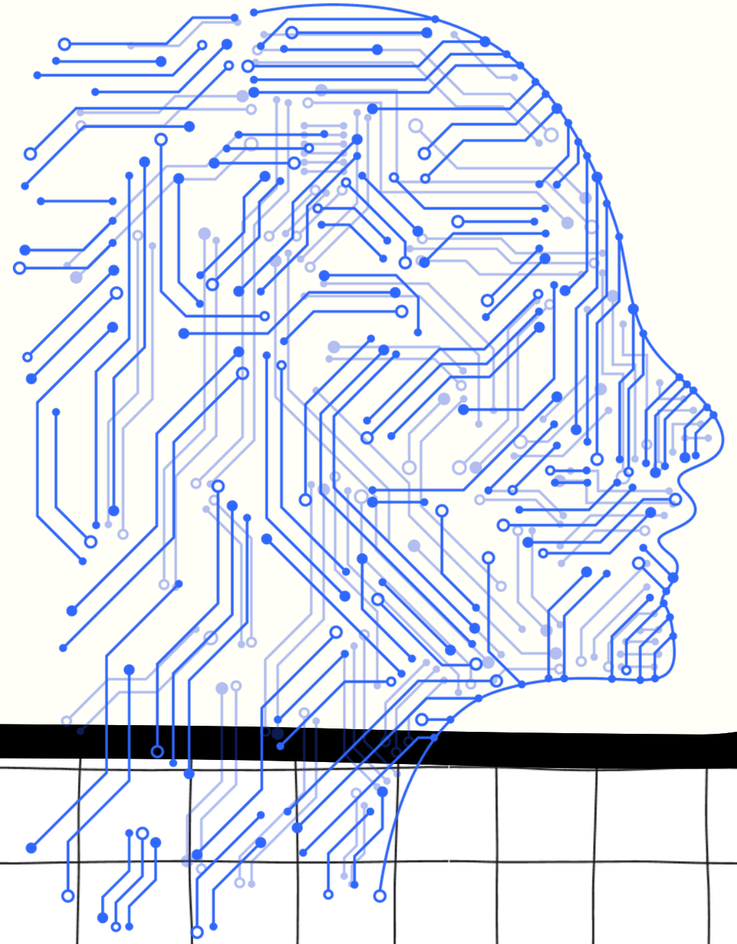
Soft Computing

Lecture:1



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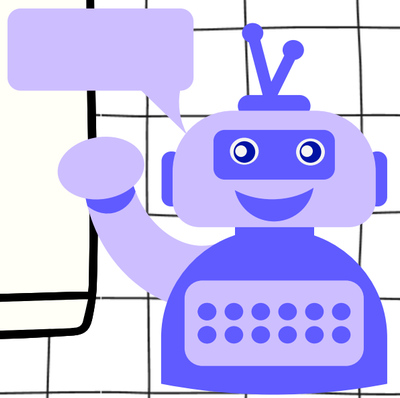
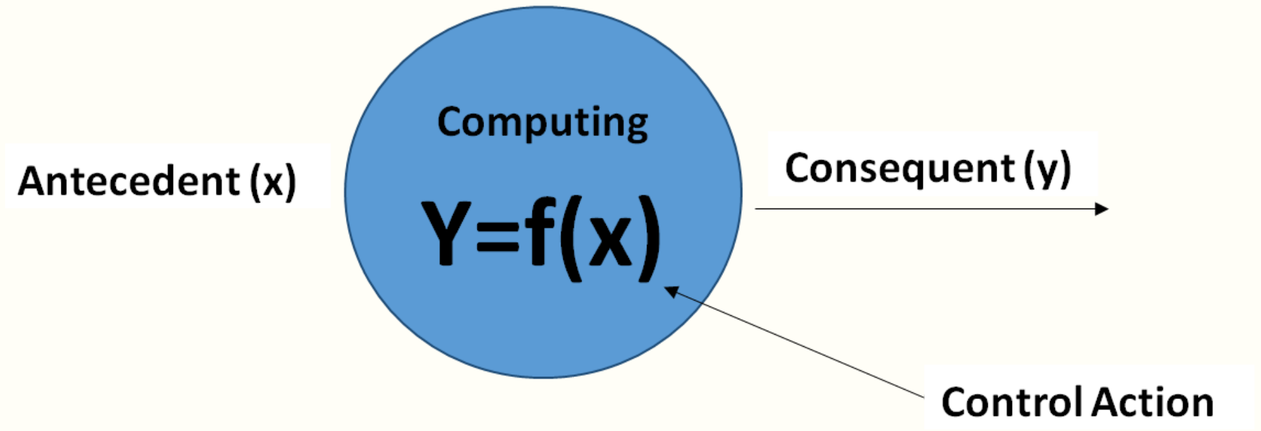


Computation

01 Y=f(x), f is a mapping function.

02 f is also called a formal method or an algorithm to solve a problem.

