

Computational Intelligence (CI) or Soft Computing (SC)

A Brief Overview

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Outline

- Typical Requirements of Real World Applications
- Soft Computing Components and Characteristics

Outline

- **Typical Requirements of Real World Applications**
 - *Integration of Domain knowledge, field data,*
 - *Imperfect Information: Uncertainty and Incompleteness, Environmental and cognitive changes*
- **Soft Computing Components and Characteristics**

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Real World Applications

- Usually ill defined systems, difficult to model, with large solution spaces
- Precise models tend to be impractical, too expensive, or non-existent
- Generate approximate solutions by leveraging two types of resources:
 - **Problem domain knowledge** of the process (or product) and
 - **Field data** that characterize the system's behavior.
- Domain knowledge: combines first principles and empirical knowledge.
 - Often incomplete and sometimes erroneous.
- Field data: a collection of I/O measurements, representing instances of the system's behavior
 - Generally incomplete and noisy.
- Soft computing is a flexible framework in which we can find a broad spectrum of design choices to perform the integration of knowledge and data in the construction of approximate models.

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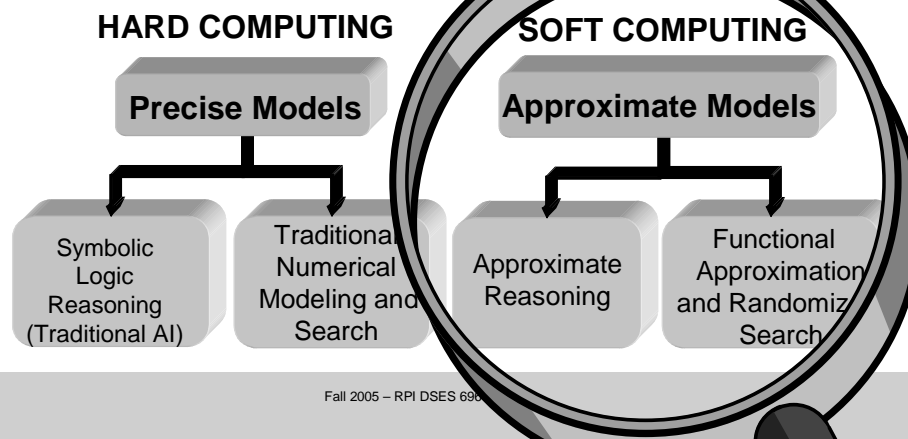
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- Typical Requirements of Real World Applications
- **Soft Computing Components and Characteristics**

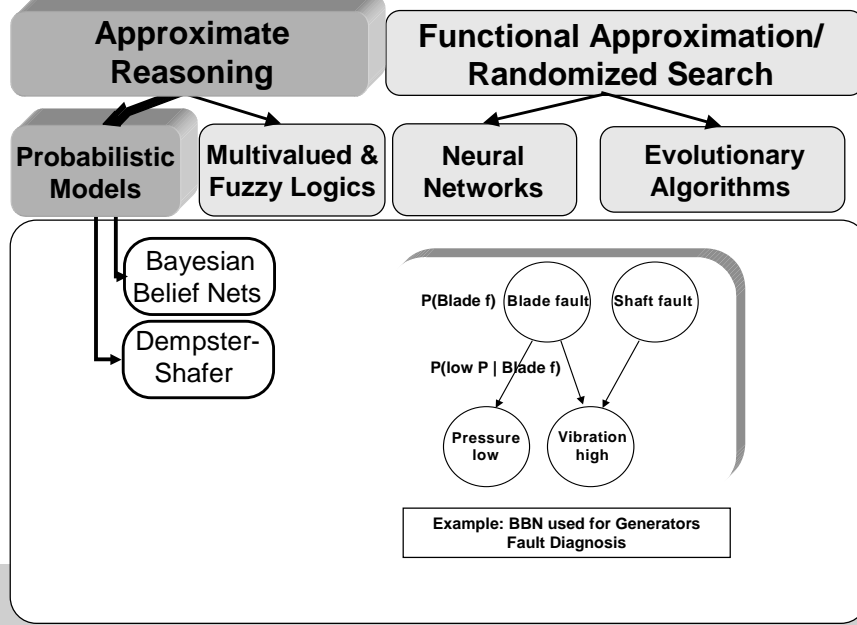
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Problem Solving Technologies

