Scikit-decide

The Reinforcement Learning, Planning & Scheduling library for engineers and researchers

AIR
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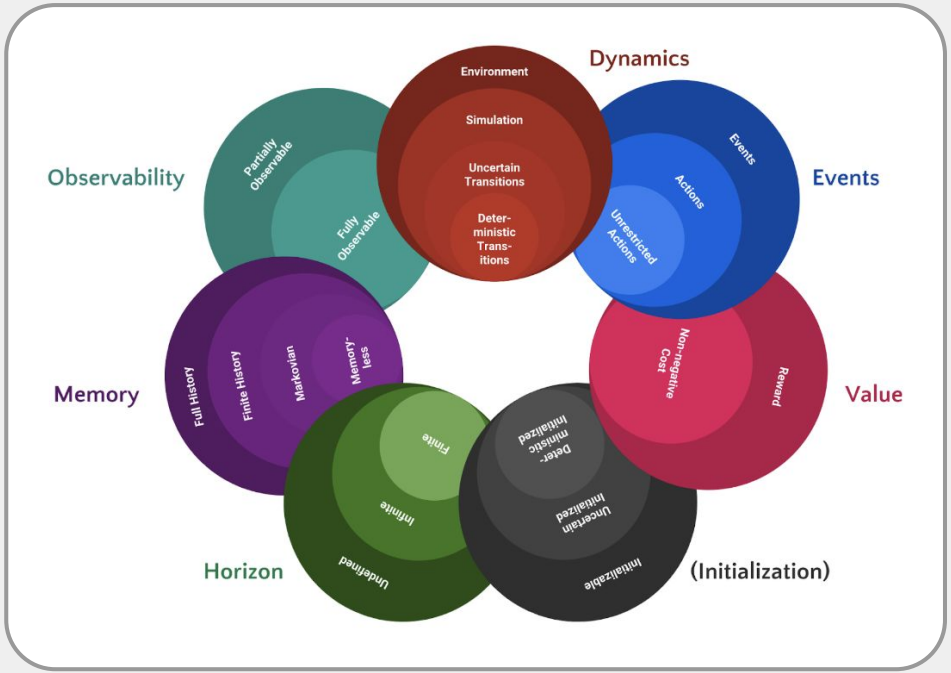
Agenda

- Rocket presentation of scikit-decide (10 mn)
- Hands-on demonstrations:
  - Reinforcement Learning on control problems (10 mn)
  - Planning in mazes (10 mn)
  - Scheduling for Resource Constrained Project Scheduling Problems (10 mn)
- A glimpse into industrial use cases and research projects supporting the development of scikit-decide (5 mn)
- Q&A (15 mn)

Scikit-decide: An AI toolbox for Reinforcement Learning, Automated Planning and Scheduling

- Framework for **decision making** initiated by Airbus
- Developed with support and expertise in AI decision-making from the Australian National University
- Focus on **problem solving**, no need for end-users to be algorithmic experts
- **Extensible architecture** with domain & algorithm catalog
- **Open sourced:**
  https://github.com/airbus/scikit-decide



Scikit-decide: catalog of domains/solvers

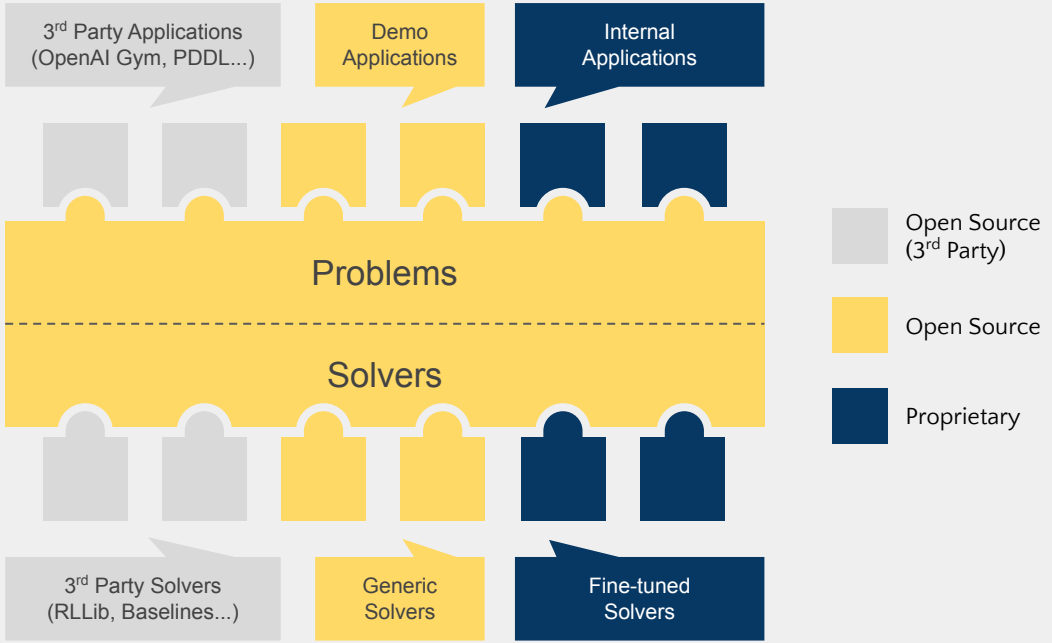
Domains *(problems definition, engineering knowledge)*