03 Computation means there will be some inputs and there will be a method by which the input will produce output.



Hard Computing

In 1996, L. A. Zade (LAZ) introduced the term Hard Computing.

According to LAZ, We term computing as Hard Computing, if

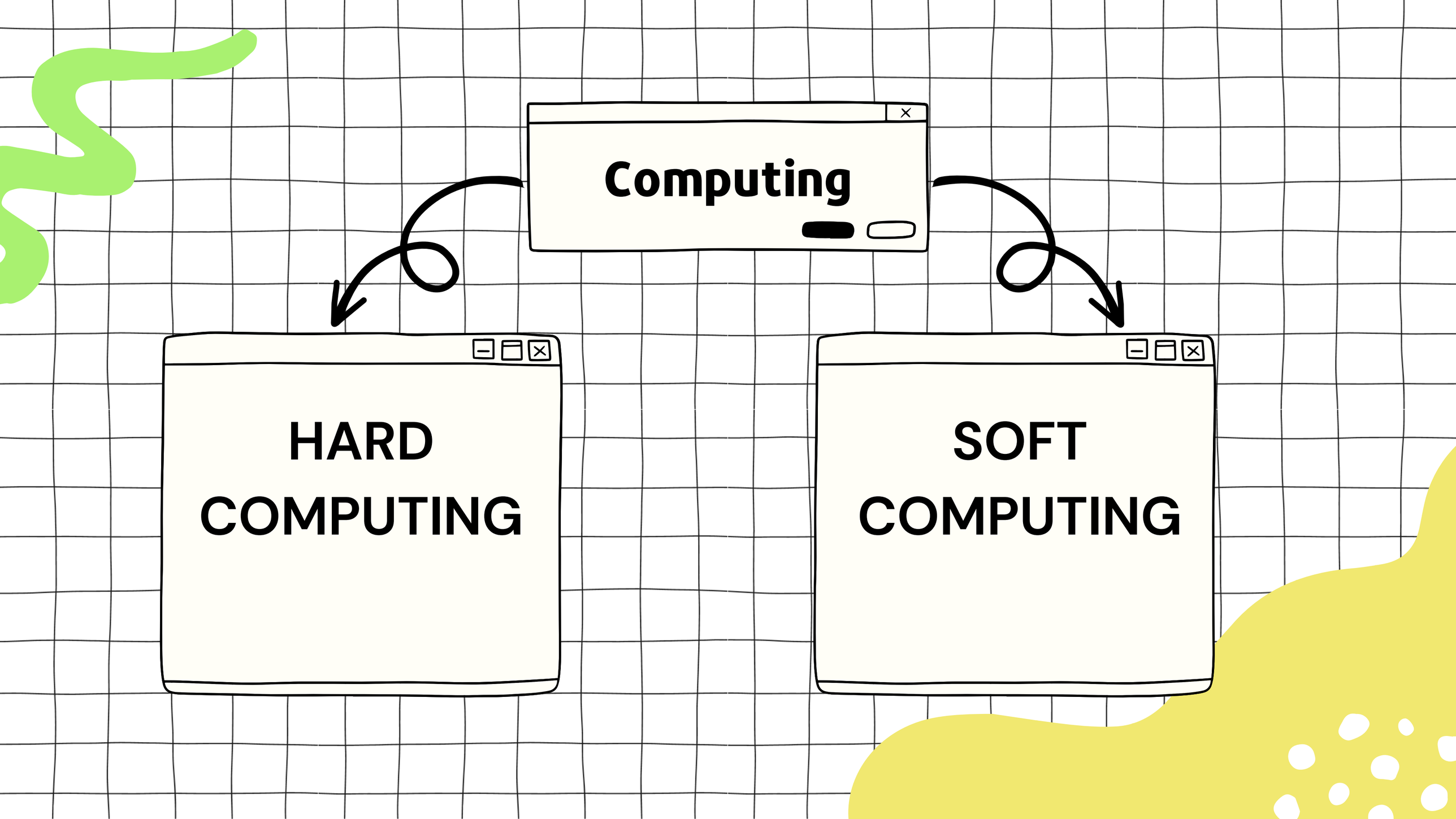
- Precise result is guaranteed.
- Control action is unambiguous.
- Control action is formally defined.

