



Autonomous exploration, active learning and human guidance with open-source Poppy humanoid robot platform and Explauto library

Sébastien Forestier, Yoan Mollard, Damien Caselli, Pierre-Yves Oudeyer

► To cite this version:

Sébastien Forestier, Yoan Mollard, Damien Caselli, Pierre-Yves Oudeyer. Autonomous exploration, active learning and human guidance with open-source Poppy humanoid robot platform and Explauto library. The Thirtieth Annual Conference on Neural Information Processing Systems (NIPS 2016), Dec 2016, Barcelona, Spain. hal-01404399v2

HAL Id: hal-01404399

<https://inria.hal.science/hal-01404399v2>

Submitted on 28 Aug 2018

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.

Autonomous exploration, active learning and human guidance with open-source Poppy humanoid robot platform and Explauto library



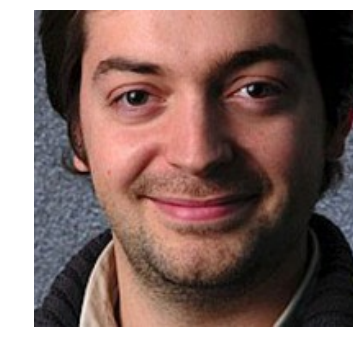
Sébastien Forestier



Yoan Mollard



Damien Caselli



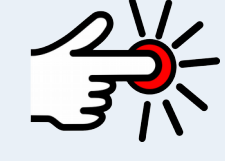
Pierre-Yves Oudeyer

Flowers Team, Inria Bordeaux, France
Email: sebastien.forestier@inria.fr



The Demonstration

The Torso robot **learns** how to move its arm to control the **ball**, **light** and **sounds**!
Interact to **help** him:

- On the **Tablet**, click an element to focus on (*sound, light, ball pose...*)
- Push the **Demo Button**  and then **demonstrate** a motion:
 - Move Torso's left arm** to show him how to control the joystick
 - Move the left joystick** to show him how to teleoperate the Ergo robot



An open platform *Poppy robots + Explauto library*, to:

- Allow **non-roboticists** researchers to conduct **learning experiments** with robots
- Benchmark algorithms for active multi-tasks policy learning with robots

github.com/sebastien-forestier/NIPS2016

Poppy: an experimental platform for science

*"Make **scientific** outputs openly **accessible**, **reproducible** and **cumulative**"*

Poppy robots are accessible in terms of **cost** and **complexity**, allowing researchers to share hardware and experimental details

Fast design, building and experimentation of alternative morphologies: **3D printing** and **rapid prototyping** techniques now make it possible!

