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## anytime tree searches for operations research

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► **To cite this version:**

Luc Libralesso, Vincent Jost, Louis Esperet, Thibault Honegger. anytime tree searches for operations research. Journées G-SCOP 2019, May 2019, Grenoble, France. hal-02155357

**HAL Id: hal-02155357**

**<https://hal.science/hal-02155357>**

Submitted on 13 Jun 2019

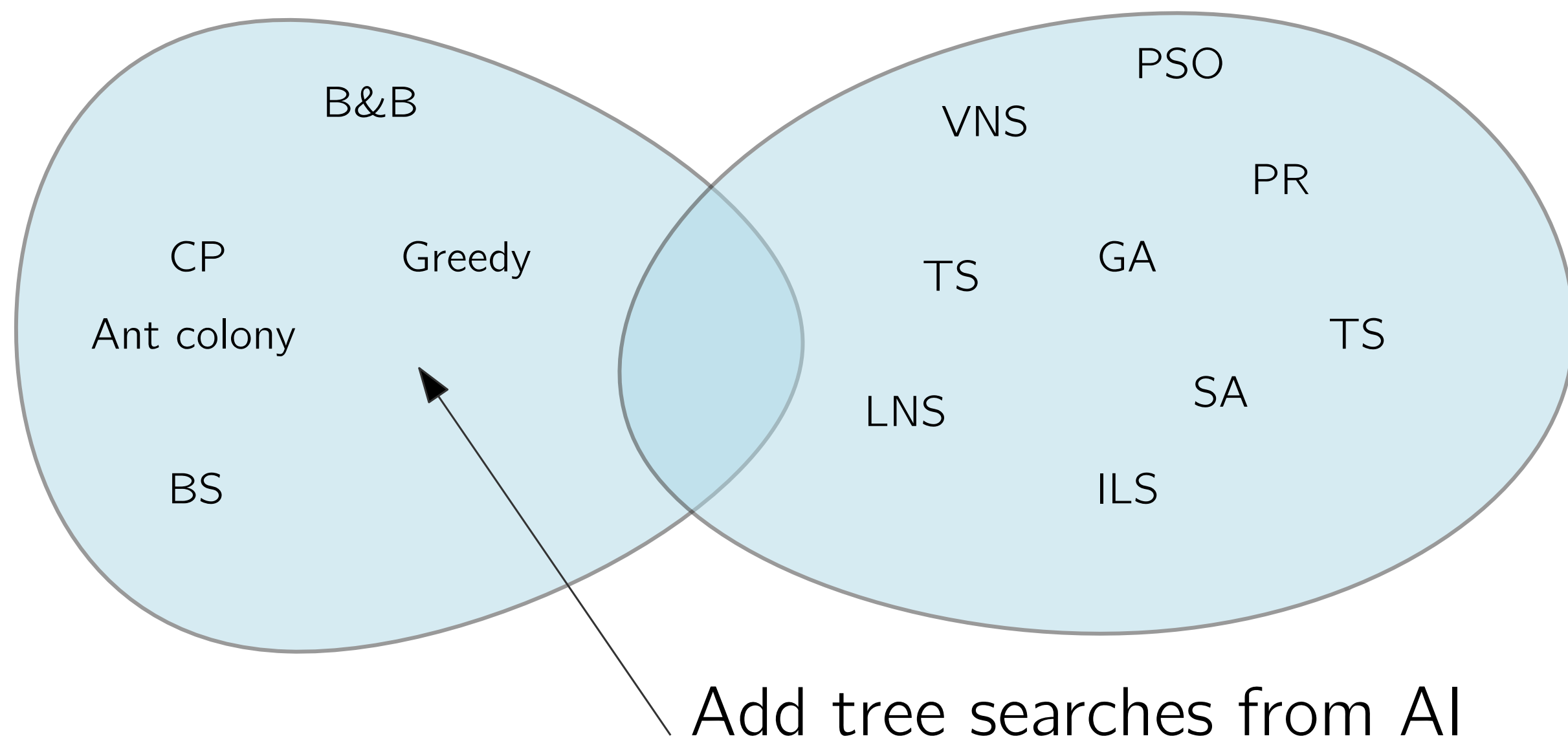
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## How to solve hard problems ?