Examples of Hard Computing

Solving numerical problems (e.g. roots of polynomials, integration etc).

Searching and Sorting techniques.

Solving computational geometry problems (e.g. shortest tour in a graph, finding closest pair of points given a set of points.


Computing
HARD COMPUTING
SOFT COMPUTING

Soft Computing

Soft computing is the reverse of hard (conventional) computing.

It provides cost-effective solutions to the complex real-life problems for which hard computing solution does not exist.

Zade coined the term of soft computing.

The objective of soft computing is to provide precise approximation and quick solutions for complex real-life problems.

Characteristics of Soft Computing

Soft computing provides an approximate but precise solution for real-life problems.

The algorithms of soft computing are adaptive, so the current process is not affected by any kind of change in the environment.

The concept of soft computing is based on learning from experimental data. It means that soft computing does not require any mathematical model to solve the problem.

Soft computing helps users to solve real-world problems by providing approximate results that conventional and analytical models cannot solve.

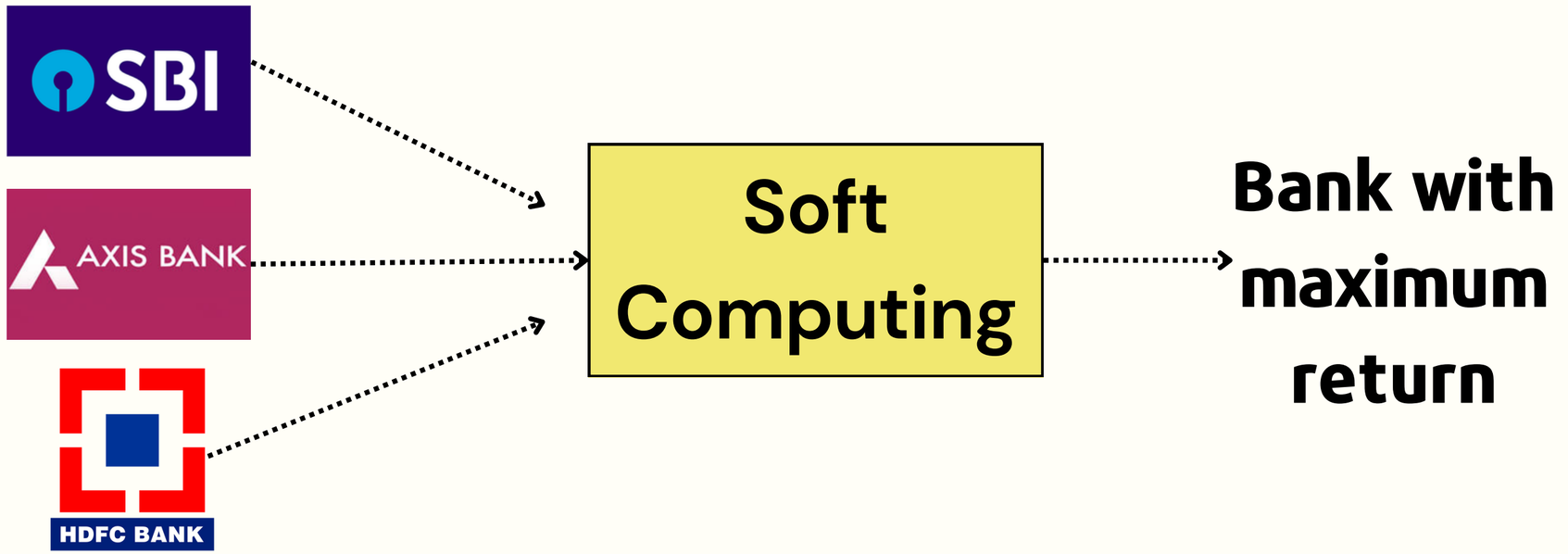
It is based on Fuzzy logic, genetic algorithms, machine learning, ANN, and expert systems.