poppy-project.org

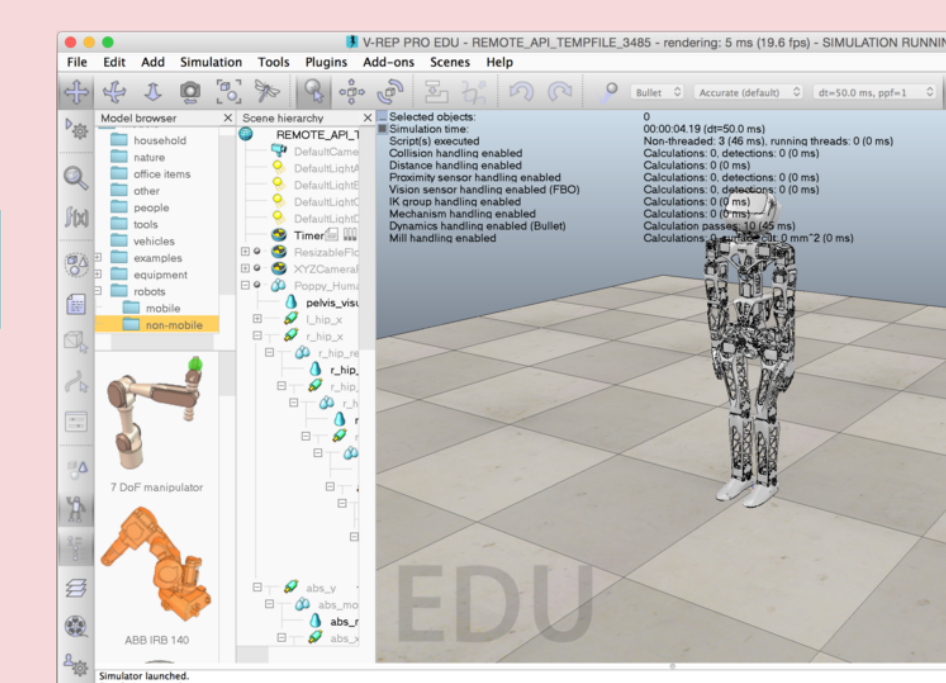


Make your Ergo Jr jump in 3 lines of code

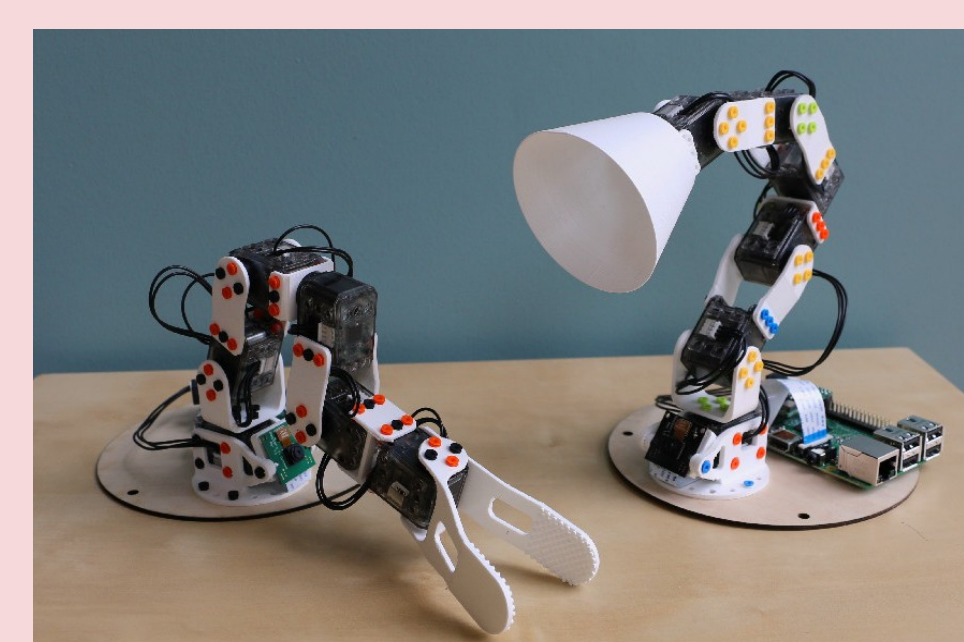
```
In [ ]: from poppy.creatures import PoppyErgoJr
jr = PoppyErgoJr()
In [ ]: jr.jump.start()
```



