PhD Position in Probabilistic Program Induction

Challenge: Overcome brittleness of artificially intelligent agents

Change: Use probabilistic programs

Impact: Trustworthy intelligent agents in the wild

Job description

Despite the remarkable progress artificial intelligence has made over the decades, it still lacks many features we attribute to human intelligence. Perhaps the most startling deficiency is the flexible use of knowledge humans exhibit. Once they understand a concept, humans can use it in new situations, find it new purposes, generate exemplars, and compositionally assemble new concepts. Artificially intelligent agents, in contrast, are brittle and use knowledge only in narrowly defined contexts. Humans are so adaptive and flexible because they are adept at both learning and reasoning. When new challenges arise, they stay on top of their game by learning new skills and information. By reasoning about core properties of skills, humans transfer them to new challenges, with or without modification. With machine learning and probabilistic and logical reasoning, artificial intelligence has made significant progress in both directions independently. However, what we are missing is a framework that unifies them.

This PhD project will investigate the use of probabilistic programs as a unifying paradigm for learning and reasoning. Probabilistic programs extend programming languages with stochastic execution primitives. This simple idea turns probabilistic programs into a lingua franca for artificially intelligent agents: they support logical reasoning by using programming languages and probabilistic modelling through stochastic execution. While their reasoning capabilities are well understood, learning probabilistic programs from observations is still a major challenge - you will have the opportunity to tackle this problem. We envision that the outcomes of this research will have a big impact on artificial intelligence and its applications.

You will perform groundbreaking research within the Algorithmics group at TU Delft. The Algorithmics group aims to design and understand fundamental properties of planning and coordination algorithms for intelligent decision making in real-world applications, such as for coordinating electrical loads within network constraints, or logistic processes on a shunting yard or container terminal. To realise these objectives, the group focuses on the following research topics: model-based reinforcement learning, multi-party optimisation, constraint reasoning, and meta-heuristics

Requirements

- You hold an MSc degree or a similar degree with an academic level equivalent to a two-year Master's degree in Computer Science or a closely related field;
- You have a strong background and demonstrable experience in artificial intelligence and machine learning. Background in probabilistic programming is not needed, but desirable;
- You have strong programming and algorithm developments skills;
- You have a strong interest or experience with empirical and theoretical research. More importantly, you enjoy doing research;
- You have good communication skills in English, demonstrated by an MSc thesis or other relevant writing;

- You are a team player

Conditions of employment

TU Delft offers PhD-candidates a 4-year contract, with an official go/no go progress assessment after one year. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities, increasing from € 2395 per month in the first year to € 3061 in the fourth year. As a PhD candidate you will be enrolled in the TU Delft Graduate School. The TU Delft Graduate School provides an inspiring research environment with an excellent team of supervisors, academic staff and a mentor. The Doctoral Education Programme is aimed at developing your transferable, discipline-related and research skills.

The TU Delft offers a customisable compensation package, discounts on health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. For international applicants we offer the Coming to Delft Service and Partner Career Advice to assist you with your relocation.

TU Delft (Delft University of Technology)

Delft University of Technology is built on strong foundations. As creators of the world-famous Dutch waterworks and pioneers in biotech, TU Delft is a top international university combining science, engineering and design. It delivers world class results in education, research and innovation to address challenges in the areas of energy, climate, mobility, health and digital society. For generations, our engineers have proven to be entrepreneurial problem-solvers, both in business and in a social context. At TU Delft we embrace diversity and aim to be as inclusive as possible (see our Code of Conduct). Together, we imagine, invent and create solutions using technology to have a positive impact on a global scale.

Challenge. Change. Impact!

Faculty Electrical Engineering, Mathematics and Computer Science

The Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) brings together three disciplines - electrical engineering, mathematics and computer science. Combined, they reinforce each other and are the driving force behind the technology we use in our daily lives. Technology such as the electricity grid, which our faculty is helping to make future-proof. We are also working on a world in which humans and computers reinforce each other. We are mapping out disease processes using single cell data, and using mathematics to simulate gigantic ash plumes after a volcanic eruption. There is plenty of room here for ground-breaking research. We educate innovative engineers and have excellent labs and facilities that underline our strong international position. In total, more than 1,100 employees and 4,000 students work and study in this innovative environment.

Click here to go to the website of the Faculty of Electrical Engineering, Mathematics and Computer Science.

Additional information

For more information about this vacancy and the application procedure, please contact Sebastijan Dumancic, Assistant Professor (S.Dumancic@tudelft.nl)

Application procedure

Are you interested in this vacancy? Please apply before **September 1, 2021** via the application button and upload the following documents:

- 1-page Motivation letter explaining why are you interesting in this vacancy
- Your CV
- Your MSc thesis or a paper you have written
- Your MSc transcripts
- Please highlight in your CV/Motivation letter relevant projects and achievements that demonstrate your relevant competence

- A pre-employment screening can be part of the selection procedure.
- You can apply online. We will not process applications sent by email and/or post.
- Acquisition in response to this vacancy is not appreciated.

FACULTY/DEPARTMENT

Faculty of Electrical Engineering, Mathematics & Computer Science

JOB TYPE

PhD

SCIENTIFIC FIELD

Engineering

HOURS PER WEEK

36-40

SALARY

€ 2.395,00 - € 3.061,00

DESIRED LEVEL OF EDUCATION

University graduate

VACANCY NUMBER

TUD01255

APPLY :HERE