Basics of Soft Computing

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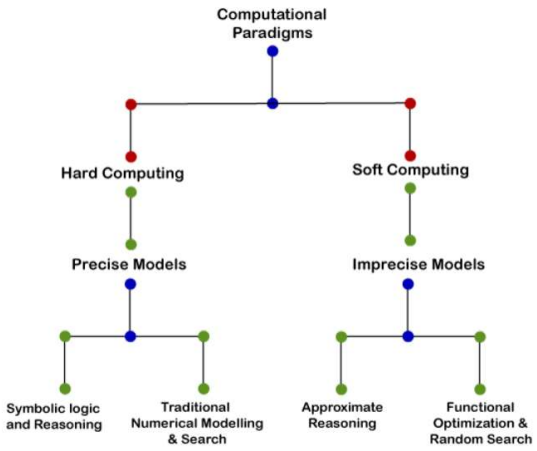
Topics Covered:

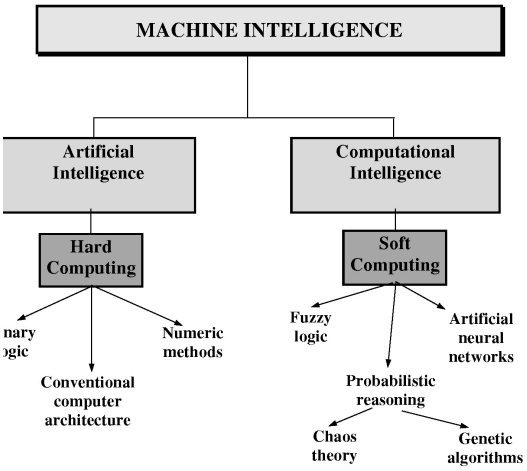
1. **Hard Computing**
2. **Soft Computing**
3. **Difference between Soft and Hard Computing**

Computation

Computation is a process of converting the input of one form to some other desired output form using certain control actions. According to the concept of computation, the input is called an antecedent and the output is called the consequent.
A mapping function converts the input of one form to another form of desired output using certain control actions.
There are two types of computation:

1. Hard Computing
2. Soft Computing





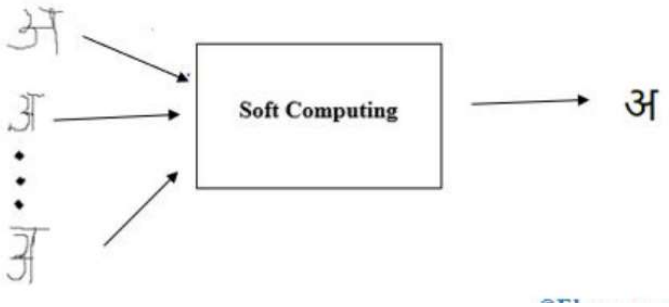
Hard Computing

1. Uses existing mathematical algorithms to solve certain problems.
2. Provides a precise and exact solution to the problem.
3. Based on binary logic and numerical system.

Soft Computing

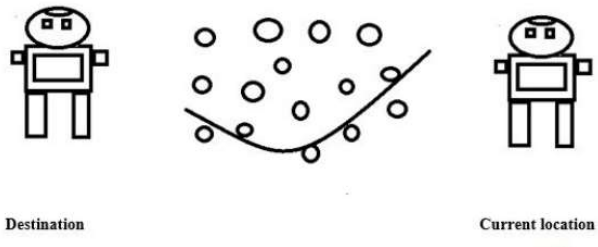
1. Multidisciplinary system which is a fusion of neural networks, fuzzy logic and genetic algorithms
   Fuzzy logic: for knowledge representation
   Neural Network: for learning and adaptation
   Genetic Algorithms: for evolutionary computation.
2. Goals:
   1. To develop intelligent machine which are difficult to model mathematically.
   2. to exploit the tolerance for **Approximation** (model features are similar to real one , but not the same), **Uncertainity** (not sure of same features as of real entity), **Imprecision**(model features are not same but close to real features) and **Partial Truth** in order to achieve close resemblance with human like decision making.
3. Need:
   1. To provide solution to real life problems.
   2. To map human mind using it.
4. Elements:
   1. Artificial Neural Network:

      An artificial neural network (ANN) emulates a network of neurons that makes a human brain (means a machine that can think like a human mind). Thereby the computer or a machine can learn things so that they can take decisions like the human brain.
      Eg: a handwritten character written in different handwriting may be understood using this.



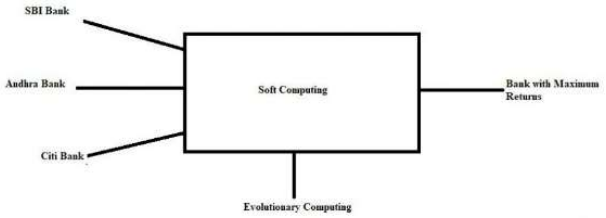
   2. Fuzzy logic:

      A mathematical logic which tries to solve problems with an open and imprecise spectrum of data.
      Eg:a robot that wants to move from one place to another within a short time where there are many obstacles on the way. This can be solved using this.



   3. Genetic Algorithm:

      can solve the problems which cannot be solved in real-time also known as the NP-Hard problem.
      It is a heuristic search or randomized search method, which provides an initial set of solutions and generate a solution to the problem efficiently and effectively.
      Eg: Different bank has different schemes and policies, this can be used to know which bank would provide maximum profit.



5. Disadvantages:
    1. Give an approximate output value
    2. If a small error occurs the entire system stops working, to overcome its entire system must be corrected from the beginning, which is time taking process.

DIFFERENCE BETWEEN HARD AND SOFT COMPUTING

	HARD COMPUTING	SOFT COMPUTING
Computation Time	more	less
Dependency	On binary logic and numerical systems.	On approximation and dispositional.
Computation Type	Sequential	Parallel
Result	Exact and precise	Approximate
Nature	Settled, Deterministic	Random, Stochastic
Programs	Must be written.	Come out with its own programs.
Works on	Exact data	Ambiguous and noisy data
Uses logic	Two values	Multi valued
Features	Precision Exactness Categoricity	Approximation Impreciseness Partial Truth Uncertainity
Applications	In critical Systems In numerical analysis Real life applications requiring precise time	Handwritten Recognition Image processing Decision support system Data compression Automative systems Daily life: microwave , washing machine, refrigeratior Robotics Work

Eg:
string1 = "xyz" and string2 = "xyw"

Problem 1
Are string1 and string2 same?
Solution
No, the solution is simply No. It does not require any algorithm to analyze this.

Problem 2
How much string1 and string2 are same?
Solution
Through conventional programming, either the answer is Yes or No. But these string are 80% same (by soft computing)