. COMPLICATIONS

There are abundant complications when trying to create an intelligent system. Much of the old or simple AI is a list of conditions for what reaction to have based on expected stimuli. But this is arguably not intelligence, and imitating true intelligence requires an understanding of how the input relates to the output, as well as large interdisciplinary effort among most AI subfields along with psychology and linguistics.

Many complications involve 'Human – Machine interaction' because of the complexity of human interaction. A lot of the communication that happens that happens between humans cannot be coded facts a machine could simply recite. There are hundreds of subtle ways that humans interact with each other that affect communication. Innovation in voices, body language, and response to various stimuli, emotions, popular culture facts, and slang all affect how two people might communicate. This is hard to model in a machine that does not have basic common sense model already in place that can learn or make inferences.

'Fuzzy logic', which is modeled after humans' excellent ability of making approximations without any real values, poses many complications. Computation by definition, require numbers and not words or concepts.

Complications arise while trying to imitate human intuition or common sense. The amount of background information that is taken for granted by humans is immense and hard to replicate in machine.

There is difficulty in trying to imitate human emotion because of how complex and subjective they can be, especially when multiple emotions are expressed.

When using a Machine Learning approach, the system

Will process conversations that have been labeled by humans, but these labels are not always consistent.

'Image Processing' also has complications with recognizing different locations from photos on the internet because of the variability in images.

Modeling the world from internet photos is difficult because of how much the average internet photos varies.

Generally, image processing requires data to be somehow consistent, but that obstacle will have to be overcome to render 3D models of popularly photographs locations on Earth. Simply detecting what an image contains is a tricky process.

'Handling large amount of inconsistent data' is another complication, because inconsistent data is inevitable but difficult to process. But being able to take in a large amount of data and analyze the underlying concepts would be necessary to do something like summarize a novel, which is something that is currently not possible.

'Ethical Concerns' arise when building a machine that can be sent into the military that could use lethal force. Although, this is a scary concept, it has high priority for research by the US government.

Finally, using all of the subfields of AI to develop strong AI (or better than human intelligence) is incredibly complicated.

Developing a system that has sentient thought would require us to fully understand how the brain and consciousness work, which we do not.

There are a multitude of difficult compilations within AI research.

AI is a complex field but much progress has been made in the last few years.

IV. RISKS

Most of the scientists believe that an intelligent system is not capable of representing human emotions like love or hate, and on the second thought there is also no need for a system to willfully become generous or vengeful.

While thinking of many different ways in which an AI system may behave, the experts simply narrowed it down to two synopsis:

a. AI systems that are programmed to kill i.e. Autonomous weapons. If the wrong persons get their hands on these kinds of weapons then they would be able cause mass casualties easily and also, an AI arms race will hastily head towards an AI war that's also going to head towards mass casualties. Well, in order to steer clear of the thought of being conquered by the enemy, these weapons are programmed to be extremely difficult to just simply 'turn off', and that's the reason why humans will be most likely to lose control of such a situation.
b. The second type of case happens whenever we fail to fully align the AI's goal with ours, which is strikingly difficult. If you ask a well trained intelligent car to take you to a particular destination as fast as it can, then it might get you there covered in vomit and chased by helicopters, doing literally what you have asked for. If a super intelligent system is tasked with an ambitious geoengineering project, it might create disruption with our ecosystem as a side effect.

Now as we discussed the above two scenarios, we can say that our concern for the advanced AI isn't vengeful but competence.

A magnificent well – informed AI system will be exceptionally satisfying at performing its goals but we do have to align those goals with ours.

V. SAFETY

The ultimate goal is to keep the concussion of Artificial Intelligence in favor to the society which in turn results in triggering the research in many areas like control and security, validation and verification and even also law and economics.

Let's just assume that your system gets hacked or crashed down then it will be quite a problem. Now, when it comes to an AI system it becomes really essential that the intelligent system does what we've asked it to do specially when it comes to systems lie vehicles such cars, airplane or a power grid or an automated trading system or may be a pacemaker.

One of the major short term challenges in order to maintain the safety is to take precaution from an Arms Race in Lethal Autonomous Weapons.

On the other hand, when we consider the long term impact, a significant question arrives that if we succeed in the chase of strong Artificial Intelligence and if an AI becomes more sophisticated than humans could ever be what will happen?

In 1965 I.J. Good pointed that conniving a wise intelligent system is itself a challenging task. The achievement of such systems could result in provoking an intelligence detonation which will leave the human intelligence way too far behind.

By designing radical latest technologies, and thus produced super intelligent system might be able to help us wipe out poverty, disease or may be even war. But so the creation of such a strong AI system might also be the last, until and unless we learn to align our goals with that of the Artificial Intelligence.

Now as we know that an AI has the capability to turn into more intellectual than any human ever, we can't predict how it's going to behave. We won't be able to use previous developments in technologies because of the ability to outsmart us willingly or unwillingly.

