Technische Universiteit
Eindhoven
University of Technology

Department of Electrical Engineering
Control Systems

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PhD position

Data-Driven Learning of Linear Parameter-Varying Models

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Contact
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Description:

Faculty/department: Control Systems group, Electrical Engineering department
Duration of contract: 4 years
Starting date: as soon as possible
Salary scale: €2042 gross/month (with annual increase)

Research group:

The Control Systems group has a long tradition in modeling, system identification and control of dynamical systems. The group aims to be a nationally and internationally acknowledged center in mastering complexity of dynamic systems. Currently, the Control Systems group focuses its fundamental research around model approximation, networked systems, model predictive control and spatial-temporal systems. The group covers a wide variety of applications in modeling and control system design in projects. These include power networks, electromechanical systems, automotive systems, chemical production processes, and various applications in the process industry. We disseminate our expertise and knowledge to students, the scientific community and to industry. Currently about 30 people work at the Control Systems group, including postdocs and PhD students.

Project description:

Linear Parameter-Varying (LPV) systems are flexible models capable of representing nonlinear/time-varying dynamical systems in terms of a linear structure. Signal relations in this structure depend on a so-called scheduling variable, which embeds time-variance, nonlinear dynamical aspects, etc., into the behavior of the LPV model.

The LPV framework provides computationally efficient and robust control-synthesis approaches for nonlinear/time-varying systems, making it attractive to chemical-process and high-tech mechatronic applications. However, systematic LPV modeling based on measured data or first-principle knowledge is still unresolved — a widely recognized shortcoming of this promising theory —. Currently it is not understood how (1) to achieve an exact and low-complexity embedding of a nonlinear behavior into an LPV structure, (2) to find optimally parameterized representations of LPV behaviors, and (3) to efficiently estimate them based on measured data.

This Phd project aims to surmount these challenges by establishing an innovative synergy between the *Machine Learning* (ML) and LPV frameworks. The aim is to develop computationally efficient model learning approaches capable of supporting control synthesis. The emerging ML framework provides powerful data-driven approaches to facilitate non-parametric learning of complicated data-relations. The flexibility of the ML framework in defining learning objectives (aim-relevant estimation) and its ability to facilitate optimal recovery of structural relationships (model structure selection) provide

novel perspectives in terms of developing dedicated methods to solve the limiting problems (1)-(3) of the current LPV theory.

The results of the fundamental research will be applied to modeling problems in complex physical/chemical and/or electrical/mechatronic systems as high-purity distillation columns and high-performance positioning applications.

Requirements:

We are looking for a candidate who meets the following requirements:

- You are a talented and enthusiastic researcher.
- You have experience with or a strong background in systems and control, mathematics, statistics and signal processing. Preferably you finished a master in Systems and Control, (Applied) Physics, (Applied) Mathematics, Information Technologies, Electrical Engineering or Mechanical Engineering.
- You have good programming skills and experience (Mathematica and/or Matlab is an asset).
- You have good communicative skills, and the attitude to partake successfully in the work of a research team.
- You are creative and ambitious, hard working and persistent.
- You have good command of the English language (knowledge of Dutch is not required).

What we offer:

We offer a challenging job at a dynamic and ambitious university through a fixed-term appointment for the period of 4 years. The research in this project must be concluded with the attainment of a PhD degree. As an employee of the university you will receive a competitive salary as well as excellent employment conditions. A salary is offered starting at EUR 2042 per month (gross) in the first year and increasing up to EUR 2612 per month (gross) in the last year. Moreover 8% bonus share (holiday supplement) is provided annually. Assistance for finding accommodation can be given. The university offers an attractive package of fringe benefits such as excellent technical infrastructure, child care, savings schemes, and excellent sports facilities.

TU/e offers opportunities for personal development by developing your social and communication skills. We do this by offering every PhD student a series of courses that are part of the PROOF program as an excellent addition to your scientific education.

Information and application:

More information on the vacancy and project can be obtained from dr. ir. Roland Tóth (r.toth@tue.nl) or prof. dr. ir. P.M.J. Van den Hof (p.m.j.vandenhof@tue.nl)

For terms of employment please contact: Mrs. C.C.W.M. Gijsbers (cgijsbers.ee@tue.nl), HR advisor of the Department of Electrical Engineering.

If you are interested in this position, please send (1) a detailed curriculum vitae, (2) an application letter motivating your interest in the offered position and research topic, and summarizing your views on the research area, (3) a publication list, (4) a copy of your best publication in English, (5) course lists of your Masters and Bachelor programs (incl. grades), (6) results of a recent English language test (like IELTS) and the (6) names of two references.