Introduction and Motivation

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Constraint Based Production Scheduling

Key Points

- AI is more than LLM

- Stochastic vs. deductive AI methods

- Constraint Based Scheduling and its alternatives

- Key advantages

  - Compositional
  - Reusable
  - Explainable

- Course structure

1 Artificial Intelligence

2 Scheduling

2.1 Constraint-Based Scheduling

Constraint Programming - in a nutshell

- Declarative description of problems with

  - *Variables* which range over (finite) sets of values
  - *Constraints* over subsets of variables which restrict possible value combinations
  - A *solution* is a value assignment which satisfies all constraints

- Constraint propagation/reasoning

  - Removing inconsistent values for variables
  - Detect failure if constraint can not be satisfied
  - Interaction of constraints via shared variables
  - Incomplete

- Search

  - User controlled assignment of values to variables
  - Each step triggers constraint propagation

- Different domains require/allow different methods

Constraint Programming is Different

- Declarative Programming

  - Concentrate on what you want
  - Not how to get there
  - Program != Algorithm
  - Program = Model

- Applied to Combinatorial Problems

  - No complete polynomial algorithms known (exist?)
  - CP less ad-hoc than heuristics
  - Models can evolve

A Subtractive Process

"Oh, bosh, as Mr. Ruskin says. Sculpture, per se, is the simplest thing in the world. All you have to do is to take a big chunk of marble and a hammer and chisel, make up your mind what you are about to create and chip off all the marble you don't want."-Paris Gaulois.

Source: https://quoteinvestigator.com/2014/06/22/chip-away/

2.2   Other Solution Approaches

Other Technologies

- Heuristics

- Integer Programming

- Local search

- Deep neural networks

3   Course Structure

3.1   What is not covered?

How does it all work?

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3.2   A Short History

Summary

- Why use Constraint Based Scheduling?

- Compared to other AI methods

- Compared to other solution approaches