VI. FUTURE

Artificial Intelligence has come a long way in the last decade. But there's still a large amount of work required to develop strong AI. Giving a machine Common Sense or intuition is a critical component of allowing a machine to truly learn. Knowing how to convert the input to output appears important, but a machine that truly understands why output relates to the input is necessary for strong AI. It is also necessary to further develop methods for detecting human emotions and actions. This is a multi – disciplinary subject and will require advancements in Psychology, Linguistics, Machine Learning, Natural Language Processing and Image Processing to learn how humans behave to detect emotions and to analyze human expressions and body language.

Here are some ways listed below in which AI is going to be helpful to us in the near Future:

a. Automated Transportation: - We have already begun to see the beginning of smart cars or self-driving cars, but for now these kinds of vehicles need to have a driver at the wheel for safety. Instead of these very exciting ongoing developments, the technology isn't perfect yet, and it is going to take a while for the common people to accept these smart vehicles to use widely. The U.S. Transportation Department has released definitions of different levels of automation since Google began testing a self – driving car in 2012.

b. Cyborg Technology: - Being human has its own flaws and one of the biggest disadvantages of being a human is simply our own body and brain. Now, according to a researcher Shimon Whiteson it is possible to augment ourselves with computers in the near future in order to improve our own natural abilities. Yoky Matsuka of Nest believes that in the near future an AI system will be developed which is going to be useful for the people with amputated limbs, as the brain will be able to communicate with a robotic limb to provide more control to the patient.

c. Attaining Dangerous Jobs: - Robots have already begun to attain some of the most dangerous jobs like defusing a bomb. Well, technically they are not robots; they are drones, which are being used as the physical counterpart in bomb defusing, which requires a human to control them, instead of using an AI system. Despite of whatever their classification is, they have saved thousands of lives by taking over these kinds of jobs in the world. There are also some other jobs which are being reconsidered for robot integration for example, Welding, which is quite known for releasing earsplitting noise, intense heat and toxic substances, now can be outsourced to robots.

d. Robot as Friends: - Don't you think that how fascinating it would be to be friends with a robot? As for now robots have no emotions. The first big step towards a robot companion has been made by a company yin Japan – one who would be able to feel and understand human emotions. Introduced in 2014, "Pepper" the companion robot went on sale in 2015, with all 1000 initial units selling out within a minute. Pepper went on sale in U.S. in 2016, and more sophisticated friendly robots are sure to follow.

e. Improved Elder Care: - For most of the elderly people, living everyday life and doing the basic needs is still a struggle, and for doing that most of them to hire outside help to manage their care or they just have to rely on family members. As the computer scientist at Washington State University Matthew Taylor says 'AI is at a stage where replacing this need isn't too far off'. Home robots would be able to help the elderly people with their everyday tasks and will allow them to stay

independent and in their homes for as long as possible, which results in improving their overall well-being.

VII. APPLICATIONS

1. Gaming: - The most popular application of AI which is quite familiar with the people is Video Game AI that's being used for quite a long time now – since the very first video games, in fact. But with the exponential increase in the complexity and effectiveness of that AI in the past few decades, lead the video game characters to learn our behaviors, respond to stimuli and react in some ways that we can't predict. In 2014 a game called 'Middle Earth: Shadow of Mordor' was developed and is one of the best example for the individual personalities given to each NPC (Non-Player Character), their past interaction memories, and their variable objectives. Some other shooting games like 'Far Cry' and 'Call of Duty' are also using AI, with enemies that has the special feature of analyzing their environment to find objects or perform actions that might be able to help in their survival; to increase their chance at victory. As far as AI goes, video games are quite simple but because of the large market demand, a huge amount of effort and money are being invested every year in order to make this AI perfect.

2. Natural Language Processing: - Human Language and conversation is complex and subjective. The current standard forms of communication with machines involve mouse and keyboards, or a specific and basic set of verbal commands. This is different from how human interact, simply because the amount of variability in human communication; 'red' in 'red hair' is different from 'red' in 'red apple'. This fundamental problem of correctly representing concepts with symbols, or words, is greatly hindering the progression of Natural Language Processing. If these challenges are overcome, systems with Natural Language Processing would have the capabilities to express beliefs they have acquired, translate languages at human translator levels, understand the difference between a red apple and red hair, and process commands like 'hand me that purple thing down there' into physical action.

3. Image Processing and Vision System: - Human centered design is attempting to move away from the current paradigm where a machine simply responds to given commands from a keyboard, mouse, or simple verbal commands. This shift will require am increased ability to process images and perceive information. Most existing image processing software that performs facial recognition utilizes 2D spatial analysis by looking for geometric shapes and edges in the face. But research suggests that the most accurate behavioral judgments of human action come from analyzing both facial expression and body language.

4. Virtual Personal Assistants: - Siri in iOS, Cortana in Windows 10 and even Google now have been developed as intelligent digital personal assistants. Briefly, they help us to acquire the useful information with voice recognition given from the user; for instance let's just say we need to search for the nearest restaurant then we can speak "Where's the nearest Indian restaurant?" or "At what time is my presentation today?" or "Remind me to go to the defense class at 7 o'clock today" and the personal assistant will respond back by looking for the appropriate information, delivering the information to us from our phone, or sending the particular needed commands to the other applications. Artificial Intelligence plays an important role in these kinds of applications, as they collect information based on our requests and use that information to give us the results marked up to our preferences. Microsoft has stated that 'Cortana tends to progressively learns about its users' and then it will eventually develop the ability to forecast or assume its users needs. These Virtual Personal Assistants processes a large amount of data from different sources to learn about its users and be more helpful to organize their daily routine.

