ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS

by

Gaurav Sawant

Under the guidance of Prof. Pranav Nerurkar

March 2019

A disseration submitted to the

Faculty of VJTI

in partial fulfilment of the requirements for the

degree of

Bachelor of Technology

Department of Information Technology

Dedication

To my wonderful parents and all my friends who have been selflessly helping
me pursue my dreams.

Acknowledgments

Table of Contents

Abstract

Since the invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the power of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with respect to time.

A branch of Computer Science named Artificial Intelligence pursues creating the computers or machines as intelligent as human beings.

According to the father of Artificial Intelligence, John McCarthy, it is The science and engineering of making intelligent machines, especially intelligent computer programs.

Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think.

AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

Chapter 1

Introduction : What motivated AI?

While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, Can a machine think and behave like humans do?

Thus, the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans.

AI Technique is a manner to organize and use the knowledge efficiently in such a way that

- It should be easily modifiable to correct errors.

- It should be useful in many situations though it is incomplete or inaccurate.

Artificial intelligence is a technology based on disciplines such as Computer Science, Linguistics, Mathematics and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.

AI has been dominant in various fields such as

Gaming AI plays crucial role in strategic games such as chess, poker, Tic-Tac-Toe, etc., where machine can think of large number of possible positions
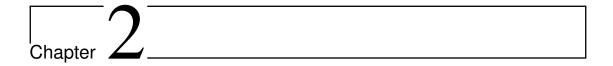
based on heuristic knowledge.

Vision Systems These systems understand, interpret, and comprehend visual input on the computer. For example,

- A spying aeroplane takes photographs, which are used to figure out spatial information or map of the areas.

- Doctors use clinical expert system to diagnose the patient.

- Police use computer software that can recognize the face of criminal with the stored portrait made by forensic artist.

Speech Recognition Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in humans noise due to cold, etc.

Handwriting Recognition The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.

Intelligent Robots Robots are able to perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.

Chapter 2

Terminologies in Artificial Intelligence

Agent

Agents are systems or software programs capable of autonomous, purposeful and reasoning directed towards one or more goals. They are also called assistants, brokers, bots, droids, intelligent agents, and software agents.

Autonomous Robot

Robot free from external control or influence and able to control itself independently.

Backward Chaining

Strategy of working backward for Reason/Cause of a problem.

Blackboard

It is the memory inside computer, which is used for communication between the cooperating expert systems.

Environment

It is the part of real or computational world inhabited by the agent.

Forward Chaining

Strategy of working forward for conclusion/solution of a problem.

Heuristics

It is the knowledge based on Trial-and-error, evaluations, and experimentation.

Knowledge Engineering

Acquiring knowledge from human experts and other resources.

Percepts

It is the format in which the agent obtains information about the environment.

Pruning

Overriding unnecessary and irrelevant considerations in AI systems.

Rule

It is a format of representing knowledge base in Expert System. It is in the form of IF-THEN-ELSE.
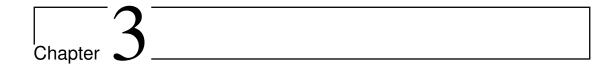
Shell

A shell is a software that helps in designing inference engine, knowledge base, and user interface of an expert system.

Task

It is the goal the agent is tries to accomplish.

Turing Test

A test developed by Allan Turing to test the intelligence of a machine as compared to human intelligence.

Expert Systems in AI

Expert Systems (ES) are one of the prominent research domains of AI.

The expert systems are the computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise.

Characteristics of Expert Systems

- High performance

- Understandable

- Reliable

- Highly responsive

The expert systems are capable of

- Advising

- Instructing and assisting human in decision making

- Demonstrating

- Deriving a solution

- Diagnosing

- Explaining

- Interpreting input

- Predicting results

- Justifying the conclusion

- Suggesting alternative options to a problem

The components of ES include

- *Knowledge Base*

- *Inference Engine*

- *User Interface*

Natural Language Processing in AI

Natural Language Processing (NLP) refers to AI method of communicating with an intelligent systems using a natural language such as English.

