

Artificial Intelligence and its Application in Different Areas

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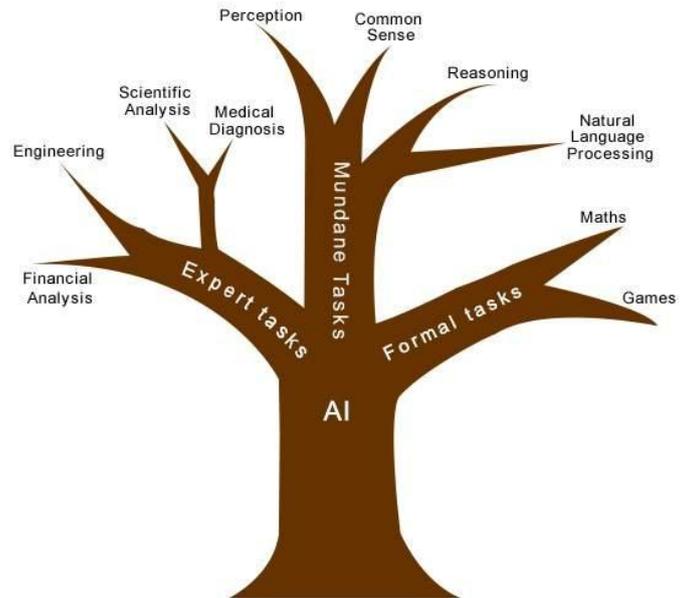
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Abstract: In current time there is trend of automatic machines. In the future many areas of human capabilities will be replaced by the intelligent machines. Artificial Intelligence (AI) is intelligence exhibited by machines or softwares. It is a popular field in computer science. In past one –two decades Artificial Intelligence has improved the manufacturing and service systems performance in a good manner. Currently Artificial Intelligence is used in various fields of engineering, business, medicine, weather forecasting, various fields of science to solve complex problems. This paper gives an overview of this technology. This paper will also explore the current use of Artificial Intelligence in Google for handling searches, in the medical area to improve hospital inpatient, problem of database migration, in computer games and image classification.

Keywords: Artificial Intelligence, Neural Networks (Computer), Google Search

I. INTRODUCTION

In current time Artificial Intelligence is playing a great role in the Operational research as well as Management science research areas. Intelligence is the ability to reason, plan, solve problems, think abstractly, complex ideas, learn quickly and learn from experiences. In future, machines using intelligence will replace human capabilities in many areas. Artificial Intelligence is the branch of Computer Science concerned with making computers behave like humans. The term Artificial Intelligence was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology. It is the study of computational methods that make it possible to perceive, reason, and act. Artificial Intelligence makes machines more useful and smarter. It's different from psychology, it has special importance in the computer science field because of its impact on perception, reasoning, and action. Artificial Intelligence works with the help of artificial neural networks and lots of scientific theories (which include If-else conditions and Logics). Major Artificial Intelligence areas are Expert Systems, Robotics, Natural Language Processing, Games, Computer Science, and Aviation. These growing technologies have a huge impact on various fields of life. The various techniques applied in Artificial Intelligence are Fuzzy Logic, Neural Network, Evolutionary computing and Hybrid Artificial Intelligence. Artificial Intelligence is more permanent, consistent, less expensive compared to Natural Intelligence. Artificial Intelligence performs tasks much faster and better than the human.



The Turing test Approach: The Turing test was proposed by Alan Turing in 1950. This test was designed to test that whether a machine can think or not. The test involves a human interrogator who interacts with a human and with a machine. The interrogator has to identify who is human and which one is computer. The computer passes the test if an interrogator, after posing some written questions, fails to tell whether the written response is coming from human or from the machine.

II. AREAS OF ARTIFICIAL INTELLIGENCE

A. Learning and adaptive system: The ability to capture behaviour of previous experience and to develop simple rules related to such experience.

1.1 Cybernetics: "Science concerned with the study of systems of any nature which are capable of receiving, storing and processing information so as to use it for control."

