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RESEARCH PAPER

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A REVIEW OF ARTIFICIAL INTELLIGENCE SYSTEMS

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Abstract: Globalization has become a business imperative and companies are venturing their businesses all over the world. To survive and excel, companies are implementing global strategies and are compelled to adopt Information systems (IS) to collaborate with business partners, enhance their intimacy with customers and suppliers, to design and deliver new products and services and to improve their operational excellence. Digitalization, Sustainable development, bringing transparency in business operations and delivering high quality eco-friendly products and services by automating tasks as much as possible are some of the current focus of business strategists. Information Systems play a pivotal role in making this happen and have transformed the business landscape. Companies are deploying various types of Information Systems to improve their competitive advantage and IS are used to perform day to day operations, to support management decision making and to increase competitive advantage. Among the Information Systems, Artificial Intelligence Systems (AIS) occupy a special position as they can "mimic human intelligence" and have become an integral part of every business activity. Today, we are witnessing a business world where AIS are used not only to automate tasks, but are also deployed to give expert advice and are able to interact with humans and provide them with the required services as per their preferences. Intelligent agents, Chat bots, Expert systems and Speech Recognition Systems are some of the facets of Artificial Intelligent systems which are already in gouge. By 2030, Artificial Intelligence is likely to have spread into almost all the fields - Ubiquitous. The applications of AI are not limited to a particular area, but from a little thing to an innovative development, there exists AI. This decade can be considered to be the rise of artificial intelligence systems to greater heights. Several companies are investing in the development of AIS to improve their businesses. In this paper, we review the different types of Artificial Intelligence Systems and highlight some of the popular Industrial AIS in use today.

Keywords: Artificial Intelligence, Information Systems, Chat bots, Expert Systems

I. INTRODUCTION

Survival and growing business are the two predominant goals of a global company. To make this happen, companies are deploying various types of Information Systems (IS). To survive, businesses employ IS to speed up operations, process and solve complex business problems, store huge volumes of data and reduce cost by automating repetitive tasks. To grow business, Information systems are employed to get connected with suppliers and global customers 24*7*365 days through computer networks, predominantly the Internet. Business Enterprises also exploit the simulation capability of IS to design innovative products and services with minimal infrastructure and wastage. With several Information Systems in use, a special category of 'Information System - Artificial Intelligent Systems' support companies to do tasks that can only be done by humans. AIS possess different features when compared to other IS. Typical AIS have features such as Symbolic processing, Intuitive Knowledge, Learning capability and inferencing capability. The role played by Artificial Intelligent Systems (AIS) include automating monotonous tasks, providing expert advices, game playing, aid in speech recognitions, support computer assisted instruction, language translation and so on. The adoption and utilization of AIS has increased dramatically as it offers several advantages like faster execution, increased productivity with no compromise in quality, less expensive than natural intelligence, less erratic and provide consistent results, etc.,

II. EVOLUTION OF ARTIFICIAL INTELLIGENT SYSTEMS

Artificial Intelligence is the study of how to make computers do things at which, at the moment, people are better [1]. The evolution of modern AIS can be described in the following major stages [2] as below:

Stage 1: Naïve Solution Stage dates back to 1950s when a group of scientists wished to replicate human intelligence using computers. The solutions at this stage were fundamentals to the evolution of AIS at later stages. The term 'Artificial Intelligence' was first used in the 'Dartmouth Conference' held in 1956.

Stage 2: Around 1970s, the focus among scientists was to develop general problem solving methods and to build AIS that can be applied to general domains. This stage is described as '**General method stage'**.

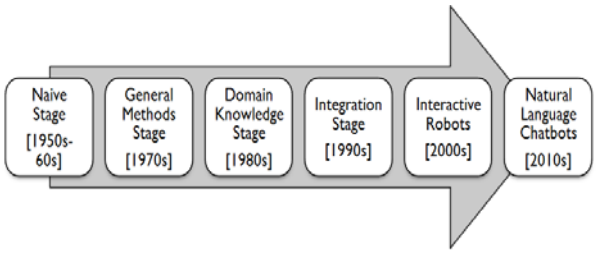

Fig 1: Major stages of Artificial Intelligent Systems

Stage 3: In 1980s, it was realized that the problem solving methods are specific to each business domain and AIS named 'Expert Systems' evolved. Expert Systems were developed specific for each business domain like Healthcare, Banking, Game playing and so on. Rule based Expert System – MYCIN became popular and this stage was named as 'Domain Knowledge Stage'.

