

Soft Computing

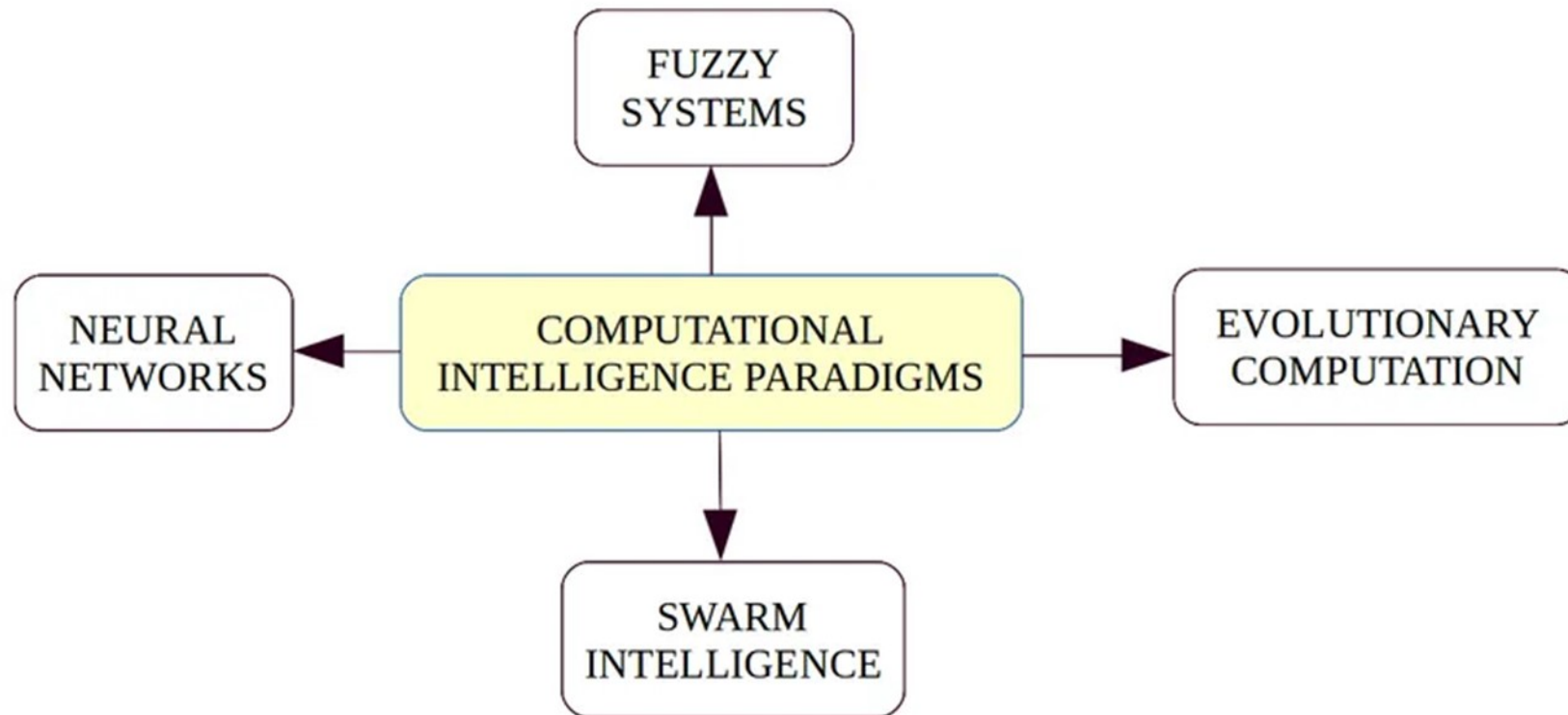
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Computational Intelligence (Soft Computing)

- In general, Computational Intelligence is a subset of Artificial Intelligence indeed.
- There are two types of machine intelligence: the artificial one based on hard computing techniques and the computational one based on soft computing methods, which enable adaptation to many situations.
- Hard computing has conventional intelligence and requires an analytical model. Hard computing generally requires prewritten programs and thus acts on a fixed set of instructions.
- Soft computing is a new and modern approach that approximates systems.
- Soft computing helps users to solve real-world problems by providing approximate results that conventional and analytical models cannot solve.

- Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty, vague, partial truth, and approximation. In effect, the role model for soft computing is the human mind.
- The guiding principle of soft computing is: Exploit the tolerance for imprecision, uncertainty, partial truth, and approximation to achieve tractability, robustness and low solution cost.
- Main components of Soft Computing are:
 1. Neural Networks
 2. Fuzzy Systems
 3. Evolutionary Computation (Genetic Algorithm and Differential Evolution)
 4. Swarm Intelligence (PSO, ACO, ABC, etc.)

- Soft computing components are not competent rather they are complementary each others.
- It offers better results, if they used in combination, rather than in stand-alone.