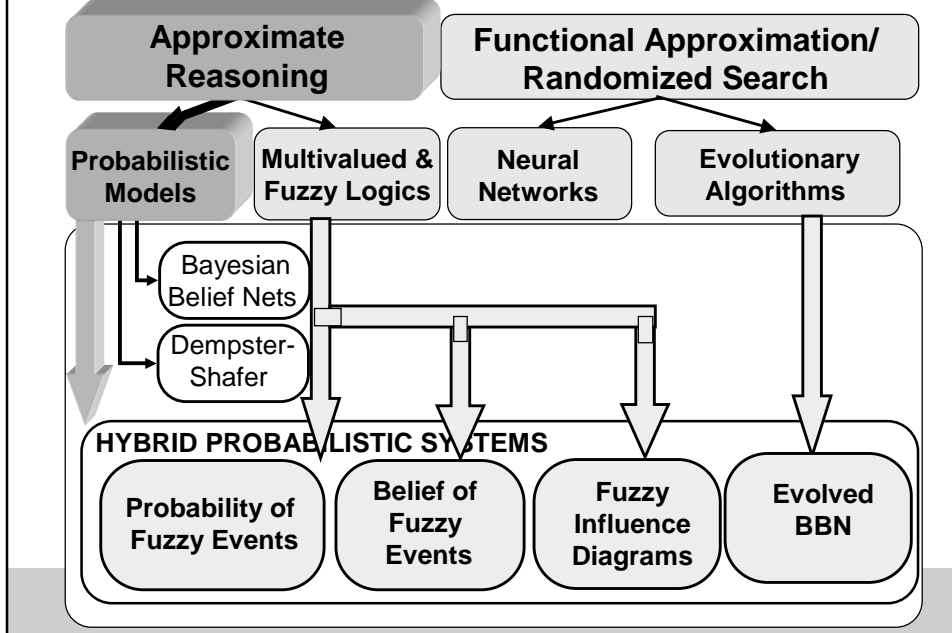
“In contrast to traditional hard computing, soft computing exploits the tolerance for imprecision, uncertainty, and partial truth to achieve tractability, robustness, low solution-cost, and better rapport with reality” (Zadeh 1991)