Stage 4: After 1990s, AIS development adopted hybrid approach by integrating several problem solving methods. This stage is referred to as 'Integration Stage'. In this stage, 'Deep Blue Chess' machine from IBM defeated world chess champion, Garry Kasparov.

Stage 5: The next stage of Intelligence systems saw the emergence of Interactive robots and recommendation technology of intelligent systems were used to track web activity helping Digital Marketing.

Stage 6: In this decade, Natural Language Chatbots are ruling the digital world – Apple's Siri, Google Now, Microsoft's Cortana have taken AIS to the next level. 'Watson' is given as the cognitive solution to business from IBM.

III. TYPES OF ARTIFICIAL INTELLIGENCE SYSTEMS

Artificial Intelligence Systems can be broadly grouped into the following types:

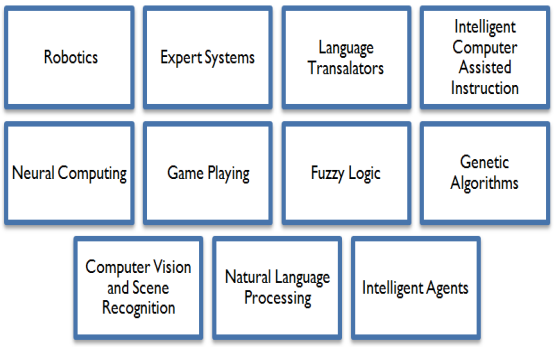

Fig 2 : Types of Artificial Intelligence Systems

A. ROBOTICS

Robots are used in performing various varieties of tasks including the one which cannot be performed by humans in the areas of military, medical surgery, space missions, etc., The term 'Robot' was first used by Karel Capel, a Czech Writer in his play 'Rossum's Universal Robots'[3]. A Robot is defined as "a reprogrammable multifunctional manipulator designed to move materials, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks" by the Robotics Institute of America [4]. Wide arrays of Robots are available today including Industrial Robots, Military Robots, Medical Robots, Household Robots, and Entertainment & Toy [5]. Some of the popular robots include Asimo, Pepper, Spot, Nao, MyKie, etc.

B. EXPERT SYSTEMS

Expert Systems perform several roles as advisor, decision makers; Supporting Doctor in Diagnosis, suggesting alternative solutions, etc.., Expert System is a Computer Based Information System that applies reasoning process of a human expert to a new situation [6]. Expert Systems were first developed in 1970s by Professor Edward A Feigenbaum who is popularly called as Father of Expert Systems [7]. The different types of Expert Systems include Rule based Systems, Frame based Systems, Model based Systems and Hybrid Systems [8]. Expert Systems possess distinct expertise in a specific area of work, provide consistent results and are very quick. Some of the popular Expert Systems include Dendral, Mycin, Deep Blue, Xcon, etc.,

NATURAL LANGUAGE PROCESSING (NLP)

Processing helps in analyzing data which were inaccessible earlier and are extensively used for enterprise search, deep learning, and sentiment analysis. The Capability of understanding human language by a computer program is referred to as 'Natural Language Processing (NLP)'[9]. Some of the current products in NLP include Alexa from Amazon, Siri from Apple, Cortana from Microsoft, Google Now…

C. LANGUAGE TRANSLATORS

Today, Information is available all over the world through Internet. People are able to share their knowledge in their own language and this knowledge is made available to other languages employing language translators. Language Translators translate text from one language to another [10]. Google Translate, IBM Watson Language Translator is some of the popular Language Translators.

D. INTELLIGENT COMPUTER ASSISTED INSTRUCTION (ICAI)

Students learning a specific topic can be categorized into different categories like Student group looking for basic concepts, Student Group expecting Advance concepts and the groups looking for specialized problems, cases and so on. Intelligent Computer Assisted Instruction Systems is well positioned to facilitate student groups expecting advanced and specialized learning materials. These systems consist of three components – Problem Solving Expertise, Student Model, and Tutoring Model and are capable to provide presentation and evaluation to student responses. They are also referred to as 'Intelligent Tutoring Systems' [11]. Some of the popular ICAI Systems include Mika from Carnegie's Learning, iTalk2Learn, etc.,

E. GAME PLAYING

With Responsive and Intelligent behavior, AIS are used to simulate human behavior in playing games. AIS are used to play Chess, Poker, Checkers, etc., Game Playing AIS are very dynamic and are capable to take fast intelligent decisions. Some of the popular Games Playing AIS include

IBM's Deep Blue, Façade, Black and White, Sims, Versu, F.E.A.R, etc [12].