1.2 Concept Formation

B. Problem solving: Ability to formulate a problem in a suitable form.

2.1 Inference (Resolution-Based Theorem Proving)

2.2 Interactive Problem Solving

2.3 Automatic Program Writing

C. Language understanding: The ability to understand and respond to the natural language.

- 3.1 Speech Understanding
- 3.2 Language Translation
- 3.3 Question Answering
- 3.4 Information Processing
- 3.5 Information Retrieval

D. Perception (visual): The ability to analyze a scene by relating it to an internal model which represents the perceiving organism's "knowledge of the world." The result of this analysis is a structured set of relationships between entities in the scene.

- 4.1 Pattern Recognition
- 4.2 Scene Analysis

E. Modeling: The ability to develop an internal representation and set of transformation rules which can be used to predict the behaviour and relationship between some set of real-world objects or entities.

- 5.1 The Representation Problem for Problem Solving Systems
- 5.2 Modeling Natural Systems

F. Robots: A combination of most or all of the above abilities with the ability to move over terrain and manipulate objects.

- 6.1 Exploration
- 6.2 Transportation/Navigation
- 6.3 Industrial Automation (e.g., Process Control)
- 6.4 Security

G. Games: The ability to accept a formal set of rules for games such as Chess, Go, Checkers, etc., and to translate these rules into a representation or structure which allows problem-solving and learning abilities to be used in reaching an adequate level of performance.

- 7.1 Particular Games (Chess, Go, Bridge, etc.)

III. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

A. Application of Artificial Intelligence in Google Search

According to a report published on 26th October 2015 Google developed Artificial Intelligence called "RankBrain" to handle Searching of Google search Engine. Using RankBrain google search engine provide almost 15% new search daily of its 3.5 billion searches. Main speciality of RankBrain is it learns from its Mistakes. RankBrain can accurately find the most suitable match of user search and it also learns from its mistakes to make future result more accurate.

In its first test Google RankBrain got 80% score, whereas algorithms designers of RankBrain make target of 70% accuracy.

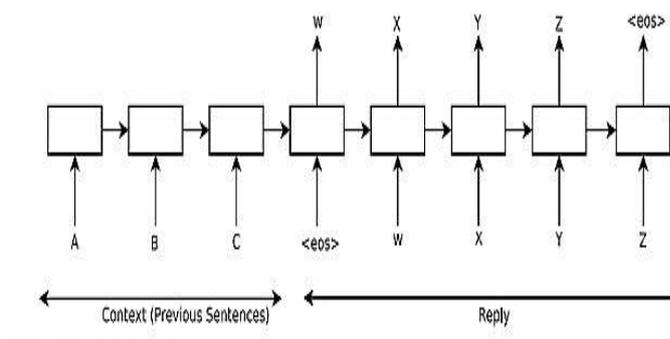
Actually, RankBrain is a part of Google search engine. Google search engine called Hummingbird, Hummingbird come in light in middle of 2013.

Hummingbird is the overall search algorithm, it encompasses various parts with RankBrain being one of the overall all algorithm.

In an interview, Google commented that RankBrain is third most important factor in the ranking algorithm along with links and content.

The main working of RankBrain is that if it sees a word or phrase not familiar, RankBrain can make a guess words or phrases having a similar meaning and accordingly display filter result.

RankBrain is comparatively more effective than other search queries existing in current time. RankBrain have over 200 different ranking factors.



Signals used by Google for Ranking:

Signals are used to help in web page ranking. Eg., it reads word of a web page then words work like a signal, if any word is in bold then it can be possible that another signal that's noted. In current time Google has more than 200 major ranking signals and 10,000 variations or sub-signals. RankBrain is the third-most important signal of Google ranking signals.

Working of RankBrain:

- 1.1 RankBrain search based on hundred of signals including location, key words, the site's ranking and more.
- 1.2 These signals are gathered by algorithms of RankBrain.
- 1.3 RankBrain uses Artificial Intelligence to convert word into computer understandable vector form.
- 1.4 If it found any new word which doesn't recognize it takes an 'educated guess' at what it could mean, based on other similar meaning of phrases and words.
- 1.5 After making searches and applying educated guess it filters the result and displays more accurate links to users.
- 1.6 Every time RankBrain uses same process to make an accurate result.