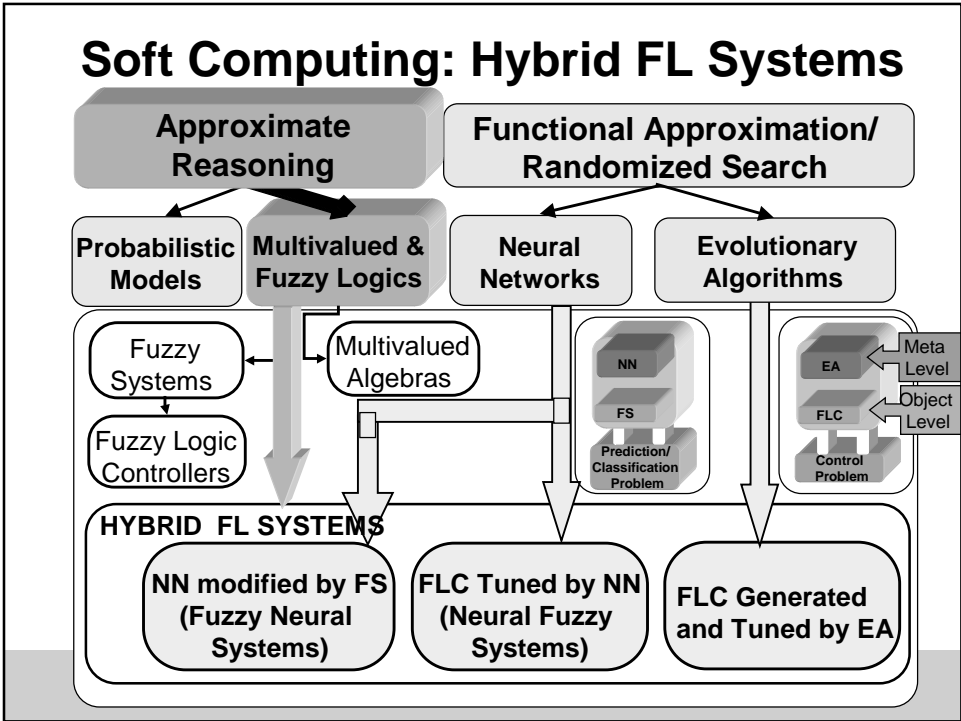
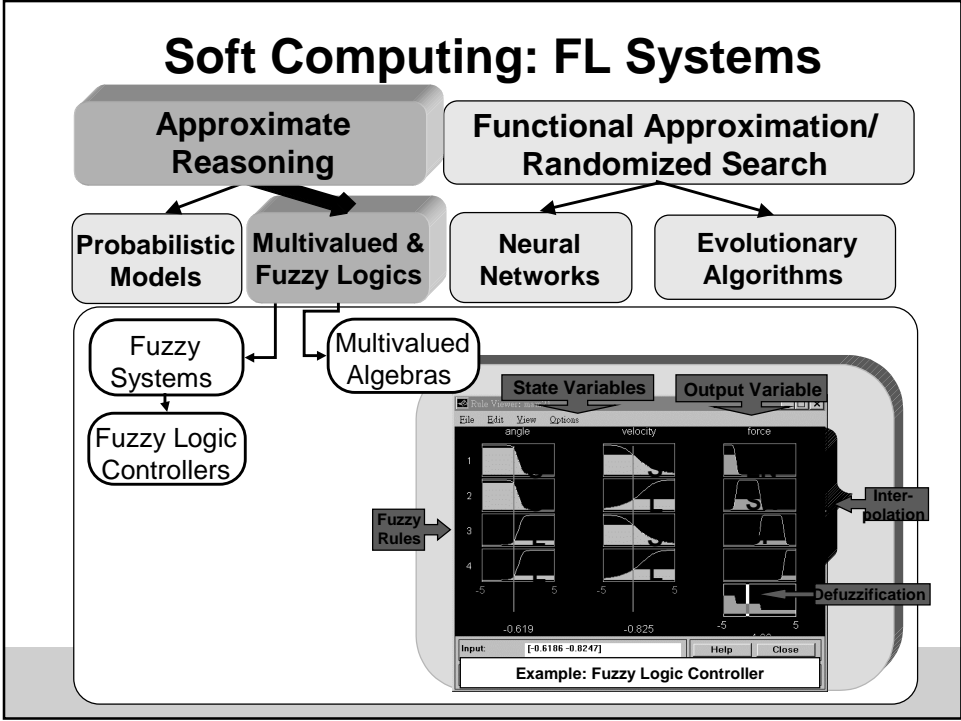