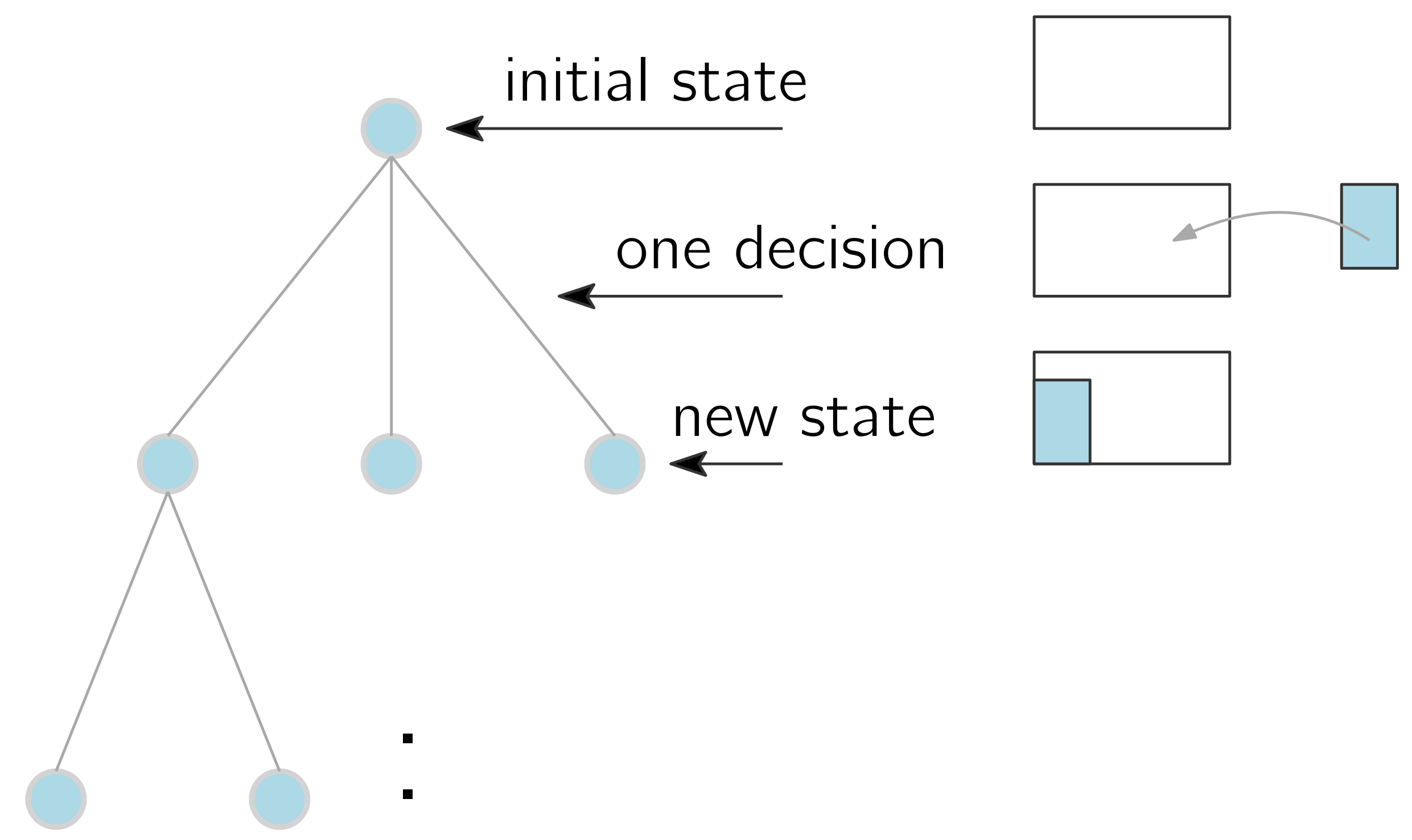
Constructive

local improvement



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

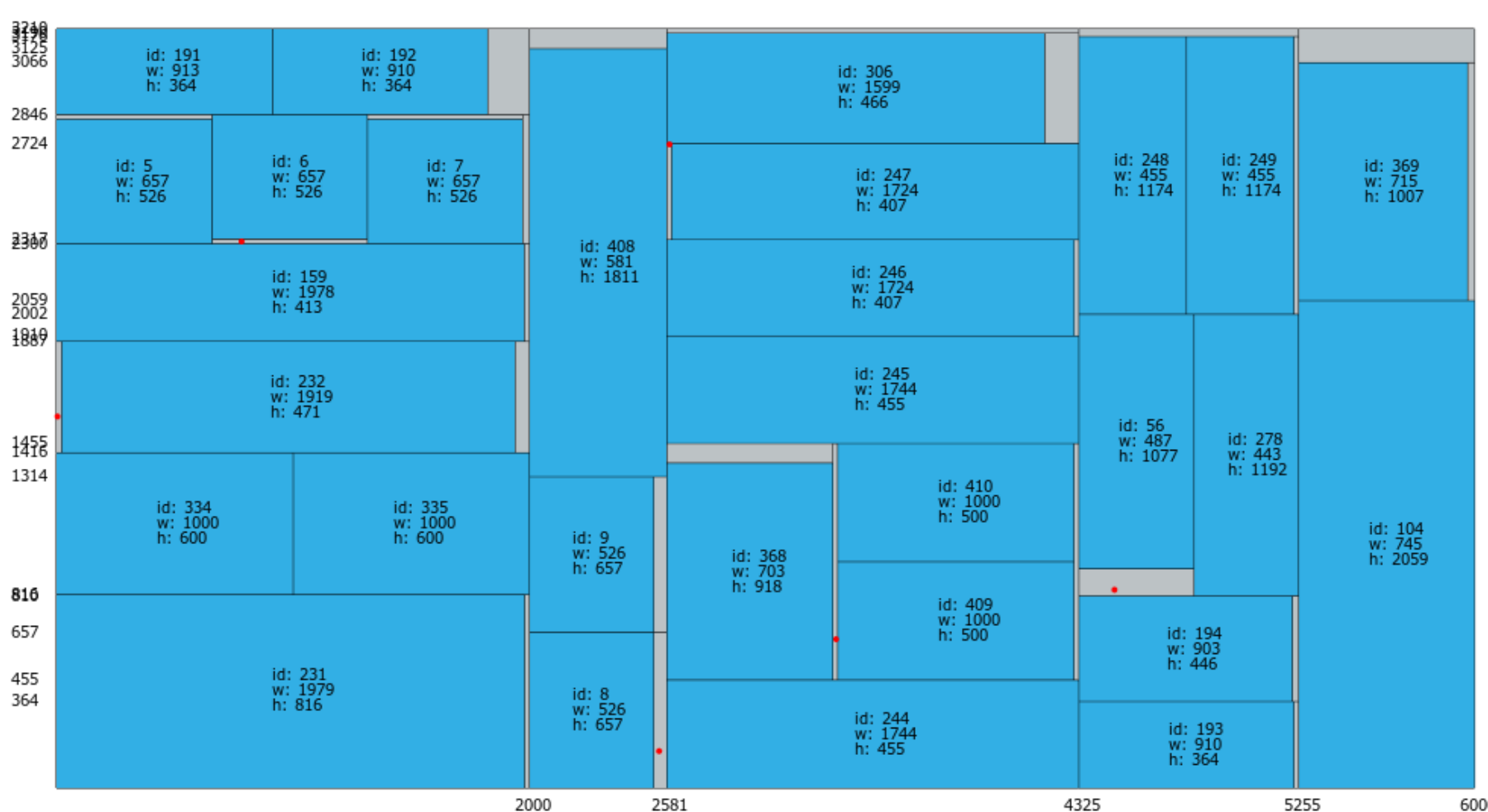
## Tree search principles