Poppy Humanoid



Robot simulator

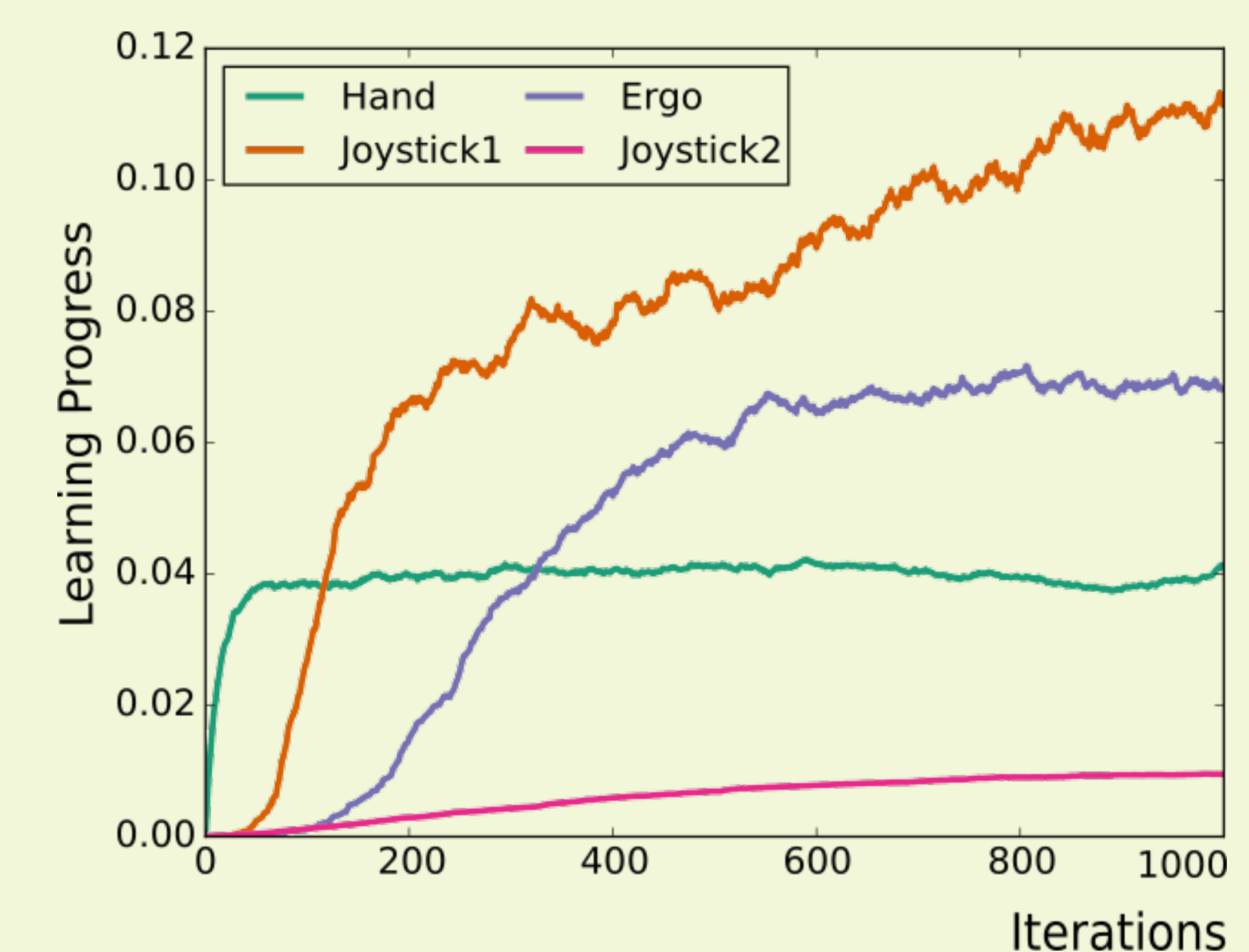


Poppy Ergo Junior

Intrinsically Motivated Multi-Task Reinforcement Learning

Intrinsically motivated RL allows:

- To learn **parameterized policies**
- To solve families of **parameterized problems**
- Problems structured in spaces that can be
- organized in a **hierarchy of reusable skills**



github.com/sebastien-forestier/ExplorationAlgorithms

Forestier, S. and Oudeyer, P.-Y. (2016). *Modular active curiosity-driven discovery of tool use*. In 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Daejeon, Korea.

