



HAL
open science

anytime tree searches for operations research

Luc Libralesso, Vincent Jost, Louis Esperet, Thibault Honegger

► **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

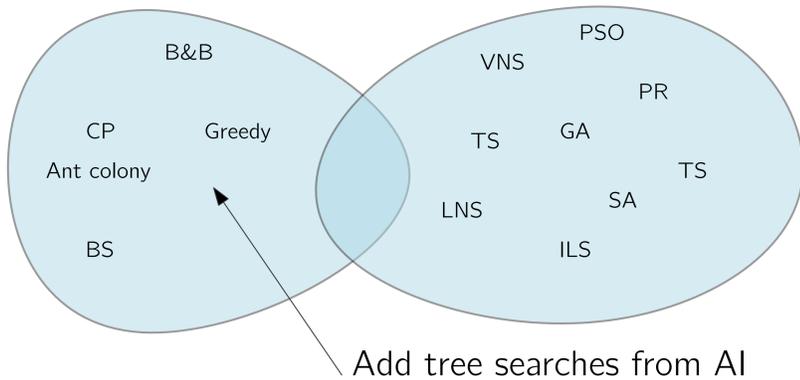
HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

How to solve hard problems ?

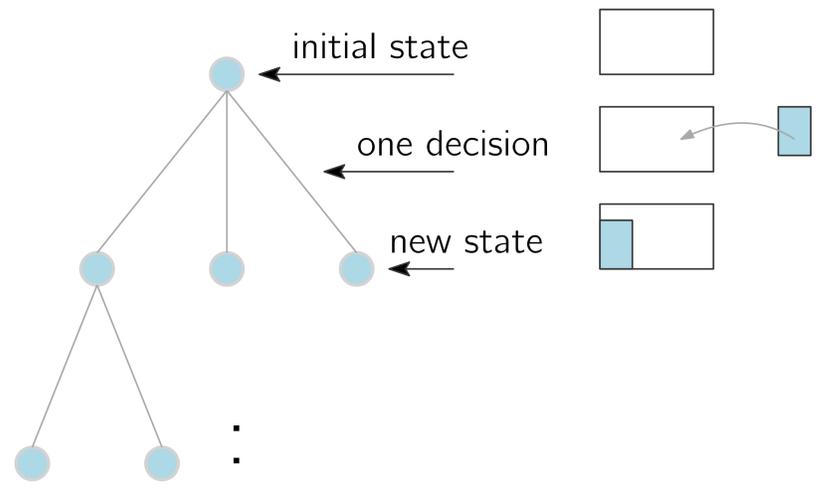
Constructive

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.

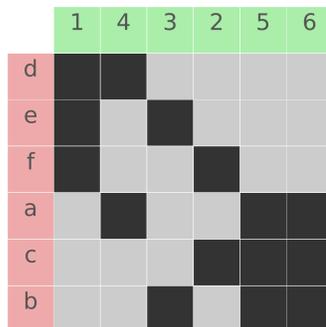
Applications

Saint-Gobain's Glass cutting challenge



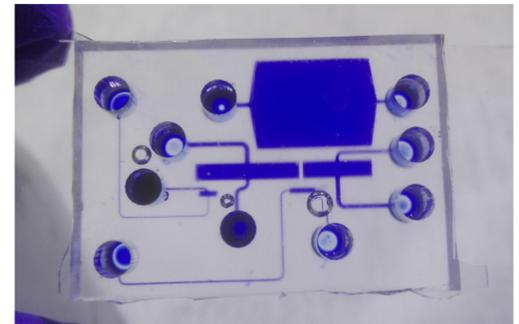
pack glass items (in blue), minimize the waste (gray)
avoid defects (red dots) and many other constraints
We obtained the best final results during the competition

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