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

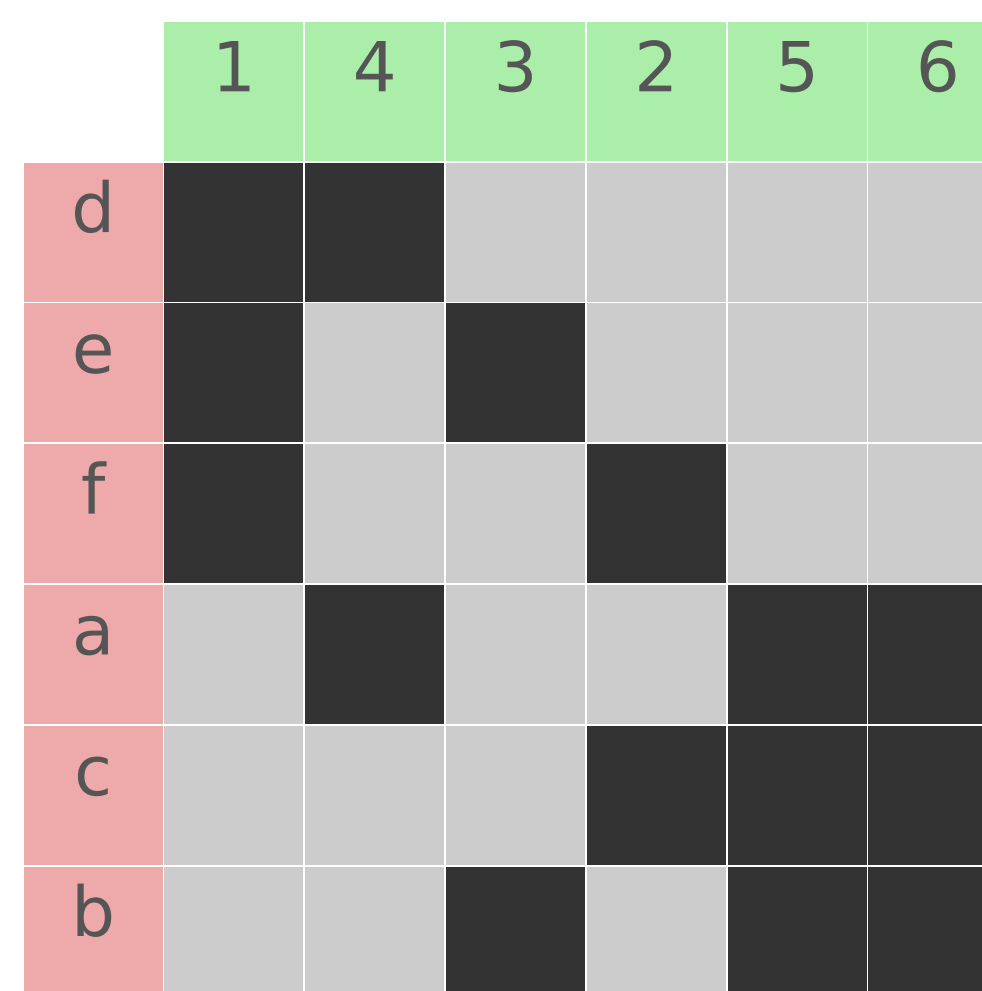
## Applications

### Saint-Gobain's Glass cutting challenge



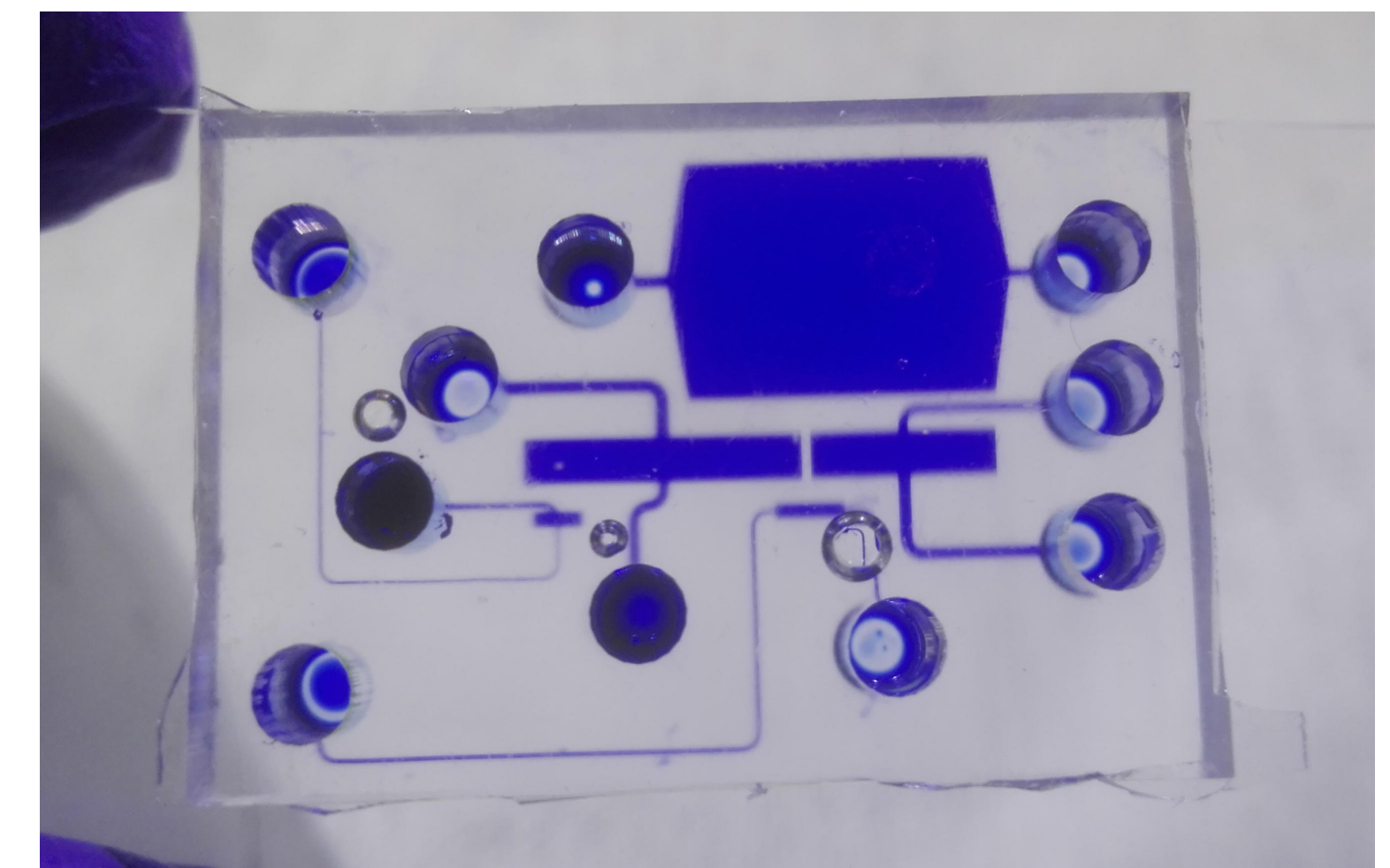
pack glass items (in blue), minimize the waste (gray)  
avoid defects (red dots) and many other constraints  
**We obtained the best final results during the competition**

### 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

### Offline & Online Learning

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

### 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.)

### 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