

Artificial Intelligence

Overview

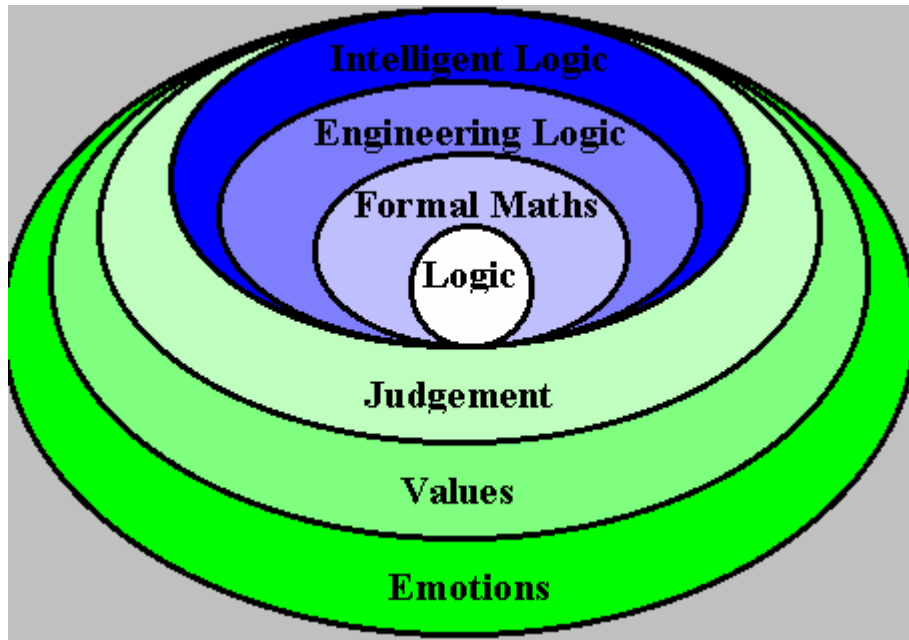
Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. The ability to create intelligent machines has intrigued humans since ancient times and today with the advent of the computer and 50 years of research into AI programming techniques, the dream of smart machines is becoming a reality. Researchers are creating systems which can mimic human thought, understand speech, beat the best human chess player, and countless other feats never before possible.

How does Artificial Intelligence works?

In the field of artificial intelligence, there are two main camps: the Neats, and the Scruffies. The division has held practically since AI was founded as a field in 1956. The Neats are “advocates of formal methods such as applied statistics. They like their programs to be well-organized, provably sound, operate based on concrete theories, and freely editable. The Scruffies like messy approaches, such as adaptive neural networks, and consider them-selves hackers, throwing anything together as long as it seems to work. Both approaches have had impressive successes in the past, and there are hybrids of the two themes as well.

All artificial intelligence designs are at least superficially inspired by the human brain, as by definition artificial intelligence is about mimicking some aspect of intelligence. AI’s had to build concepts of the things they manipulate or work with, and store those concepts as chunks of data. Sometimes these chunks are dynamic and frequently updated, sometimes static. Generally an AI is concerned with exploiting relationships between data to achieve some goal.

Topography of Artificial Intelligence



At the core of our architecture is a formal logical inference engine. A meld of compiler and proof technologies giving fast computation of logical truths rather than data values. Beyond the theories into the applications which is targeted at engineering applications. As much automated problem solving as we know how implement within the limits of energetic engineering rather than AI breakthroughs beyond logic and mathematics, beyond deduction, into empirical science. Judgment is called for here, and trusting machines may not be appropriate. Built on the logical core, the main body of applicable mathematics with just as much pure math's as helps to oil the wheels. We seek an environment in which, in an environment full of hard graft algorithmic problem solving, intelligent capabilities can evolve and emerge but not by natural selection.

Applications in the field of Artificial Intelligence

1. Pattern Recognition
 - a. Fraud Detection and Prevention
 - b. Face Recognition
 - c. Handwriting Recognition

Pattern Recognition in Ai is the research area that studies the operation and design of systems that recognize patterns in data. When a program makes observations of some kind, it is often programmed to compare what it sees with a pattern. For example, a vision program may try to match a pattern of eyes and a nose in a scene in order to find a face.

Fraud Detection and prevention in AI performs a really very good task for the bankers. If your card use has been queried, it's probably because more banks are now using artificial intelligence software to try to detect fraud. Fraud was reduced by 30% by 2003. Artificial intelligence community is constantly bringing us new solutions. In the field of Ai, we can say that face recognition plays an important role in any kind of industries as there will be a security in each and every application they are working with systems and other machines. When the person moves away from the computer, it automatically locks the machine.