Explauto: a library to study learning in robotics agents

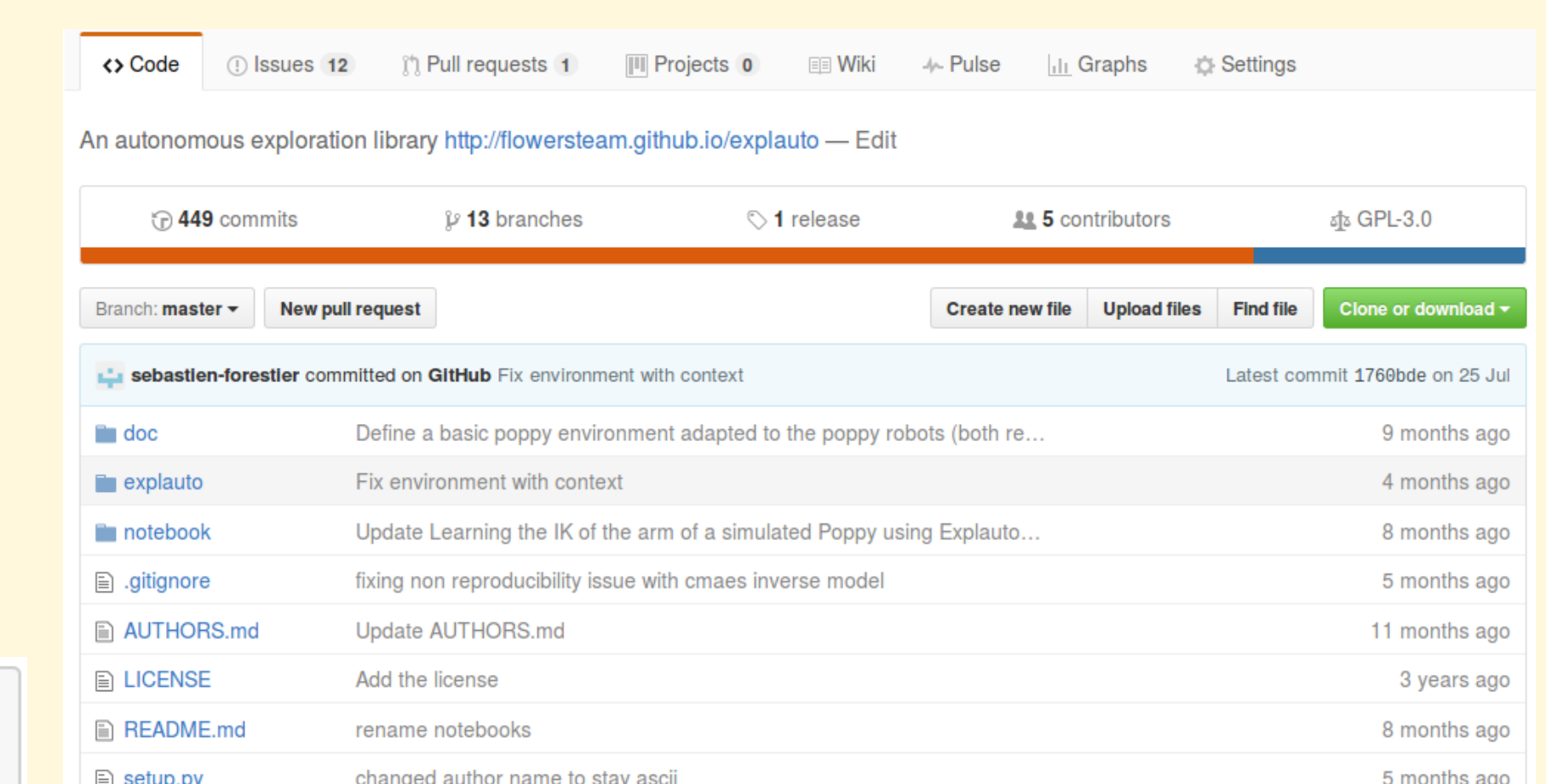
Explauto provides a high-level Python API for an easy definition of:

- Real and simulated **robotics setups**
- Incremental learning** of parametrized policies
- Active selection** of parametrized RL problems

```
from explauto.experiment import Experiment, make_settings

s = make_settings(environment='simple_arm',
                  babbling_mode='motor',
                  interest_model='random',
                  sensorimotor_model='nearest_neighbor')

expe = Experiment.from_settings(s)
```



Explauto: A library to study, model and simulate curiosity-driven learning and exploration in virtual and robotic agents

github.com/flowersteam/explauto