Scikit-decide

The Reinforcement Learning, Planning & Scheduling library for engineers and researchers
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
Exposé industrial problems to researchers

Open Source
Proprietary
Internal Applications
Demo Applications
3rd Party Applications
(OpenAI Gym, PDDL...)

3rd Party Solvers
(RLlib, Baselines...)

Generic Solvers

Fine-tuned Solvers

Problems

Solvers
ecosystem

reinforcement learning
- OpenAI Gym
- Stable baselines
- RLlib

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

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

- **Australian National University**
  - Early contributor
  - Provided guidance on the library architecture and API

- **AIPlan4EU**
  - Ambition to bring AI planning technologies to the European On-Demand AI Platform
  - Provides bridge to scikit-decide
  - Brings PDDL domains to scikit-decide

- **TUPLES**
  - 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