B) Application of Artificial Intelligence Techniques in Network

Intrusion Detection Systems (IDS) uses the various Artificial Intelligence techniques for protecting computer and communication networks from intruders. Intrusion Detection System (IDS) is the process of monitoring the events occurring in network and detecting the signs of intrusion.

2.1 Artificial Neural Network in Intrusion Detection Systems

(IDS): ANN is a mathematical model that consists of an interconnected group of artificial neurons which processes the information. In IDS ANN are used to model complex relationships between inputs and outputs or to find patterns in data. In this a neuron calculates the sum by multiplying input by weight and applies a threshold. The result is transmitted to subsequent neurons.

Basically, the ANN has been generalized to: $y_i = f(\sum w_{ik}x_k + \mu_i)$

(1) w_{ik} Where w_{ik} are weights attached to the inputs, x_k are inputs to the neuron i , μ_i is a threshold, $f(\bullet)$ is a transfer function and y_i is the output of the neuron.

2.2 Fuzzy Inference Systems (FIS) in IDS:

Sampada et al [12] proposed two machine learning paradigms: Artificial Neural Networks and Fuzzy Inference System, for the design of an Intrusion Detection System. They used SNORT to perform real time traffic analysis and packet logging on IP network during the training phase of the system. They constructed a signature pattern database using

Protocol Analysis and Neuro-Fuzzy learning method. They then tested and validated the models using the 1998 DARPA Intrusion Detection Evaluation Data and TCP dump raw data. The data set contains 24 attack types. The attacks fall into four main categories viz. Denial of Service (DOS), Remote to User (R2L), User to Root (U2R), and Probing. From the results, it was shown that the Fuzzy Inference System was faster in training, taking few seconds, than the Artificial Neural Networks which took few minutes to converge. Generally, both techniques proved to be good, but with the Fuzzy Inference System having an edge over Artificial Neural Networks with its higher classification accuracies. Their experiment also showed the importance of variable selection, as the two techniques performed worse when all the variables were used without selection of the variables. Good results were recorded when a subset (about 40%) of the variables were used [12].

c) Application of Artificial Intelligence Techniques in Medical Area Artificial intelligence techniques have the potential to be applied in almost every field of medical area.

3.1) Artificial Intelligence in Medicine

3.1.1) Fuzzy Expert Systems in Medicine: Fuzzy logic is a data handling methodology that permits ambiguity and hence is particularly suited to medical applications. It captures and uses the concept of fuzziness in a computationally effective manner. The most likely area of application for this theory lies in medical diagnostics and, to a lesser extent, in the description of biological systems [14]. Fuzzy expert systems use the structure of a series of 'if – then' rules for modeling.

The techniques of fuzzy logic have been explored in many medical applications. Fuzzy logic is preferred over the multiple logistic regression analysis in diagnosing lung cancer using tumour marker profiles. Fuzzy logic is also used in the diagnosis of acute leukaemia and breast and pancreatic cancer and also predict patients' survival with breast cancer. They can also characterize MRI images of brain tumours ultrasound images of the breast, ultrasound. Fuzzy logic controllers have been designed for the administration of vasodilators in the peri-operative period to control blood pressure.

3.1.2) Evolutionary Computation in Medicine: Evolutionary computation is the general term for several computational techniques based on natural evolution process that imitates the mechanism of natural selection and survival of the fittest in solving real-world problems. The most widely used form of evolutionary computation for medical applications are „Genetic Algorithms“ [8]. „Genetic Algorithms“ based on the natural biological evolution are the most widely used form of evolutionary computation for medical applications. The principles of Genetic algorithms have been used to predict outcome in critically ill patients. MRI segmentation of brain tumours to measure the efficacy of treatment strategies is also done through evolutionary computation. They have also been used in computerized analysis of mammographic micro calcification.

3.2) Using Artificial Intelligence to Improve Hospital Inpatient Care: Clinical decision support systems (CDSS) were one of the first successful applications of AI, focusing Primarily on the diagnosis of a patient's condition given his symptoms and demographic information [4]. Mycin a rule-based expert system for identifying bacteria causing infections and recommending antibiotics to treat these infections was developed in 1970 under the work of CDSS for medical diagnosis. Pathfinder, which used Bayesian networks to help pathologists more accurately diagnose lymph-node diseases. AI has also been useful for computer-aided detection of

tumors in medical images. Such approaches help in the diagnosis of various forms of cancer, and congenital heart defects.

