# anytime tree searches for operations research

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# ANYTIME TREE SEARCH ALGORITHMS FOR OPERATIONS RESEARCH

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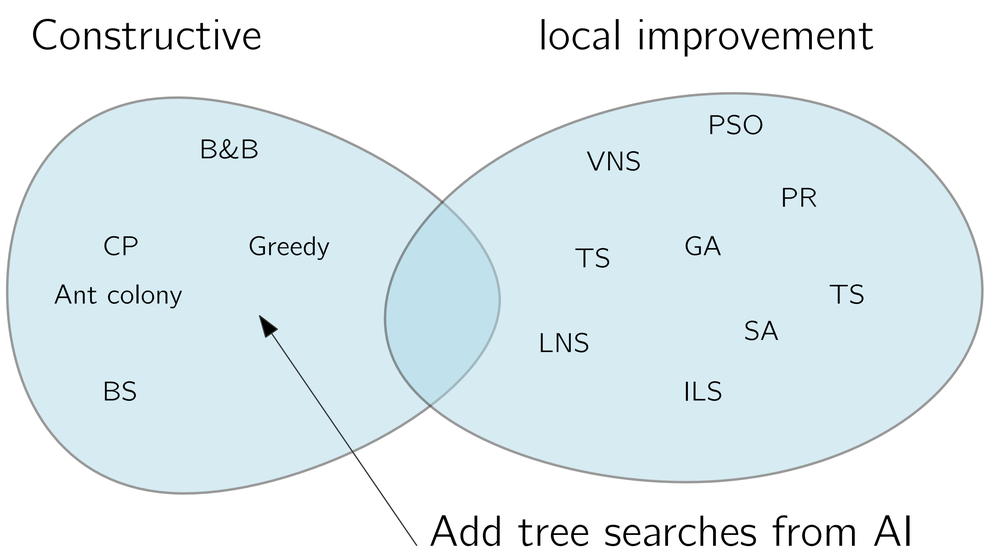
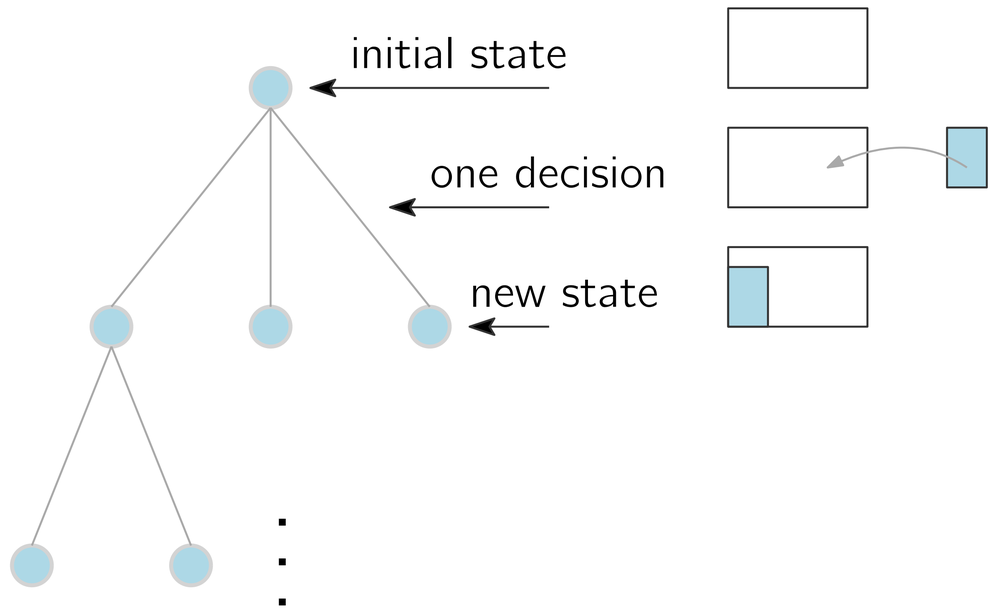
## How to solve hard problems ?




We believe that tree search from AI is suited for operations research

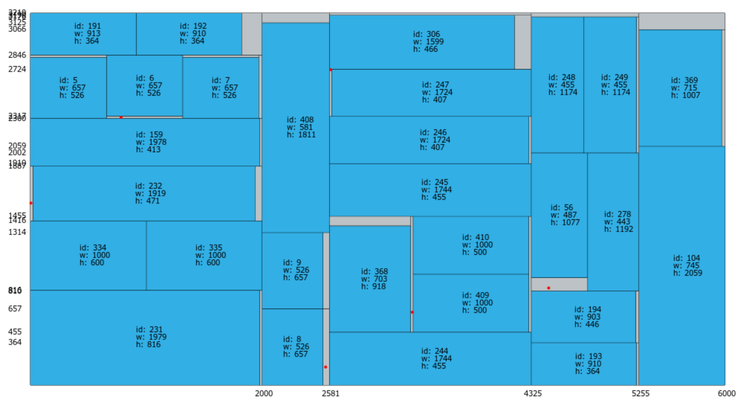
## Tree search principles




Each problem can be represented by a search tree.
We design generic algorithms that explore this tree.

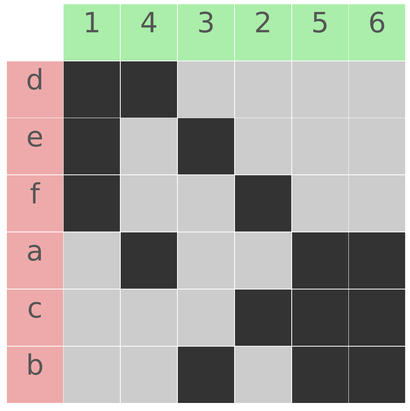
## Applications

### Saint-Gobain's Glass cutting challenge



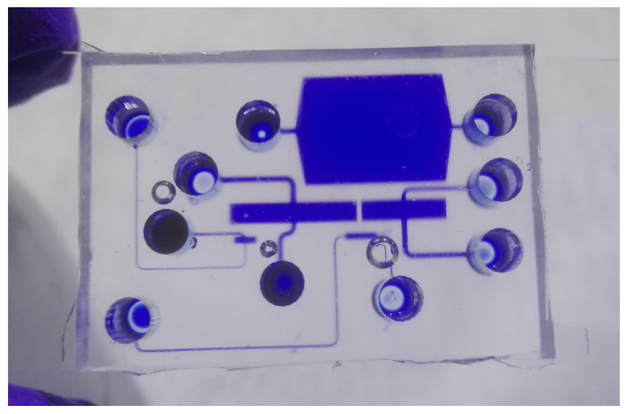
pack glass items (in blue), minimize the waste (gray)
avoid defects (red dots) and many other constraints
**We obtained the best final results during the competition**

### Triangle Width




from embedded vision systems
maximize "white triangle"
tree search algorithms
obtain the best results

### Brains on chips



*partnership with Netri*
aims to design devices that mimic brains
**GOAL: better studies on Alzheimer's disease**
we work on using tree search to generate chips

## Research Themes

### Integration of AI techniques

Many algorithms exist in AI
They are not well known in OR
We develop a framework in C++ to use them in OR

### Combination with other OR techniques

integrate dynamic programming (history cuts)
integrate pheromones mechanisms from Ant Colony Optimization
combine with local search techniques (local search, path relinking *etc.*)

### Offline & Online Learning

use machine learning to obtain better guides
use machine learning to perform heuristic cuts
Use bandit inspired algorithms

### Use it on other industrial problems

anytime tree search algorithms seem to be suited to solve complex problems
we obtained excellent results on such problems compared to other approaches