Face recognition is used to unlock the machine without the need to enter a password via the keyboard. This prevents others from using the computer because their faces are not likely to match the original user's stored face model.

Handwriting recognition is one of the most promising methods of interacting with small portable computing devices, such as personal digital assistants, is the use of handwriting in Ai. In order to make this communication method more natural, they proposed to observe visually the writing process on an ordinary paper and to automatically recover the pen trajectory from numerical tablet sequences.

2. Bio-informatics
 - a. Data Mining
 - b. Bio-Medical Informatics

AI provides several powerful algorithms and techniques for solving important problems in bioinformatics and chemo-informatics. Approaches like Neural Networks, Hidden Markov Models, Bayesian Networks and Kernel Methods are ideal for areas with lots of data but very little theory. The goal in applying AI to bioinformatics and chemo-informatics is to extract useful information from the wealth of available data by building good probabilistic models.

Data Mining is an AI powered tool that can discover useful information within a database that can then be used to improve actions.

Bio-Medical Informatics in the field of Ai is a combination of the expertise of medical informatics in developing clinical applications and the focused principles that have background guided bioinformatics could create a synergy between the two areas of application.

3. Expert Systems
 - a. Diagnosis and Trouble-Shooting
 - b. Decision Making
 - c. Design and Manufacturing
 - d. Process Monitoring and Control
 - e. EIA(Environmental Impact Assessment)

Expert System in Ai is the knowledge-based applications of artificial intelligence have enhanced productivity in business, science, engineering, and the military. With advances in the last decade, today's expert systems clients can choose from dozens of commercial software packages with easy-to-use interfaces. Diagnosis and Trouble-shooting explains the development and testing of a condition-monitoring sub-module of an integrated plant maintenance management application based on AI techniques, mainly knowledge-based systems, having several modules, sub-modules and sections.

Intelligent Decision Support Systems have the potential to transform human decision making by combining research in artificial intelligence, information technology, and systems engineering. The field of intelligent decision making is expanding rapidly due, in part, to advances in artificial intelligence and network-centric environments that can deliver the technology. Communication and coordination between dispersed systems can deliver just-in-time information, real-time processing, collaborative environments, and globally up-to-date information to a human decision maker.

Design and Manufacturing in the field of Ai is a special issue with the latest development in the research and application of AI techniques for product development problems. The main objective is to present some research initiatives that promise a high level success in the industries.

Process Monitoring and Control a generic AI architecture for intelligent monitoring and control, suitable for application in multiple domains like in the domain of patient monitoring in a surgical intensive care unit (SICU)

EIA (Environmental Impact Assessment) Expert systems are promising technologies that manage information demands and provide required expertise. They thus seem well suited to many of the tasks associated with EIA. Additional advantages of using expert systems for EIA are:

1. Expert systems help users cope with large volumes of EIA work
2. Expert systems deliver EIA expertise to the non expert
3. Expert systems enhance user accountability for decisions reached and
4. Expert systems provide a structured approach to EIA.

Because the application of expert system technology to EIA is relatively new, one might consider the technology as too advanced and not appropriate for developing countries. This is not true, and expert systems are slowly being disseminated throughout developing countries in Asia and the Pacific.

4. Computer Vision

Vision involves both the acquisition and processing of visual information. AI powered technologies have made possible such astounding achievements as vehicles that are able to safely steer themselves along our superhighways, and computers that can recognize and interpret facial expressions. AI vision technology has made possible such applications as image stabilization, 3D

modeling, image synthesis, surgical navigation, handwritten document recognition, and vision based computer interfaces.

