RESEARCH ARTICLE

THE CONCEPT OF SOFT COMPUTING

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ARTICLE INFO	ABSTRACT
	Soft computing also known Computational Intelligence is a term applied to a field within Computer Science which is characterized by the use of inexact solution. It is also deals with approximate models & gives solutions to complex real life problems. Soft computing is tolerant of impression, uncertainty, and partial truth. The basic role of soft computing is the human mind. Soft computing is totally based on techniques like Fuzzy logic, Genetic algorithms, Artificial Neural Network, Machine learning & Expert system, Evolutionary computation (EC), Probabilistic reasoning (PR). Now it becomes a major research & study area in automatic control engineering. Also used successfully in many domestic, commercial & industrial applications. The techniques & application areas of soft computing will continue to expand. This paper gives an overview of the current state of soft computing techniques & compared to traditional hard techniques.

INTRODUCTION

Earlier computational approaches only precisely analyze on relatively simple system. Many More complex problems which is arising in Science & Technology fields. The soft computing deals with impression, uncertainty, partial truth & approximation to achieve goal, tractability, robustness & low solution cost & gives effective result. Soft computing techniques based on formal logical systems like Propositional Logic, First-Order-Predicate Logic (FOPL), sentential logic & predicate logic etc. soft computing techniques are anticipated to complement each other. Soft computing (SC) solutions are unpredictable, uncertain and are between in 0 and 1. The basic idea of soft computing was invented by Lotfi A. Zadeh in 1981. He defined, " Soft computing is an emerging approach to computing which is parallel the remarkable ability of human mind to reason & learn in the environment of uncertainty & imprecision."

What is Soft Computing?

"Soft computing is a collection of methodologies that aim to exploit the tolerance for imprecision & uncertainty to achieve tractability, robustness & low solution cost". "The essence of soft computing is that unlike the traditional, hard computing, soft computing is aimed at an accommodation with the pervasive imprecision of the real world.

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Thus, the guiding principle of soft computing is to exploit the tolerance for imprecision, uncertainty, and partial truth to achieve tractability, robustness, low solution cost, and better rapport with reality."- Lotfi Zadeh

The principal constitutes are fuzzy logic, neurocomputing & probabilistic reasoning. It is likely to play an increasingly important role in many application areas, which is including software Engineering. Soft computing aims to solve complex problems by exploiting the imprecision & uncertainty in decision making process. It is used when we don't have enough information about the problem. Sometime it is called Computational Intelligence. Soft computing is a series of techniques & methods so that real practical situations could be dealt with in the same way as human deal with them like intelligence, common sense, consideration of analogies, approaches, common sense, logic etc. soft computing is a family of problem resolution methods. It is imaginary basic for the area of intelligent system.

Techniques of Soft Computing

- Fuzzy logic model
- Artificial Neural networks
- Genetic algorithms
- Machine Learning
- Probabilistic Reasoning

Fuzzy Logic: The concept of fuzzy logic was introduced by Zadeh, is a method for representing human knowledge. It is

basically a multivalved logic, which is defined between conventional evaluations.

Characteristic of fuzzy logic

- In fuzzy logic, exact reasoning is viewed as a limiting case of approximate reasoning.
- In fuzzy logic, everything is a matter of quantity.
- In fuzzy logic, knowledge is interpreted a collection of elastic / equivalently, fuzzy constraint on a collection of variable.
- Inference is viewed as a process of propagation of elastic constraints.
- Any logical system can be fuzzified.
- It is suitable for the system with a mathematical model.
- It allows decision making with estimated values.
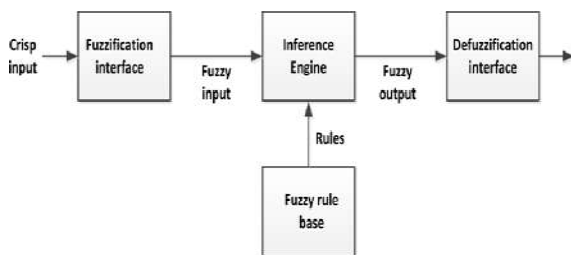- The fuzzy rule base is in the form of: IF---Then" rule.

Fig. 1. Architecture of a fuzzy logic system

Artificial Neural Networks: ANN or neural computing or neural network is one of the rapidly growing fields of research, attracting researchers such as electronic engineering, control engineering & software engineering. ANN inspired by the way biological neurons systems & the brain works.