5. Self – Driving Cars: - No one might have seen someone doing their nails or tying a knot of their tie or doing any other activity while driving yet, but smart cars or self-driving cars are getting closer to reality; the two latest approaches that had been seen in the news lately are 'Google's self-driving car' project and 'autopilot feature' developed by Tesla. An algorithm has been developed by Google that will lead the self-driving cars learn to drive in the same way as humans does but obviously through experience. The main point of developing this algorithm was that, eventually, the car will be able to look on the road and make decisions based on what it sees, meanwhile helping it to learn. On the other hand while Tesla's 'autopilot feature' has not been advanced yet but it's already being used on the road, indicating that these technologies are certainly on their way in.

6. Fraud Detection: - Sometimes you must have gotten a letter or a mail asking you if you've made a specific purchase on your credit card or not?, Most of the banks send those types of mails just to confirm whether there's been a fraud committed from your account or not and in order to confirm that you had accepted the purchase before giving the money over to some other company. The technology that's been deployed to monitor for this type of fraud is Artificial Intelligence. Computers deal with a huge amount of deceitful and non-deceitful purchases and asked to learn to look for signs that a transaction falls into one category or another. After training this kind of AI well enough it will be able to identify a fraudulent transaction based on the signs and indications that it learned through the training exercise.

7. Security Surveillance: - We as humans are not really good as multi – tasking because our brain will start to mess things up and monitoring a large number of security cameras being a single person isn't a very secure system; and people tends to easily get bored, and even in the best of circumstances keeping track of multiple monitors at a time can be quite difficult. That's why in order to make a great deal of sense we

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have to train the computers to. With supervised training exercises, security algorithms can take input from security cameras and determine whether there may be a threat—if it "sees" a warning sign, it will alert human security officers. Identifying actions that might imply a thief in a store are likely beyond the current technological limitations.

8. Handwriting Recognition: - This is where human handwriting is turned into text that then can be edited when input into a palmtop computer or a tablet. A stylus is used to write on the computer screen and then handwriting recognition software will then change it into the text, e.g. a teacher using a smart board can turn their own writing into text in the same manner. This allows you to scan in a page, containing text, and the OCR software will convert this into editable text. It does this by recognizing the shapes of the letters and converting them into ASCII text. There is a great need to train the computer system to recognize different letters in different ways.

9. Human – Machine Interaction: - Most technology literate people, today, are accustomed to the idea that interacting with a computer is just different then interacting with a human. There is a push towards human – centered interfaces which emphasize removing the mechanical feeling inputs from machines and making them more humanlike. This requires video input to track facial features and emotional cues, video input to track human movements and recognize actions, audio input that can detect emotions and different types of commands, audio input that can hear and process natural language. Detecting emotion allows for machines to behave in a more anthropomorphic manner because humans will recognize emotion and adjust the Interaction accordingly. By analyzing facial expressions, body language, conversations tones, and actual dialog, systems can anticipate human needs. This would also be useful in emotional development research; tutoring and mental disorders just to name a few. Machines are already being developed for a wide range of autonomous tasks.ome of these machines would be used as soldiers capable of lethal force, or as machines that can physically assist the elderly or infants. Machines that are given the capacity to use lethal force or care for those that need help have a high possibility of making life changing decisions because of a lack of understanding. It is crucial for machines like these to understand the full picture and not only respond to simple but basic verbal commands.

VIII. SUMMARY OF APPLICATIONS

Machine Learning, Natural Language Processing, Knowledge Management, Human – Machine interaction, and Image Processing are all interrelated and important for creating a machine that might one day be more intelligent and capable than humans. Representing the concepts behind the word is one of the main issues raised in Searle's Chinese Room. The OMCS project with ConceptNet will provide a backbone with which new concepts can easily be learned. Computing with words, in addition to ConceptNet, will increase the usefulness of the inferences made. In addition to improvements in how a machine might think, there has been research into developing better techniques for detecting human emotions and analyzing images. This progression is important because it will help shift to a more human – centered paradigm, where the machine will anticipate interaction with the human instead of only responding to commands.

IX. CONCLUSION

This paper is based on the concept of artificial intelligence, areas of artificial intelligence and its techniques. The field of artificial intelligence gives the ability to the machines to think analytically, using concepts. Artificial Intelligence will continue to play an increasingly important role in the various fields. We conclude that further research in this area can be done as there are very promising and profitable results that are obtainable from such techniques, while scientists have not yet realized the full potential and ability of artificial intelligence. This technology and its applications will likely have far-reaching effects on human life in the years to come. This review has not attempted to detail all the literature in the area but to report mainly the most recent work.

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