Soft Computing: Probabilistic Systems

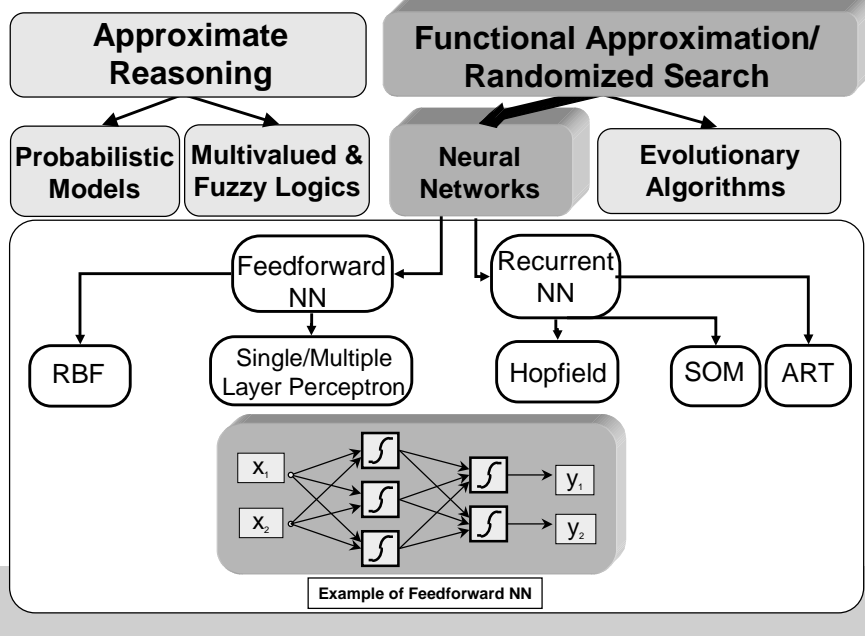


Soft Computing: Hybrid Probabilistic Systems

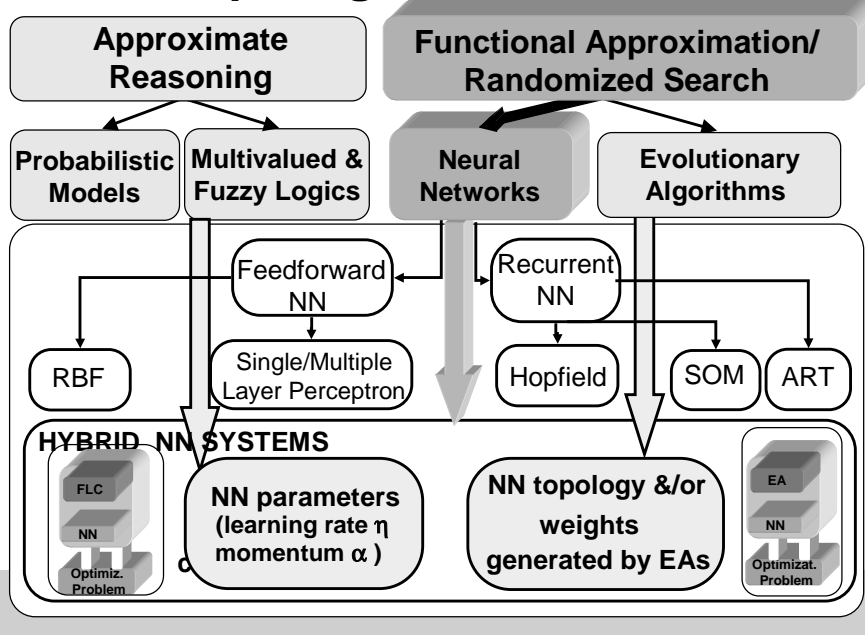


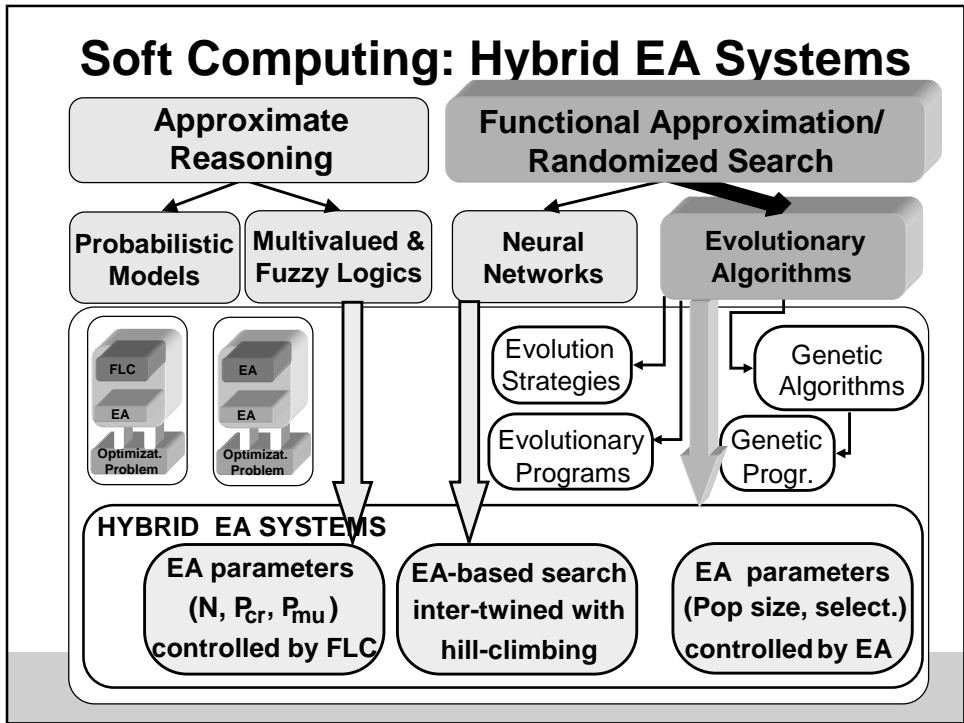
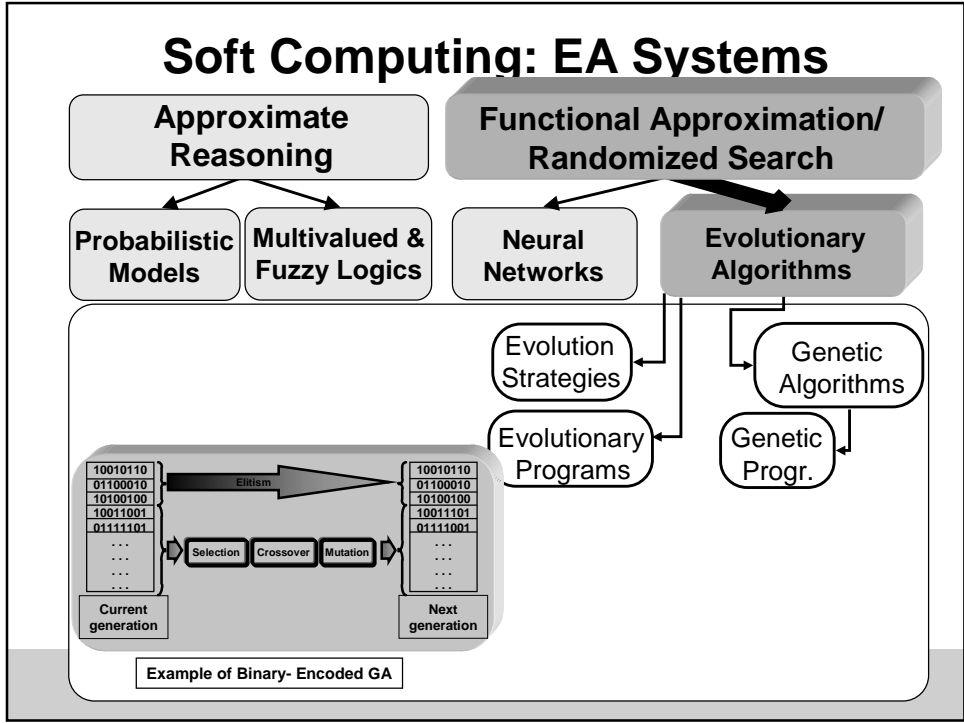


Soft Computing: NN Systems



Soft Computing: Hybrid NN Systems





Notes

- **We will start with:**
 - an introduction on **Fuzzy Systems** [Sept 1]
 - an introduction on and **Evolutionary Algorithms** [Sept 8]
- **Then, we will cover**
 - **Fuzzy Systems Theories, selected applications and case studies** [Sept 22 - Oct 20]
 - **Hybrid Fuzzy Systems (NN+ FS or EA +FS)** [Oct 27 –Nov 10]
 - **Evolutionary Multi-Objective Optimization/Decision** [Nov 17-Dec 1]
 - **Other selected areas of Soft Computing using case studies** [Dec 8]