Application Areas of ANN

- Pattern recognition
- Data recognition
- Image processing
- Stock market
- Weather predication
- Image compression
- Security

Advantages of ANN:

- The result of ANN depends on accuracy of available data.
- ANN deal with incomplete data sets.
- ANN's are successfully in prediction & forecasting applications.
- ANN is adaptive methods i.e. To learn without any prior assumption.
- ANN is non-linear model with good generalization ability.

Genetic Algorithms

It is a search techniques used in computing to find true approximate solutions to optimization & search problems. It is particular class of evolutionary algorithm

It is require two basic things

- Genetic representation of the solution domain.
- Fitness functions to evaluate the solution domain

It is a part of AI & Fuzzy computing & they are mainly used to solve various optimization problems. GA is basically a model of a machine learning inspired by the process of evolution in nature.

Application Areas of GA

- *Climatology*
- *Biomedical Engineering*
- Code-breaking
- Control Engineering
- Game theory
- Electronic design

Advantages of GA

- GA is stochastic algorithm.
- Randomness as an essential role in both selection & reproduction phases.
- GA always considers a population of solution.
- It can be applied to resolve any problem.

Expert System

An Expert system also known as Knowledge-Based-System (K-B-S). It is Computer Based System that can make intelligent decisions by emulating the decisions making abilities of human experts. The K-B-S is generally related with facts, rules, procedures, etc.
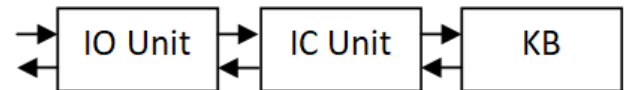

Fig.2 Component of Knowledge-Base-System

Importance of Soft Computing: The conceptual structure of soft computing suggests that students should be trained not just in fuzzy logic, neurocomputing, genetic programming, or probabilistic reasoning but in all of the associated methodologies, though not necessarily to the same degree.
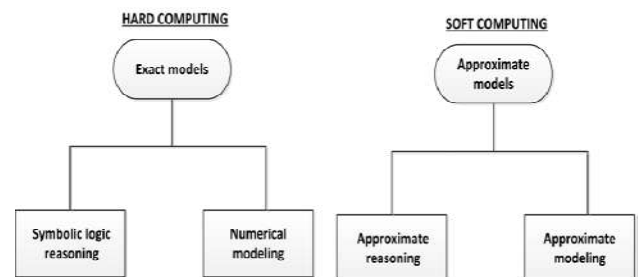
Hard Computing Vs Soft Computing

Fig. 3. Problem-solving approach

Goal of Soft Computing

- It is new multidisciplinary field, to construct a new generation of AI, Known as Computational Intelligence.

Hard Computing	Soft Computing
Hard computing requires program which is to be written.	Soft computing can evolve its own program.
Hard computing uses two valued logic & strictly sequential.	Soft computing can use multivalved fuzzy logic & allows parallel computation.
Hard computing is determistic & requires exact input data.	Soft computing incorporate stochashcity & can deal with ambiguous & noisy data.
Hard computing produces precise answers.	Soft computing can yield approximate answers.

- To develop intelligent machine to provide solutions to real world problems, which are not modeled or two difficult to model mathematically.
- Its aim is to develop the tolerance for approximation, Uncertainty, imprecision & partial truth in order to achieve close resemblance with human like decision making.

Application Areas of Soft Computing

- Programming Language
- User friend application interface
- Computer network
- Database Management
- Fault diagnostic
- Information security
- Many industrial & commercial applications.
- Handwriting recognition
- Automotive systems and manufacturing
- Image processing and data compression
- Architecture
- Data Mining
- Power systems
- Decision support system
- Control Systems

Future of Soft Computing: Soft Computing is likely to play an important role in Science & Technology. Soft computing represents a significant standard which is move in the aims of computing. A change which reflect the fact that the human mind, unlike present day computers, possesses a remarkable ability to store and process in information.

Conclusion

Soft computing techniques are becoming more important as the power of Computer processing devices. Intelligent systems are required to make complex decisions & choose the best outcome from many possibilities, by using complex algorithm. The soft computing theory & their techniques & its current applications will grow rapidly together with the use of IOT device in future domestic, industrial & commercial markets. The successful applications of soft computing suggest that the impact of soft computing will be felt increasingly in coming years.

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