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SOFT COMPUTING

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ABSTRACT

Soft computing is a synthesis of various computation methods. It is becoming more popular among various researchers and organisations as the demand for high-quality software and changing business rules grows. Soft computing techniques are used to generate results and analyses that measure capricious human mind phenomena such as partial truth, belief uncertainty, and approximation. The paper provides an overview of soft computing techniques such as Artificial Neural Networks (ANN), Fuzzy Logic Systems (FLS), Radial Basis Function (RBF), and others. With the help of the Neuphron open source framework, a soft computing framework has been proposed to predict software quality by calculating error in weights of different nodes of a Multi-layer perceptron (MLP) neural network. So even though soft computing is an evolving set of methodologies, this review not only reveals a promising direction for soft computing by incorporating deep learning, but also makes some suggestions for improving the performance of deep learning with soft computing techniques.

1. INTRODUCTION

The use of approximate calculations to provide imprecise but usable solutions to complex computational problems is known as soft computing. The approach allows for solutions to problems that are either unsolvable or take too long to solve with current hardware[2]. Soft computing is also known as computational intelligence.

Soft computing is a method of problem solving that does not rely on computers. Soft computing, unlike traditional computing models, is tolerant of partial truths, uncertainty, imprecision, and approximation by using the human mind as a model. Soft computing's tolerance allows researchers to approach problems that traditional computing cannot.

2. METHODOLOGY

CHARACTERTISTICS:

To address real-world issues, soft computing applied human expertise in the form of fuzzy if-then Computer models influenced by biology[1]

Perception, pattern recognition, non-linear regression, and classification issues.

- Biological neural networks and artificial neural networks logic and unconventional knowledge.
- It is a characteristic of all disciplines of computational intelligence. Neuro-fuzzy and soft computing largely rely on high speed computation to detect patterns or rules in data sets.

Deleting a neuron from a neural network or a rule from a fuzzy inference system does not render the system completely inoperable.

GOALS OF SOFT COMPUTING:

- The main goal of Soft Computing is to develop intelligent machines to provide solutions to real world problems, which are not modeled, or too difficult to model mathematically[3].
- It's aim is to exploit the tolerance for Approximation, uncertainity, imprecision and Partial truth in order to achieve close resemblance with human like decision making

ADVANTAGES OF SOFT COMPUTING:

The use of the soft computing approach has demonstrated two key benefits:

- It made it possible to solve nonlinear problems for which mathematical models are not available[4]
- It introduced human knowledge, such as cognition, recognition, understanding, learning, and other concepts, into the fields of computing.

DISADVANTAGES OF SOFT COMPUTING:

- The biggest drawback is that they are not fault-tolerant, meaning that if any of the artificial neurons sustain damage, they would cease to function.

CONSTITUENTS OF SOFT COMPUTING:

- Multivalued Logic

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- Fuzzy Computing for the management of ambiguity and imprecision
- Neurological Computing

Neural computers imitate some of the brain's processing skills.

• Genetic Methods

Genetic algorithms (GAs) are used to evolve programmes to carry out certain tasks and to emulate some of the processes seen in natural evolution. This process is referred to as "Genetic Programming" (GP).

CONSTITUENTS OF SOFT COMPUTING

- Fuzzy Logic (FL)[5]
- Evolutionary Computation (EC) - based on the origin of the species
- Genetic Algorithm

GENETIC ALGORITHM

Genetic Algorithms initiated and developed in the early 1970's by John Holland are unorthodox search and optimization algorithms, which mimic some of the process of natural evolution.

Gas perform directed random search through a given set of alternative with the aim of finding the best alternative with respect tp the given criteria of goodness. These criteria are required to be expressed in terms of an object function which is usually referred to as a fitness function.

BENEFITS OF GENETIC ALGORITHM

- Easy to understand.
- We always get an answer and the answer gets better with time.
- Good for noisy environment.
- Flexible in forming building blocks for hybrid application.
- Has substantial history and range of use.
- Supports multi-objective optimization. Modular, separate from application.

>Swarm Intelligence

Ant Colony Optimizations

- Neural Network (NN)

- Machine Learning (ML)

NEURAL NETWORKS

An NN, in general, is a highly interconnected network of a large number of processing elements called neurons in an architecture inspired by the brain.

NN Characteristics are:

- Mapping Capabilities / Pattern Association
- Generalisation
- Robustness
- Fault Tolerance
- Parallel and High speed information processing

NEED OF SOFT COMPUTING :

Real-world situations can defy typical computing or analytical models to offer a solution. In that instance, we need an additional technique, such as soft computing, to get a rough answer.

Mathematical issues requiring exact solutions are resolved via hard computing. Some issues with real-world solutions are not addressed. Soft computing hence provides assistance for real-world issues for which a clear solution is lacking.

Soft computing is useful when traditional mathematical and analytic models fall short. For instance, soft computing can be used to map even the human mind.

Mathematical issues can be solved using analytical models, which are valid in the best-case scenarios. However, the difficulties in the real world don't exist in an ideal setting; they do. Soft computing offers insights into practical issues as well as just theory.

Soft computing aids in mapping the human mind, which is impossible with traditional mathematical and analytical models. This is because of all the reasons listed above.

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ELEMENTS OF SOFT COMPUTING :

A basic element for the developing science of conceptual intelligence is thought to be soft computing. The add-ons to soft computing are fuzzy logic (FL), machine learning (ML), neural networks (NN), probabilistic reasoning (PR), and evolutionary computation (EC). Additionally, soft computing employs these methods to handle any complicated issue.

TRADITIONAL AL TO COMPUTER INTELLIGENCE

Conventional Al mostly uses techniques today referred to as machine learning, which are formal and based on statistical analysis[6]. This is sometimes referred to as neat Al, logical Al, or symbolic Al methods consist of Expert systems uses reasoning skills to arrive at a conclusion.

Using the knowledge at hand, draw conclusions. Case-based reasoning is a method for resolving novel problems.

Based on the resolutions of earlier, comparable issues. A group of variables are represented by a joint probability distribution with explicit independence using Bayesian networks.

SOFT COMPUTING VS. HARD COMPUTING

HARD COMPUTATION

- Based on the idea of exact modelling (mathematical or analytical) and analysis to get precise outcomes. Works effectively for straightforward issues but is restricted to the NP Complete set.
- Computing softly tries to overcome NP-complete issues.
- Employs imprecise techniques to provide accurate yet helpful responses insurmountable issues to represents a substantial paradigm shift in computing's goals, a shift that is reflective of the human mind.
- Tolerant of ambiguity, imperfection, partiality, and approximation.
- Appropriate for challenges in the actual world where ideal models cannot be used available.

3. CONCLUSION

A knowledgeable system can handle a lot of Using the knowledge at hand, draw conclusions. Case-based reasoning is a method for resolving novel problems.

Based on the resolutions of earlier, comparable issues. A group of variables are represented by a joint probability distribution with explicit independence using Bayesian networks.

4. FUTURE SCOPE

- Soft Computing can be extended to include bio-informatics aspects.
- Fuzzy system can be applied to the construction of more advanced intelligent industrial systems.
- Soft computing is very effective when it's applied to real world problems that are not
- Able to solved by traditional hard computing.
- Soft computing enables industrial to be innovative due to the characteristics of soft computing: tractability, low cost and high machine intelligent quotient.

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