

CHRISTOPHER ILIFFE SPRAGUE

Researcher in structured artificial intelligence

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EXPERIENCE

Researcher

SciLifeLab

Jun 2022 – Present Stockholm, SE

- Researching inductive bias for ML-based prediction of molecular interactions (adv. Hossein Azizpour & Arne Elofsson).
- Benchmarked the robustness of SOTA ML-based docking models on apo and holo receptor structure variations (esp. with backbone variations, e.g. in GPCRs).
- Benchmarked SOTA ML-based docking models on drug screening with decoys (i.e. DUDE-Z dataset).
- Currently working on endowing diffusion generative models with stability and robustness guarantees with stochastic port Hamiltonian systems (e.g. for stable multi-modal docking or folding).

Researcher

KTH Royal Institute of Technology | Robotics, Perception, and Learning Department

Dec 2017 – Jun 2022 Stockholm, SE

- Published research (100+ citations) in the intersections of control theory, machine learning, perception, and planning (adv. Petter Ögren and John Folkesson).
- Developed planning and computer vision algorithms for multiple AUV scenarios in ROS, collaborated with a team of researchers to integrate them with other subsystems (e.g. control, perception, localisation), and tested them in simulation and real life.
- Led workshops and presented research at conferences and seminars.
- Presented robotic demonstrations to industrial and governmental stakeholders of the Swedish Maritime Robotics Centre.
- Supervised multiple M.Sc. students to the completion of their theses.
- Developed and presented robotic planning assignments in a course of 200+ students over 4 semesters.
- Led help sessions in robotics and machine learning courses.
- Amplified research visibility with media outreach and social media.

AUV Assistant

University of Tasmania | Institute for Marine and Antarctic Studies

Dec 2019 – Feb 2020 Amundsen Sea, West Antarctica

- Helped deploy the Nupiri Muka AUV near Thwaites glacier for under-ice data collection during the Korean Polar Research Institute's Winter 2019-2020 Antarctic expedition (adv. Peter King).
- Helped recover Gothenburg University's oceanographic moorings.

Researcher

European Space Agency | Advanced Concepts Team

Sep 2017 – Nov 2017 Noordwijk aan Zee, NL

- Published research in the intersection of spacecraft trajectory optimisation and machine learning (adv. Dario Izzo).

SKILLS

Software

JAX PyTorch SymPy
Python Mathematica ROS

Machine Learning

Diffusion models
Physics-Informed Learning
Geometric Deep Learning
Reinforcement Learning

Mathematics

Stochastic Differential Equations
Optimal Control Stability theory
Hybrid Dynamical Systems
Order Theory Graph Theory
Hamiltonian Systems

EDUCATION

Ph.D. in Computer Science

KTH Royal Institute of Technology

Dec 2017 – Jun 2022

M.S. in Aerospace Engineering

Magna Cum Laude

Rensselaer Polytechnic Institute

May 2016 – May 2017

B.S. in Aerospace Engineering

Cum Laude

Rensselaer Polytechnic Institute

Aug 2013 – May 2016

LANGUAGES

English
Swedish
Spanish



Researcher

Japan Aerospace Exploration Agency | Institute of Space and Astronautical Science

📅 Jun 2017 – Aug 2017

📍 Sagami-hara, JP

- Researched machine learning for trajectory optimisation in the context of the lunar spacecraft mission EQUULEUS (adv. Yasuhiro Kawakatsu).
- Awarded East Asia and Pacific Summer Institute Fellowship (\$5,400) by the National Science Foundation and Summer Fellowship (¥692,500) by the Japan Society for the Promotion of Science.

Learning Assistant

Rensselaer Polytechnic Institute

📅 Aug 2016 – May 2017

📍 Troy, NY, USA

- Held consultation sessions and created a variety of workshops for study skills, time management, and stress management in order to promote academic excellence and encourage student involvement.

Software Engineering Intern

National Aeronautics and Space Administration

📅 Jun 2015 – Aug 2015

📍 Laurel, MD, USA

- Produced targeted enhancements to the fault-protection systems of NASA's Solar Terrestrial Relations Observatory (adv. Dan Wilson and Kevin Balon).
- Updated the spacecrafts' testbeds to emulate their current operational modes.
- Awarded NASA Johns Hopkins Applied Physics Laboratory Fellowship (\$4,000) by The Henry Foundation Inc.

SELECTED PUBLICATIONS

- **Sprague, Christopher I.**, & Ögren, P. (2023). An extended convergence result for behaviour tree controllers. *In submission*.
- **Sprague, Christopher I.**, & Ögren, P. (2022). Adding neural network controllers to behavior trees without destroying performance guarantees. In *2022 IEEE 61st conference on decision and control (cdc)* (pp. 3989–3996). doi:10.1109/CDC51059.2022.9992501
- **Sprague, Christopher I.**, & Ögren, P. (2021). Continuous-time behavior trees as discontinuous dynamical systems. *IEEE Control Systems Letters*.
- **Sprague, Christopher I.**, Izzo, D., & Ögren, P. (2020). Learning dynamic-objective policies from a class of optimal trajectories. In *2020 59th IEEE conference on decision and control (cdc)* (pp. 597–602). IEEE.
- **Torroba, Ignacio***, **Sprague, Christopher I.***, Bore, N., & Folkesson, J. (2020). Pointnetkl: Deep inference for gicp covariance estimation in bathymetric slam. *IEEE Robotics and Automation Letters*, 5(3), 4078–4085. *Equal contribution.
- Izzo, D., **Sprague, Christopher I.**, & Tailor, D. V. (2019). Machine learning and evolutionary techniques in interplanetary trajectory design. In G. Fasano & J. D. Pintér (Eds.), *Modeling and optimization in space engineering: State of the art and new challenges* (pp. 191–210). doi:10.1007/978-3-030-10501-3_8
- **Sprague, Christopher I.**, Özkahraman, Ö., Munafo, A., Marlow, R., Phillips, A., & Ögren, P. (2018). Improving the modularity of auv control systems using behaviour trees. In *2018 IEEE/OES autonomous underwater vehicle workshop (auv)* (pp. 1–6). IEEE.

REFEREES

Prof. Hossein Azizpour

@ KTH Royal Institute of Technology

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Prof. Arne Elofsson

@ SciLifeLab

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Prof. Petter Ögren

@ KTH Royal Institute of Technology

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Prof. John Folkesson

@ KTH Royal Institute of Technology

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PRESS (HYPERLINKED)

- SMaRC-team shares knowledge and encourages international collaboration at Breaking the Surface (Oct 20, 2021)
- Researchers celebrate Antarctic under ice voyages of underwater vehicle (Mar 18, 2020, IMAS UTAS)
- KTH doctoral students examined shipwrecks from the 16th century (Sep 16, 2019, KTH)
- A Shipwreck, 500 Years Old, Appears on the Baltic Seabed (Jul 22, 2019, New York Times)
- Using behavior trees to improve the modularity of AUV control systems (Nov 12, 2018, Tech Xplore)
- Rensselaer Graduate Students Successful in Garnering Summer Fellowships (Feb 28, 2017, RPI)

ADDITIONAL INFO

Interests

Middle-distance running

Cycling

Weightlifting

Nutrition

Hiking

Neuroscience

Psychology

Sustainability

Travelling

Volunteering

Olio Food Waste Hero