The Digital NavigatorEG

Artificial Intelligence: Briefing Paper
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Artificial Intelligence

Artificial intelligence (AI) is the study and design of intelligent agents (or networks).

AI is closely tied to the study of decision theory in mathematics and computer science.

Decision theory is concerned with identifying the values, risks and uncertainties

associated with important decisions. Most decision theory is normative (or prescriptive)

in trying to determine the best choice/solution to make. The practical application of

this prescriptive approach (how people should make decisions) is called decision

analysis, and aimed at finding tools, methodologies and software to help people

(and organizations) make better decisions. The most systematic and comprehensive

software tools developed in this way are called decision support systems.

AI Reasoning and Problem Solving Features. The field of artificial intelligence

is surrounded by a number of myths and fallacies. The most significant misconception

is the artificial brain argument; namely, that the goal of AI research is to recreate the

human mind. While robotics represents an important part of AI study, it's only a small portion of what the field is about. Rather, what all AI systems share in common is the ability to reason, problem solve and take corrective action based on preprogrammed assumptions and information inputs. AI is based on a series of preprogrammed algorithms; that is, a sequence of finite instructions used for the purpose of evaluation, calculation and data processing.

There are two distinguishing features that characterize any and all AI systems. First, the AI system must have the ability to scan or perceive its surroundings. Second, the AI system must have the ability to evaluate a situation and initiate an appropriate decision / action. We call this adaptation. As an example, a Traffic Alert and Collision Avoidance System (TCAS) is designed to reduce the incidence of mid-air collisions between aircraft. The TCAS monitors the airspace around an aircraft for other planes and jets and warns pilots of their nearby presence. Similarly, an automobile collision avoidance system is designed to react to situations that humans can not or do not, due to driver error. An automobile collision avoidance system (ACAS), for example, integrates a stability control, anti-lock braking and sensing systems to determine the optimal requirements to support driver safety and prevent accidents. The ACAS uses front and rear millimeter- wave radar detection in order to detect vehicles and obstacles on the road. The system retracts the seatbelts and warns the driver when it determines that a high probability of a collision might occur. If the driver does not

brake, the pre-crash brakes are automatically applied to reduce collision speed.

What is important to remember about both examples is the degree to which the

AI system makes preprogrammed choices on behalf of the user. In principle,

the AI system can make faster calculations and decisions than humans involving

high speeds as well as reacting to unexpected moving aircraft and vehicles.

   Neural Networks and Adaptation. An artificial neural network (ANN), often

referred to as a *neural network* (NN), is a mathematical or computational model based

on biological neural networks. An ANN is an information processing model that

parallels the way biological nervous systems, such as the brain, process information.

An ANN is made up of interconnecting artificial neurons (i.e., programming

constructs) that mimic the properties of biological neurons.   In most cases an ANN

is an adaptive network system that changes its structure based on external or internal

information that flows through the network during the learning phase. In more

practical terms neural networks are non-linear statistical data modeling tools. They

can be used to model complex relationships between inputs and outputs to find

patterns in data. In sum, an ANN like people, learns by example.

     In practical terms, AI systems can be both simple and complex in design. The

movie rental service, Netflix, for example exhibits simple AI features to the extent that

it knows how to create recommended film viewing lists based on user inputs as well as

a preprogrammed algorithmic based rating system. In contrast, modern aviation

relies on an AI flight control management system (i.e., autopilot) in order to control

the aircraft. The AI flight control system can control and automate all phases of

a flight operation, including take-off, ascent, level, descent, approach and landing.

The AI computer software reads the aircraft's current position, makes adjustments

and controls the flight control system to guide the aircraft.   The point to remember

is that AI changes the nature of intelligent networks from one of information

repository and transmission link to one of decision support system. It is a more

dynamic interactive tool that aids the user by analyzing problems, answering

questions and/or making automatic adjustments to a situation or circumstance.