- Airbus domains (proprietary)
- Academic domains
- Bindings to existing domain libraries (e.g. OpenAI Gym)...

Solvers *(algorithms)*

- Search techniques
- Reinforcement Learning
- Scheduling & Routing
- Academic contributions (ANU)
- Bindings to existing solver libraries (e.g. Stable Baselines, RLlib, minizinc)...

https://github.com/airbus/scikit-decide



Bring algorithms to engineers — **common high-level interface** — **Expose industrial problems to researchers**

ecosystem

reinforcement learning

- OpenAI Gym
- Stable baselines
- RLlib

Gym

rllib

scheduling

- RCPSPs and variants
- Minizinc bindings
- *Routing problems* **WIP**

Mini Zn

Google Optimization Tools

IBM CPLEX

GUROBI OPTIMIZATION

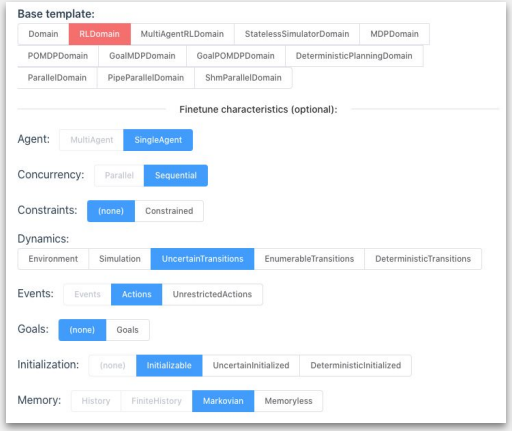
planning

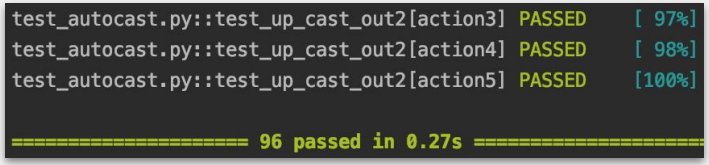
- A*, LRTA*, AO*
- MCTS, UCT
- IW, BFWS
- *unified_planner bindings* **WIP**

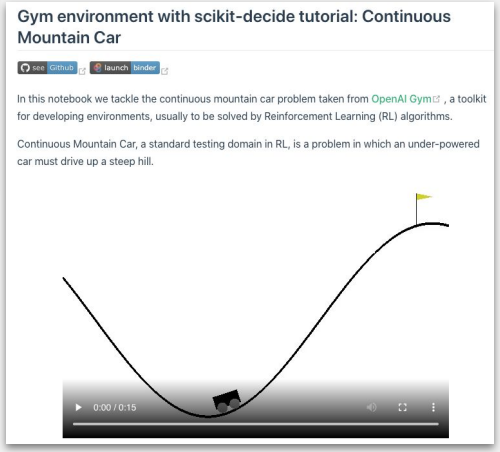
AIPlan4EU
Bringing AI Planning to the European AI On-Demand Platform

Scikit-decide: open-source standards

- **Easy install** (Python & C++ parts) via pre-compiled wheels
- **Documentation** (guide & reference)
- **Examples**, incl. online tutorial notebooks embedded in documentation
- **Code generators** for quick start (domains & solvers)
- **Unit/Integration tests**
- **CI/CD**



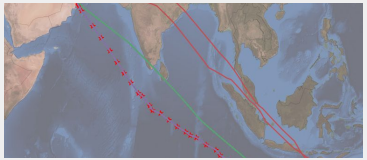
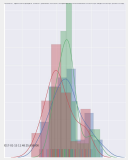




Hands-on demonstrations

- Reinforcement Learning on control problems
- Planning in mazes
- Scheduling for Resource Constrained Project Scheduling Problems [link]