5. Image Processing

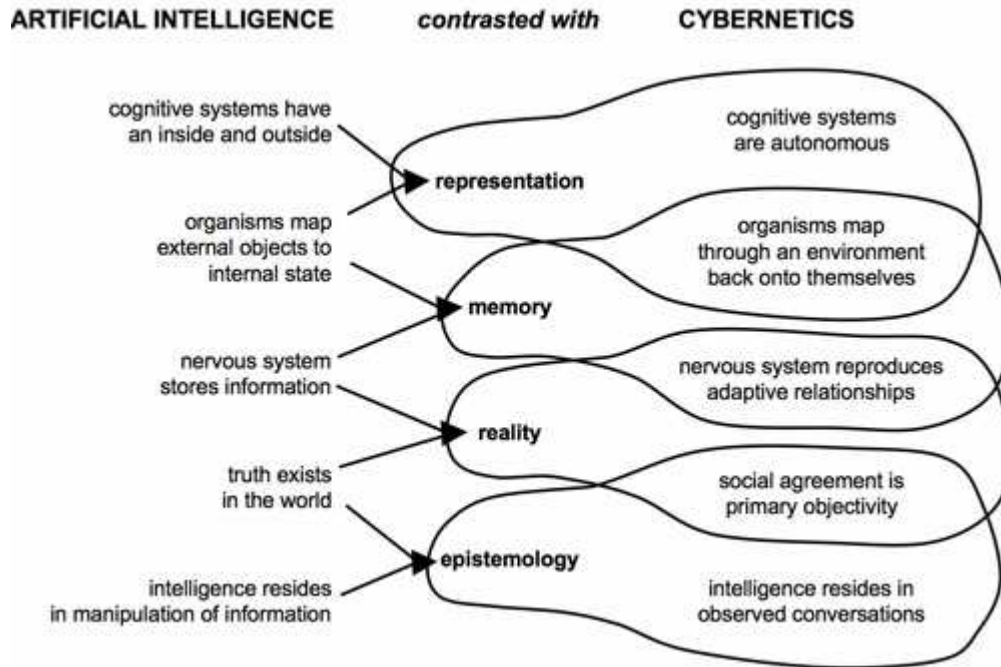
The image formation and processing group is concerned with re-search issues related to the acquisition, manipulation, and synthesis of images. In AI, applications include video phone, teleconferencing, and multimedia databases. Increasingly, this research has combined image or vision with audio or speech. For example in the video indexing project, the group is using both visual and audio cues to derive semantic labels for video shots.

6. Robotics

- a. Cybernetics
- b. Commercial and Research Applications
- c. Sensors in robots

Programming computers to see and hear and react to other sensory stimuli. In the area of robotics, computers are now widely used in assembly plants, but they are capable only of very limited tasks. Robots have great difficulty identifying objects based on appearance or feel, and they still move and handle objects clumsily. Cybernetics- In the field of computer science applies the concept of cybernetics to the control of devices and the analysis of information. In robotics, it controls the mechanisms. Robots are comprised of several systems working together as a whole. In Ai, the action capability is physically interacting with the environment; two types of sensors have to be used in any robotic system:

1. Proprio-ceptors for the measurement of the robot's (internal) parameters;
2. Extero-ceptors for the measurement of its environmental (external, from the robot point of view) parameters.



7. Knowledge Representation and Reasoning

a. Logical Agents

b. Semantic Web

Logical Agents is the representation of knowledge and the reasoning processes that bring knowledge to life which is considered as the central to the entire field of artificial intelligence. Logic will be the primary vehicle for representing the knowledge throughout.

Semantic Web describing things in a way that computers application can understand it. The Semantic Web is not about links between web pages. The Semantic Web describes the relationships between things like A is a part of B and Y is a member of Z and the properties of things like size, weight, age, and price. In AI, some parts of the Semantic Web technologies are based on results of Artificial Intelligence research, like knowledge representation for ontology's, model theory, or various types of logic, for rules. However, it must be noted that Artificial Intelligence has a number of research areas such as image recognition that are completely orthogonal to the Semantic Web.

It is also true that the development of the Semantic Web brought some new perspectives to the Artificial Intelligence community such as the Web effect that is, merge of knowledge coming from different sources, usage of URIs and so on.

8. Gaming

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. Using AI, we can also beat world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

Case studies

Case studies on Expert Systems

Knowledge based applications of artificial intelligence have enhanced productivity in business, science, engineering, and the military. With advances in the last decade, today's expert systems clients can choose from dozens of commercial software packages with easy-to-use interfaces.

Case Study- Applying Expert System Technology to testing phase of software life cycle

A research has made in applying expert systems .Expert system describes the use of an expert-systems approach to automation of systems and integration testing for validation of complex, real-time communications software.[1] The approach permits a `state'-based rather than path- or branch-based testing style. States can be associated with high-level system requirements to give a measure of test coverage. The benefits and weaknesses realized from using an embeddable expert-system shell with a custom relational database interface to construct an automated software verification tool supporting this approach, and the utility of applying expert systems technology in this software engineering area will take place in this life cycle process.

Interestingly, the effectiveness of the prototype automated software verification analysis was tested against an AWACS (Airborne Warning and Control System) baseline known to be faulty, and both documented and undocumented errors were identified. So this seems to be very interesting and very useful while developing a project using expert system.