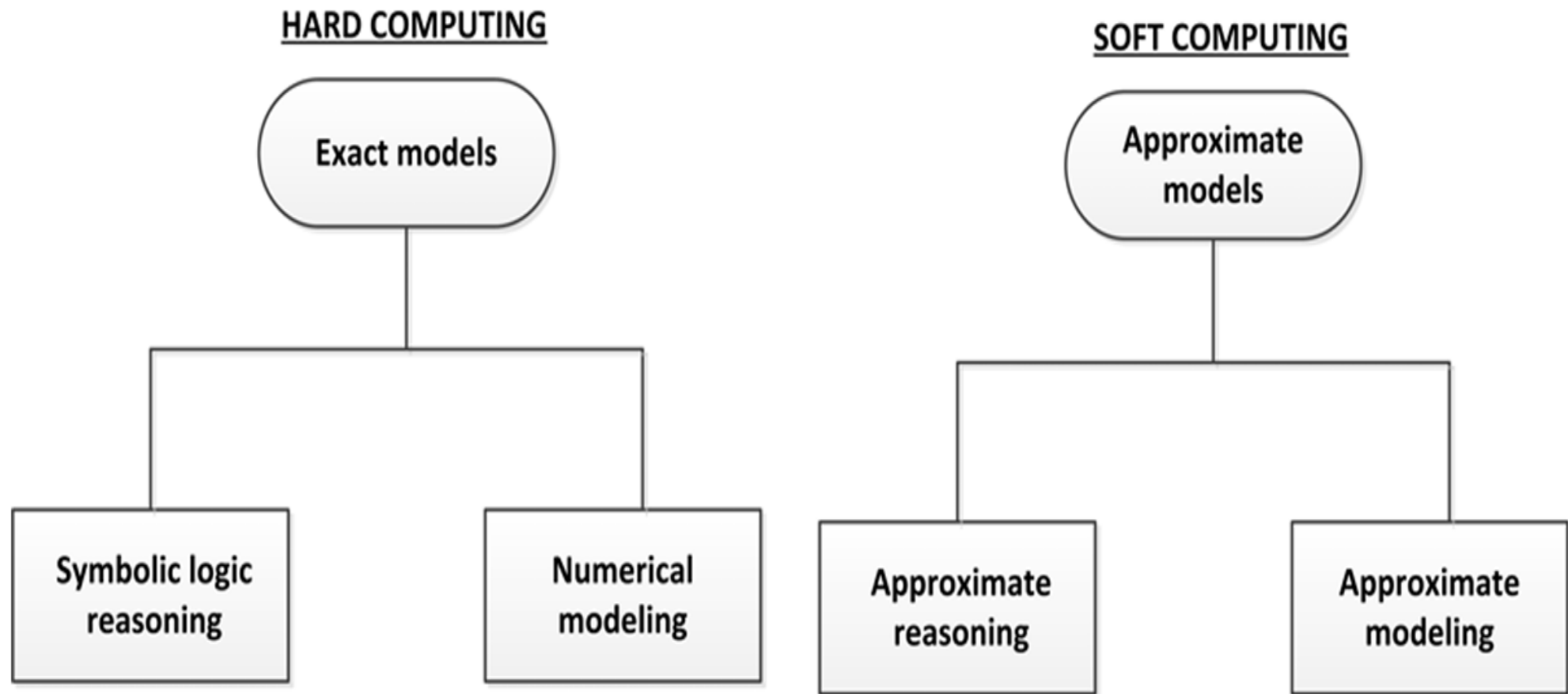


Fig. 1 Problem-solving approach

Benefits

- Soft computing techniques offer several key benefits:
 1. Robustness: Soft computing methods excel in handling noisy or incomplete data, making them suitable for real-world applications where data may be uncertain or imprecise.
 2. Flexibility: Unlike rigid mathematical models, soft computing approaches can adapt and evolve over time, accommodating changing environments and requirements.
 3. Scalability: Soft computing algorithms can scale to handle large datasets and complex problem spaces, making them versatile tools for solving a wide range of problems.

Applications

- These techniques find applications across diverse domains, including:
 1. Medicine: Diagnosing diseases, predicting patient outcomes, and designing personalized treatment plans.
 2. Finance: Forecasting stock prices, optimizing investment portfolios, and detecting fraudulent transactions.
 3. Engineering: Designing efficient systems, optimizing manufacturing processes, and controlling complex industrial processes.

Differentiate Soft Computing and Hard Computing

| Soft Computing | Hard Computing |
|--|---|
| It can be evolve its own programs | It requires program to be written |
| It uses fuzzy logic | It uses two valued logic |
| It can deal with noisy data | It can only deal with exact data |
| It allows parallel computing | It allows sequential computing |
| It gives approximate answers | It gives exact answers |
| It needs robustness | It needs accuracy |
| It is also known as computation intelligence | It is also known as Conventional intelligence |