Scikit-decide: industrial (Airbus) use cases

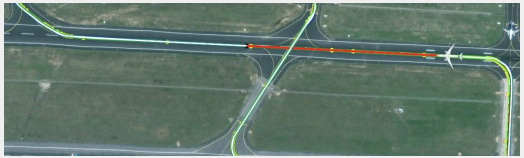



Dynamic Probabilistic Flight Planning (Airbus use case)

Reduce fuel margin to 0-1% with 99% empirical confidence, save 1% fuel burn on average

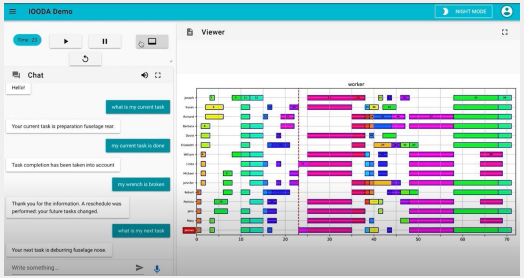

Satellite Mission Planning (Airbus Defence & Space use case)

Image delivery delays reduced by 25% compared with simple operator baseline



Reinforcement Learning & Genetic Programming for aircraft control problems (ATTOL use case)

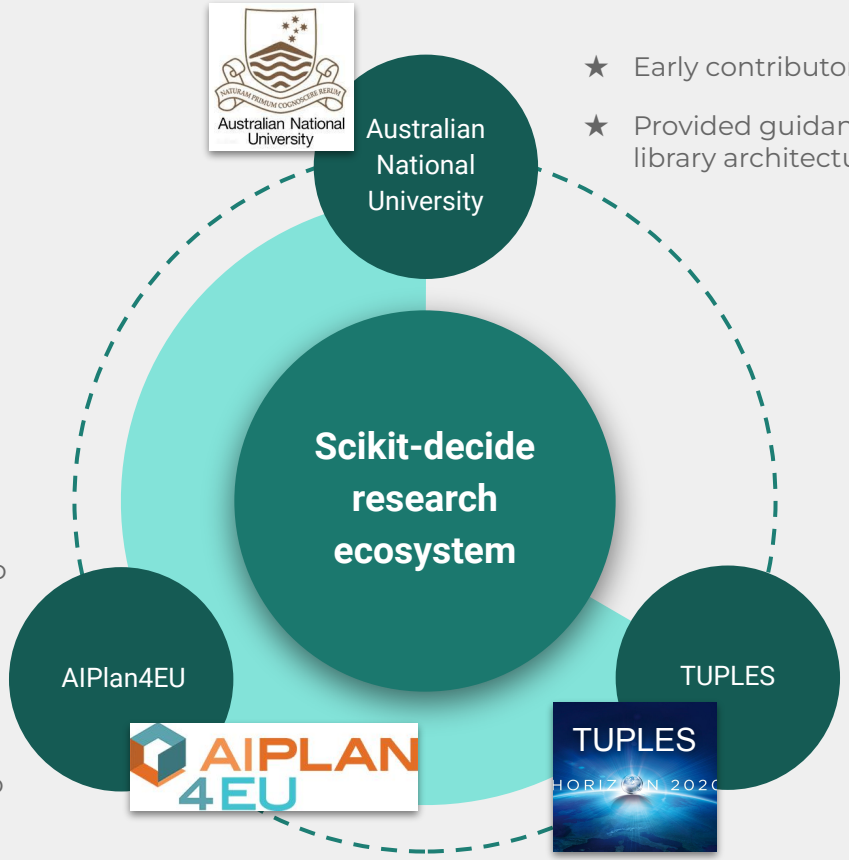
Support the development of new control laws, support autonomous taxiing



Manufacturing Tasks Scheduling with explanations and natural language interaction, taking into account employee multi-skills and stochastic disruption events

Average of 11% reduction of schedule makespan compared with industrial SoA in nominal conditions; 2.6% reduction disrupted situations compared to hand-written adaptation rules

Academic research ecosystem



★ Early contributor

★ Provided guidance on the library architecture and API

★ Ambition to bring AI planning technologies to the European On-Demand AI Platform

★ Provides bridge to scikit-decide

★ Brings PDDL domains to scikit-decide

★ Ambition to develop cutting-edge trustworthy decision-making techniques

★ Algorithms to be developed in scikit-decide

★ Will bring trustworthiness to scikit-decide

Join the scikit-decide community on github!

https://github.com/airbus/scikit-decide