F. ARTIFICIAL NEURAL NETWORKS

The concept of Artificial Neural Network (ANN) is inspired from biological neural networks. It is a machine learning approach that models human brain and contains a number of 'Artificial Neurons'[13]. Each neuron in ANN receives a number of inputs and an activation function is applied to these inputs which results in activation level of neuron i.e., output value of the neuron. The applications of neural networks include Classification, Recognition, Identification, forecasting, prediction and assessment. Examples of commercial ANN Packages include BrainMaker, NeuralShell Easy, NeuroSolutions, Neural Ware, etc.,

G. FUZZY LOGIC

Fuzzy logic is a form of multi-valued logic in which it is based on degrees of truth i.e., truth values may be any real number between 0 and 1 rather than the usual "true or false"(1 or 0). The term fuzzy logic was introduced by Dr. Lotfi Zadeh of the University of California at Berkeley in the 1960s [14]. The applications of fuzzy technologies includes House hold appliances, Animation systems, Aerospace, Industry automation, Transportation etc., The areas where Fuzzy Logic and Artificial Intelligence is in current research include Fuzzy Expert Systems, Robotics, Machine Learning , Pattern Matching etc., Stratassist is an expert system employing fuzzy logic. Companies involved in developing Fuzzy Logic Systems include Massive Software, Vibrobox, Texo Controls, etc.,

H. GENETIC ALGORITHMS

Genetic Algorithms (GAs) were first suggested by John H. Holland in his book Adaption in Natural and Artificial Systems (David E. Glodberg, 2000), first published in 1975 [15]. Genetic Algorithms (GAs) are considered as a global search approach for solving optimization from the numerous genetic combinations. The applications include Learning robot behavior, Clinical decision supports, Airlines revenue management, Groundwater monitoring networks, Quality control, Traveling salesman problem and its applications, Wireless sensor/ad-hoc networks etc., Evolver, XpertRule GenAsys are examples of Commercial Software Packages employing Genetic Algorithms

I. COMPUTER VISION AND SCENE

J. RECOGNITION

Computer vision is the science and technology of acquiring and analyzing images in order to understand objects and scenes in the real world [16]. Computer vision is important for the building of methods and techniques for intelligent systems that interpret sensory information and make use of that information to produce intelligent and goal-directed behavior. The methods which are used in Computer vision include image segmentation, object recognition and profiling, motion estimation, event detection, 3D scene reconstruction, human-behavior analysis, faces and gesture recognition. The applications of Computer vision include Automatic inspection, assisting humans in identification tasks, Controlling processes, Detecting events, Interaction, and medical image analysis.

K. INTELLIGENT AGENTS

An Intelligent agent is anything that can perceive its environment through sensors and acts upon that environment through effectors [17]. There are several sensory organs for human agents such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors but a robotic agent replaces cameras and infrared range finders for the sensors, and various motors and actuators for effectors and a software agent has encoded with bit strings as its programs and actions. The Intelligent agents are applied as Automated Online Assistants for providing automated customer service to the customers of webpage.

IV. SNAPSHOT OF AIS TYPES AND POPULAR SYSTEMS

S.No	Type of AIS	Popular AIS Systems/Companies
1	Robotics	Asimo, Pepper, Spot, Nao, MyKie
2	Expert Systems	Dendral, Mycin, Deep Blue, Xcon
3	Natural Language Processing	Alexa from Amazon, Siri from Apple, Cortana from Microsoft, Google Now
4	Language Translators	Google Translate, IBM Watson Language Translator
5	Intelligent Computer Assisted Instruction	Mika from Carnegie's Learning, iTalk2Learn
6	Game Playing	IBM's Deep Blue, Façade, Black and White, Sims, Versu, F.E.A.R
7	Neural Computing	BrainMaker, NeuralShell Easy, NeuroSolutions, Neural Ware
8	Fuzzy Logic	Massive Software, Vibrobox, Texo Controls
9	Genetic Algorithms	Evolver, XpertRule GenAsys

V. CONCLUSION

The Investments and Research activities pursued by world reputed companies like Google, Apple, Microsoft, IBM etc., signifies the role of AIS in THE near future. It is predicted that the penetration of AIS will be much higher by 2030. Already, we are witnessing several of these AIS in our day to day life. Though replacing humans is looked as a downside, AIS has lot of potentials and the future is a world of highly Intelligent Systems.

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