Processing of Natural Language is required when you want an intelligent system like robot to perform as per your instructions, when you want to hear decision from a dialogue based clinical expert system, etc.

The field of NLP involves making computers to perform useful tasks with the natural languages humans use. The input and output of an NLP system can be either Speech or Written Text.

Natural Language Generation (NLG) It is the process of producing meaningful phrases and sentences in the form of natural language from some internal representation.

It involves

Text planning It includes retrieving the relevant content from knowledge base.

Sentence planning It includes choosing required words, forming meaningful phrases, setting tone of the sentence.

Text Realization It is mapping sentence plan into sentence structure.

Following are the steps in NLP:

- Lexical Analysis It involves identifying and analyzing the structure of words. Lexicon of a language means the collection of words and phrases in a language. Lexical analysis is dividing the whole chunk of txt into paragraphs, sentences, and words.

- Syntactic Analysis (Parsing) - It involves analysis of words in the sentence for grammar and arranging words in a manner that shows the relationship among the words. The sentence such as The school goes to boy is rejected by English syntactic analyzer.

- Semantic Analysis It draws the exact meaning or the dictionary meaning from the text. The text is checked for meaningfulness. It is done by mapping syntactic structures and objects in the task domain. The semantic analyzer disregards sentence such as hot ice-cream.

- Discourse Integration The meaning of any sentence depends upon the meaning of the sentence just before it. In addition, it also brings about the meaning of immediately succeeding sentence.

- Pragmatic Analysis During this, what was said is re-interpreted on what it actually meant. It involves deriving those aspects of language which require real world knowledge.

Chapter 5

Future Scope of AI

Over the next few years, we are about to witness the world we live in entirely disrupted by improvements in AI. Children today are growing up with AI assistants in their homes (Google Assistant, Siri and Alexa) – to the point that you might consider their mere presence an extension of co-parenting. As voice and facial recognition continue to evolve, machine learning algorithms are getting smarter. More and more industries are being influenced by AI, and our society as we know it is transforming.

- **Transportation**

  The transportation industry looks like it will be the first to be completely disrupted by AI. In fact, a lot of the impact of AI is already taking place. Uber and Lyft are both working on self-driving technology. GPS navigation software company Waze (which was acquired by Google in 2013) quietly released a new app called CarPool that converts its 50-plus million users into drivers and allows users to commute to work together for a fee.

  Think about how many hours of human productivity can be saved when we put an end to mindless driving and commuting through city traffic?

The automation of the ride-hailing economy is not only going to save society time, but it's also going to reduce the cost of transportation drastically. Soon enough, requesting a self-driving vehicle will cost as much as taking the bus.

- **Criminal Justice**

  The next industry disrupted by AI is the criminal justice system. Advancements in facial recognition are making the fingerprint obsolete. Tech startups are using AI to automate legal work. Meanwhile, some courts are already using AI to sentence criminals and determine parole eligibility.

  But the criminal justice system is the one area where too much innovation could be a terrible thing for society and lead us into a dystopian future if we are not careful.

  Without proper government regulations of AI, we are at risk of major disruptions to our democracy.

- **Advertising**

  Finally, AI is going to take targeted/personalized advertising to a whole other level. If you think the Facebook Cambridge Analytical scandal was bad, then you have no idea what's in store in the next decade.

  Advertisers are already able to predict what types of ads emotionally impact your purchasing behavior. As time goes on, ads are going to continue to become more tailored to the individual.

  Ads are going to continue to become smarter and more embedded in our daily lives thanks to AI. Machine learning algorithms are building personality profiles on every human being. The amount of data collected by

advertisers continues to grow. Related product recommendations, search results and social news feed items are all examples of places where advertisers are embedding smart ads that use AI to target you as an individual consumer.

Slowly, these AI algorithms can learn your behavior, and before you know it, they know you better than you know yourself.

Even today, the impact AI is having on our society cannot be ignored. However, if you want to have a competitive edge and you are willing to prepare for these changes now, there is still plenty of time to be ahead of the curve.