3.3) Artificial Intelligence Approaches for Medical Image

Classification: Artificial intelligence techniques are used for diagnostic sciences in biomedical image classification. Model-based intelligent analysis and decision-support tools are important in medical imaging for computer-assisted diagnosis and evaluation. CAD helps radiologist who uses the output from a computerized analysis of medical images as a second opinion in detecting lesions, assessing extent of disease, and improving the accuracy and consistency of radiological diagnosis to reduce the rate of false negative cases [12].

3.3.1) Artificial Neural Networks Approach on Diagnostic Science:

The following subsections will discuss how ANN is utilized for image classification over generations.

3.3.1.1) Endoscopic Images: Image classification is an important step in CAD. In classification of endoscopic images a hybrid implementation by advanced fuzzy inference neural network which combines fuzzy systems and Radial Basis Function (RBF) was proposed. The concept of fusion of multiple classifiers dedicated to specific feature parameters with an accuracy of 94.28% but RBF was characterized by a very fast training rate than fuzzy. It extracted both texture and statistical features [13].

3.3.1.2) MRI Brain Tumour Analysis

For the MRI brain tumour images a general regression neural network (GRNN) based automatic three-dimensional classification method was proposed. This method had good time consuming rate and classification accuracy. Another intelligent classification technique proposed was Least Squares Support Vector Machines (LS-SVM). It identifies normal and abnormal slices of brain MRI data. This technique had a higher accuracy of classification over other classifiers as the false negative in LS-SVM was very low compared. Due to automatic defects detection in MR images of brain, extensive research is being performed.

D) Application of Artificial Intelligence in Databases: The use of artificial intelligence is investigated as the basis to mitigate the problems of accounting databases. The following are some difficulties with existing accounting database systems. The needs of decision makers are not met by accounting information. Humans do not understand or cannot process the computerized accounting databases. Systems are not easy to use. There is focus on the numeric data. Integrating intelligent systems with accounting databases can assist (either with the decision maker or independent of decision maker) in the investigation of large volumes of data with or without direct participation of the decision maker. Thus, the systems can analyze the data and assist the users understanding or interpreting transactions to determine what accounting events are captured by the system [5]. With the artificial intelligence we store and retrieve knowledge in human language. There are some artificial intelligence tools or techniques that help in the huge understanding of events captured by the accounting system. There is more emphasis on symbolic or text data rather than just numeric data to capture context. The artificial intelligence and expert system builds intelligence into the database to assist users. Without users direct participation such models help the users by sorting through large quantities of data. Such models also assist the decision makers under time constraints; suggest alternatives in the searching and evaluation of data.

E) Application of Artificial Intelligence Techniques in the Computer Games

Playing games is one of the most popular uses for computer technology. In the evolution of computer games, they have grown from modest text based to the three dimensional graphical games with complex and large worlds. The systems as graphics rendering, playing audio, user input and game artificial intelligence (AI) when put together provide the expected entertainment and make a worthwhile computer game. Artificial intelligence is the most important part of every computer game and playing the game without artificial intelligence would not be any fun!. If we remove artificial intelligence from computer games, the games will be so simple that nobody will be interested in playing the computer games anymore!. Without the game AI, the winning would not be difficult at all. Artificial intelligence is used to solve common problems in the computer games and provide the features to the games. Specifically, non-playing character (NPC) path finding, decision making and learning are examined. There are several ways that AI contributes to modern computer games. Most notably are unit movement, simulated perception, situation analysis, spatial reasoning, learning, group coordination, resource allocation, steering, flocking, target selection, and so many more. Even context dependent animation and audio use AI [2].

Computer Game Problems Solved with AI: Artificial intelligence solves the three common problems: non-playing character (NPC) movement, NPC decision making, and NPC learning. The four artificial intelligence techniques used are Path Finding, Bayesian Networks, Fuzzy Logic, and Genetic Algorithms which help a computer game provide non-playing character path finding and decision making as well as learning.