Examples-Soft Computing

Hand written character recognition

(Artificial Neural Network)

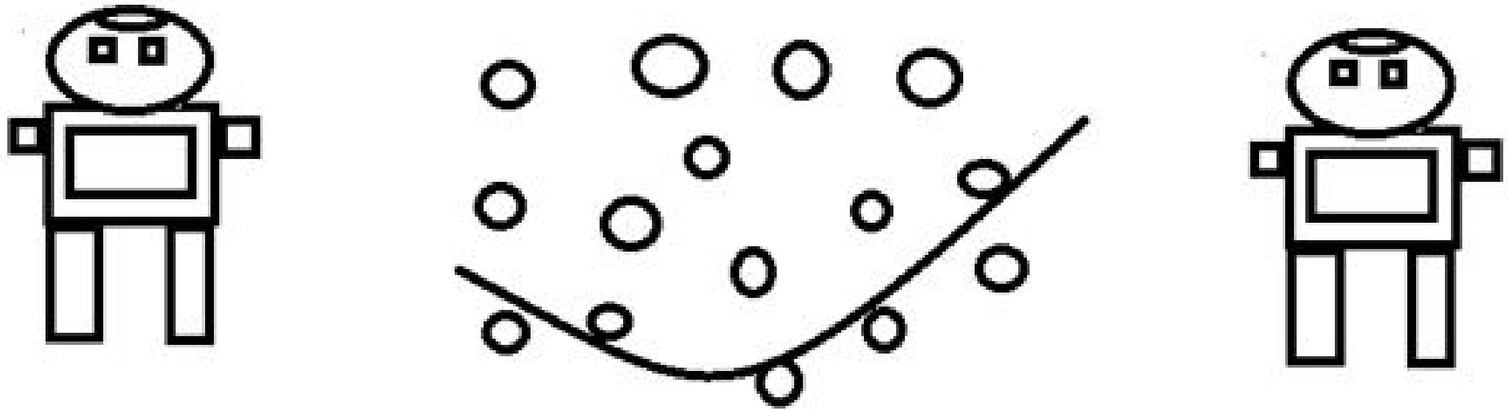
Examples-Soft Computing



Money allocation problem

(Evolutionary Computing)