A survey on Expert System Projects:

A pioneer in commercializing expert system technology, Teknowledge released two so-called "Expert system shells" in mid-1984. [2] It soon became apparent that product customers were using these tools in ways that differed from what the developers envisioned. Even internal to Teknowledge, there was considerably controversy over the value of these tools. The debate centered on the tradeoffs between the leverage they provided for certain portions of the system development task and the restrictions they imposed on the ways knowledge could be represented. The generalized experience of over 150 expert system development projects suggests some heuristics for successfully managing an expert systems application. It is unnecessary (and perhaps unwise) to undertake a massive knowledge engineering project to begin to take advantage of expert systems technology. High returns on investment can be found in automating simple knowledge-processing functions. Furthermore, these simpler systems can be built with more predictable projects, using predictable amounts of resources, and in many cases can be maintained with a very reason-able level of effort. [2]

Case study on Knowledge Representation and Reasoning

There are various fields in Artificial Intelligence Computational Intelligence on KRR. A research and case study was made by David Poole, Alan Mackworth and Randy Goebel. [3] In order to use knowledge and reason with it, you need what we call a representation and reasoning system (RRS). A representation and reasoning system is always composed of a language to communicate with a computer, a way to assign meaning to the language, and procedures to compute answers given input in the language. Intuitively, an RRS tells the computer something in a language where you have some meaning associated with the sentences in the language, you can ask the computer questions, and the computer will produce answers that you can interpret according to the meaning associated with the language. One simple example of a representation and reasoning system that is explained in this case study is a database system. The functioning of a database system is that you can tell the computer facts about a domain and then ask queries to retrieve these facts. What makes a database system into a representation and reasoning system is the notion of semantics. Semantics allows us to debate the truth of information in a knowledge base and makes such information knowledge rather than just data.

A survey

A survey was made on Turing's Dream and the Knowledge Challenge available from Research Channel. "In this Turing Center distinguished lecture, Lenhart Schubert explains that there is a set of clear-cut challenges for artificial intelligence, all centering around knowledge. The solution to those challenges could realize Alan M. Turing's dream, the dream of a machine capable of intelligent human-like response and interaction. Schubert presents preliminary results of recent efforts to extract 'shallow' general knowledge about the world from large text corpora." [4]

Case Study on Machine Learning- Case study in reusing Software Engineering

There are many machine learning algorithms currently available. In the 21st century, the problem no longer lies in writing the learner, but in choosing which learners to run on a given data set. In this case study, we argue that the final choice of learners should not be exclusive in fact, there are distinct advantages in running data sets through multiple learners. To illustrate our point, we perform a case study on a reuse data set using three different styles of learners: association rule, decision tree induction, and treatment. Software reuse is a topic of avid debate in the professional and academic arena. It has proven that it can be both a blessing and a curse. Although there is much debate over where and when reuse should be instituted into a project, they found some procedures which should significantly improve the odds of a reuse program succeeding. [5]

A survey on machine learning approaches

Corpus-based Machine Learning of linguistic annotations has been a key topic for all areas of Natural Language Processing. A survey has been presented, along three dimensions of classification. First they had made a survey on outline different linguistic level of analysis like

Tokenization, Part-of-Speech tagging, Parsing, Semantic analysis and Discourse annotation. Secondly, they have introduced alternative approaches to Machine Learning applicable to linguistic annotation of corpora such as N-gram and Markov models, Neural Networks, Transformation-Based Learning, Decision Tree learning, and Vector-based classification. Thirdly, a survey was also examined on a range of Machine Learning systems for the most challenging level of linguistic annotation; discourse analysis as these illustrates the various Machine Learning approaches. This survey was produced to provide an ontology or framework for further development of our research. [6]

Case study on Robotics

Case studies of successful Mobile robot systems

A schism developed between (symbolic) AI and robotics (including computer vision). Today, mobile robotics is an increasingly important bridge between the two areas. It is advancing the theory and practice of cooperative cognition, perception, and action and serving to reunite planning techniques with sensing and real-world performance. Further, developments in mobile robotics will have important a practical economic and military consequences. [7]

A survey of robotic wheelchair development

A survey has been published for wheelchair development. A five robotic wheelchair system have been selected to represent the many systems being developed.

Robot Mapping

This article provides a comprehensive introduction into the field of robotic mapping, with a focus on indoor mapping. It describes and compares various probabilistic techniques, as they are presently being applied to a vast array of mobile robot mapping problems. The ultimate goal of robotics is to make robots do the right thing. During map acquisition, this might mean to control the exploration of the robot(s) acquiring the data. In a broader context, this issue involves the question of what elements of the environment have to be modeled for successfully enabling a robot to perform its task therein. While these issues have been addressed for decades in ad hoc ways, little is known about the general interplay between mapping and control under uncertainty [8].

References:

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