5.1) NPC Movement Using Path-Finding Artificial intelligence computer game must provide a way for a non-playing character to move throughout the game world. For example, When then player is on one side of the building and the monster is on the other, through which path through the building the monster will reach the player? This is the NPC movement problem. AI Search Methods are used to find the path in computer games. A* algorithm is the most widely used for path negotiation because of its flexibility and also because it determine the shortest path between two points. Typical A* algorithms have three main attributes, fitness, goal, and heuristic or f, g, and h respectively. g is the cost to travel from the start node to some node between the goal. h is the heuristic or estimated cost to get from this node to the goal. f is the sum of g and h, or the total estimated cost of a path going through this node. The A* algorithm also maintains an Open list of the nodes that have not been explored yet and a Closed list of nodes that have been explored. The following is pseudo code for the A* algorithm [9]. 1. Let P = the starting point. 2. Assign f, g, and h values to P. 3. Add P to the Open list. At this point P is the only node on the Open list. 4. Let B = the best node from the Open list (best node has the lowest f-value). a. If B is the goal node, then quit. A path has been found. b. If the Open list is empty, then quit. A path has been found. 5. Let C = a valid node connected to B. a. Assign f, g, and h values to C. b. Check whether C is on the Open and Closed list. i. If so, check whether the new path is more efficient (lower f-value). 1. If so, update path. ii. Else, add C to open list. c. Repeat step 5 for all valid children of B. 6. Move B from the Open list to the closed list and repeat From step 4.[9]

5.2) NPC Decision Making Using Bayesian Networks In the previous example of the monster negotiating a path to the player, a different problem must be solved first before negotiating the path. The problem is does the monster even know the player is present in the building? If the game designers give the full information of the game world to the non-playing character then there would be no fun

in playing the game. This is an example of NPC Decision making. In this AI is needed to make the non-playing character to act in a human like way. When the player enters the building from the other side, the monster will be unaware of the presence of the player because of the wall between them. If the player enters causing a noise disturbance, then the monster will sense the player and will start negotiating the shortest path as discussed in the NPC movement using path finding. One AI technique that is used to implement this is a Bayesian Network. It helps NPC to perform complex reasoning in a human like fashion. In this the computer calculates the probability of the monster sensing the player if the player has entered the building. This expression can be written as; $P(B|A) = P(B|A) P(A) / P(B)$ [2] Where P (B|A) is the probability that the monster would sense the player if the player had actually tripped. and P (A) is the probability of the monster sensing the player. and P (B) is the probability of the player tripping [2].

5.3) NPC Learning Computer games use the Artificial Intelligence Genetic Algorithms to try and implement learning in NPC's. A genetic algorithm works in the following way [7]. 1. Create a first generation population of random organisms. 2. Test them on the problem that is being solved and rank them according to fitness. If the best organisms have reached our performance goals then stop. 3. Take the best performers and mate them by applying genetic operators such as crossover and mutation. Add a few brand-new random organisms to the population to introduce new variety and help ensure against convergence on a local maximum. 4. Loop to step 2. Genetic Algorithms try and build the perfect specimen and are very complex. This AI technique has not found itself into many modern computer games because it takes a lot of computer resources and time to evolve a specimen or NPC into something worthwhile.

IV. CONCLUSION

The field of artificial intelligence gives the ability to the machines to think analytically, using concepts. Tremendous contribution to the various areas has been made by the Artificial Intelligence techniques from the last 2 decades. Artificial Intelligence will continue to play an increasingly important role in the various fields. This paper is based on the concept of artificial intelligence, areas of artificial intelligence and the artificial intelligence techniques used in the field of Google Search to maintain Google search engine and make searching more accurate and useful for user, in the Network Intrusion Detection to protect the network from intruders, in the medical area in the field of medicine, for medical image classification, in the accounting databases, and described how these AI techniques are used in computer games to solve the common problems and to provide features to the games so as to have fun. There is bright future in the analysis of Network Intrusion Detection and there is also definite future in the area of Power System Stabilizers. 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. This technology and its applications will likely have far-reaching effects on human life in the years to come.

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