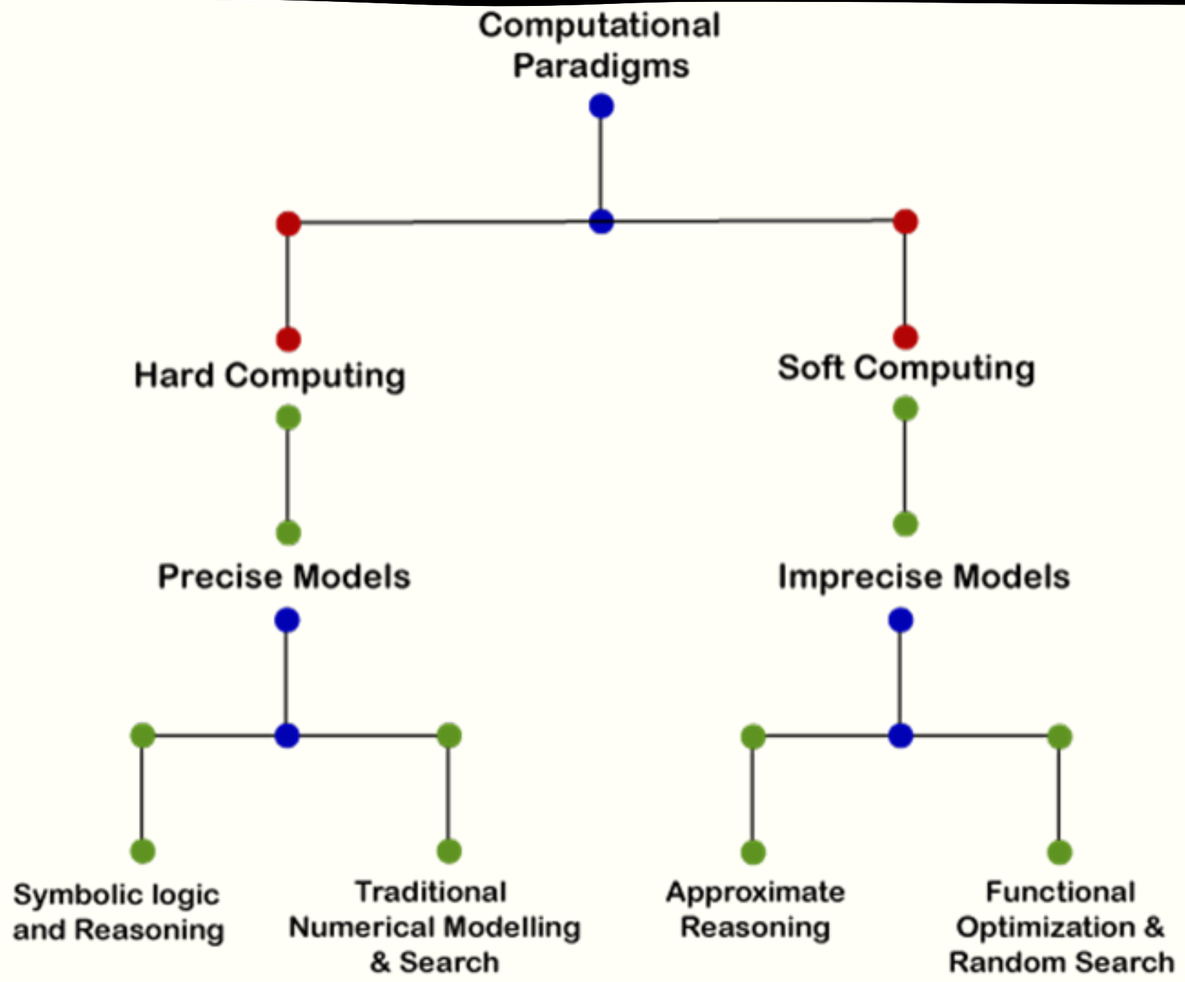
Examples-Soft Computing



Robot Movement

(Fuzzy Logic)

Soft vs Hard Computing



Soft vs Hard Computing

Hard computing uses existing mathematical algorithms to solve certain problems. Any numerical problem is an example of hard computing.

On the other hand, soft computing is a different approach than hard computing.

In soft computing, we compute solutions to the existing complex problems.

The result calculated or provided by soft computing are also not precise. They are imprecise and fuzzy in nature.

Soft vs Hard Computing

Parameters	Soft Computing	Hard Computing
Computation time	Takes less computation time.	Takes more computation time.
Dependency	It depends on approximation and dispositional.	It is mainly based on binary logic and numerical systems
Computation type	Parallel computation	Sequential computation
Result/Output	Approximate result	Exact and precise result
Example	Neural Networks, Fuzzy logics	Any numerical problem or traditional methods of solving using personal computers.

Applicaions of Soft Computing

In the field of Big Data, *soft computing working for data analysing models, data behaviour models, data decision, etc.*

In the fields of Mechanical Engineering, soft computing is a role model for computing problems such that how a machine will work and how it will make the decision for a specific problem or input given.

In this field of Computer Engineering, you can say it is core part of soft computing and computing working on advanced level like Machine learning, Artificial intelligence, etc.

Image processing and Data compression are also popular applications of soft computing.

Used for handwriting recognition.

What is Fuzzy Logic?

The term “Fuzzy” refers to the things which are not clear.

Fuzzy logic seems closer to the way our brain works.

In real world, sometimes we face a situation where we cannot determine whether it is true or false.

So, Fuzzy Logic is an approach of computing based on “degree of truth” rather than usual true or false (1 or 0) Boolean logic” on which the modern computer is based on.

Fuzzy Logic includes 0 and 1 as extreme cases of truth but also includes various states of the truth in between.

Advantages of Fuzzy Logic

Fuzzy Logic system can work with any type of inputs.

Construction of fuzzy system is easy and understandable.

Fuzzy logic is come with mathematical concept of set theory like intersection, union etc.

It provides a very efficient solutions to the complex problems.

The algorithm can be described with little data.

Disadvantages of Fuzzy Logic

There is no systematic approach to solve a given problem through fuzzy logic.

Proof of its characteristics is difficult or impossible in most cases.

Fuzzy logic is come with mathematical concept of set theory like intersection, union etc.

Since fuzzy logic works on precise as well as imprecise data, so most of the time accuracy is compromised.