

Robert Mattila

Osquldas väg 10
100 44 Stockholm
KTH EE-AC, Sweden

January 15, 2018

rmattila@kth.se

076 - 201 405 6

Currently a PhD Student researching identification, control and inference in stochastic dynamical systems. Interested in machine learning, data analytics and their future applications in real world scenarios – for example, in next-generation health-care.

Research Interests

- Identification, control and inference in stochastic dynamical systems
- Hidden Markov models and (partially observed) Markov decision processes
- Machine learning and optimization

Education

- **KTH Royal Institute of Technology** Stockholm, Sweden
PhD, Department of Automatic Control *2015 - 2020 (Projected)*
 - Supervisors: Prof. Bo Wahlberg and Assoc. Prof Cristian R. Rojas.
 - Topic: Identification and control of hidden Markov models.
- **KTH Royal Institute of Technology** Stockholm, Sweden
B.Sc. Engineering Physics, M.Sc. Systems, Control and Robotics *2010 - 2015*
 - The Swedish degree of *Civilingenjör i Teknisk Fysik*.
 - The graduation date was one semester earlier than nominal time.
 - B.Sc. GPA of 4.98/5.0 and M.Sc. GPA of 5.0/5.0 .
- **UCM, Universidad Complutense de Madrid** Madrid, Spain
ERASMUS Exchange studies *Spring 2013*
 - All (five) courses taken were taught in Spanish (including reading material).
 - GPA of 8.13/10.0 .
- **THG, Thorildsplans gymnasium** Stockholm, Sweden
Natural Sciences with specialization on Mathematics and Computer Science *2007 - 2010*

Skills, Merits and Awards

- **Computer Skills:**
 - Programming:** Matlab, Python, Julia, Java
 - Operating Systems:** OSX, Linux, Windows
 - Other:** L^AT_EX, git
- **Languages:** Native in Swedish, fluent in English and proficient (B2) in Spanish

- **Awards:**
 - Awarded the KTH Electrical Engineering Scholarship of Excellence (1 MSEK) in 2015.
 - Awarded a SURF scholarship from Caltech to work with Prof. Richard Murray in 2014.
 - Awarded the Henrik Göransson’s Sandviken Scholarship and the KTH Student Scholarship (twice) for outstanding grades.
 - Participated in the final of *Wallenbergs Fysikpris 2010* (Swedish qualifications for the International Physics Olympiad).
 - Awarded scholarship for outstanding grades when graduating from THG.
- **Reviewer** for the *IEEE Conference on Decision and Control*, the *IFAC American Control Conference* and the *IFAC Automatica* journal.
- **KIBok** (www.kibok.se): A website for buying and selling used medical textbooks, aimed for students at the Karolinska Institute. The website was developed using Python and Django, and has been running since 2013.
- Hold a Swedish driver’s license (B).

Publications

Journals

- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy, and Bo Wahlberg. Asymptotically efficient identification of known-sensor hidden Markov models. *IEEE Signal processing letters*, 24(12):1813–1817, 2017.

Conferences

- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy, and Bo Wahlberg. Inverse filtering for hidden Markov models. In *Advances in Neural Information Processing Systems 30*, pages 4207–4216, 2017.
- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy, and Bo Wahlberg. Identification of hidden Markov models using spectral learning with likelihood maximization. In *Proceedings of the 56th IEEE Conference on Decision and Control (CDC’17)*, 2017.
- Antti Siika, Robert Mattila, Bo Wahlberg, and Joy Roy. An optimal gender-specific treatment policy for abdominal aortic aneurysms constructed using a Markov decision process model. *Journal of Vascular Surgery*, 65(6):175S, 2017. In the Society for Vascular Surgery’s Vascular Annual Meeting (SVS VAM’17).
- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy, and Bo Wahlberg. Computing monotone policies for Markov decision processes: a nearly-isotonic penalty approach. In *Proceedings of the 20th IFAC World Congress*, volume 50, pages 8429 – 8434, 2017.
- Robert Mattila, Antti Siika, Joy Roy, and Bo Wahlberg. A Markov decision process model to guide treatment of abdominal aortic aneurysms. In *Proceedings of the IEEE Conference on Control Applications (CCA’16)*, pages 436–441, 2016.

- Robert Mattila, Vikram Krishnamurthy, and Bo Wahlberg. Recursive identification of chain dynamics in hidden Markov models using non-negative matrix factorization. In *Proceedings of the 54th IEEE Conference on Decision and Control (CDC'15)*, pages 4011–4016, 2015.
- Robert Mattila, Yilin Mo, and Richard M. Murray. An iterative abstraction algorithm for reactive correct-by-construction controller synthesis. In *Proceedings of the 54th IEEE Conference on Decision and Control (CDC'15)*, pages 6147–6152, 2015.
- Robert Mattila, Cristian R. Rojas, and Bo Wahlberg. Evaluation of spectral learning for the identification of hidden Markov models. *Proceedings of the 17th IFAC Symposium on System Identification (SYSID'15)*, 48(28):897–902, 2015.

Other

- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy and Bo Wahlberg, *Inverse Filtering for Hidden Markov Models*. Poster at the 2017 Workshop of the European Research Network on System Identification (ERNSI), September, Lyon, France.
- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy and Bo Wahlberg, *Method of Moments Identification of Hidden Markov Models with Known Sensor Uncertainty Using Convex Optimization*. Poster at the 2016 Workshop of the European Research Network on System Identification (ERNSI), September, Cison di Valmarino, Italy.
- Robert Mattila, Cristian R. Rojas, Vikram Krishnamurthy and Bo Wahlberg, *Method of Moments Identification of Hidden Markov Models with Known Sensor Uncertainty Using Convex Optimization*. Poster at Reglermötet 2016, June, Göteborg, Sweden.
- Robert Mattila, Vikram Krishnamurthy and Bo Wahlberg, *Recursive Method of Moments Identification of Hidden Markov Models using Convex Optimization*. Poster at the 2015 Workshop of the European Research Network on System Identification (ERNSI), September, Varberg, Sweden.
- Robert Mattila, *On Identification of Hidden Markov Models Using Spectral and Non-Negative Matrix Factorization Methods*. Master's thesis, KTH Royal Institute of Technology. Stockholm, Sweden, 2015. Supervisors: Prof. Bo Wahlberg and Assoc. Prof. Cristian R. Rojas.
- Robert Mattila, *Including Bathymetric Data in Autonomous Surface Vessels' Maneuvering Optimisation Tool*. Bachelor's thesis, KTH Royal Institute of Technology. Stockholm, Sweden, 2015. Supervisors: Prof. Juan Jiménez and José María Benítez.

Academic Experience

- **Cornell Tech, Cornell University** Manhattan, USA
Invited researcher by Prof. Vikram Krishnamurthy Summer 2017
- **VUB-ELEC, Workshop on System Identification** Brussels, Belgium
Included courses on Summer 2017
 - Frequency response function measurements (non-parametric tools), dynamic system identification (parametric tools) and control-oriented system identification by, among others, John Lataire, Yves Rolain, Rik Pintelon, Ivan Markovsky, Philippe Dreesen and Simone Formentin.
- **S³CS, Swedish Summer School in Computer Science** Djurö, Sweden
The courses were taught by Summer 2016

- Michael Mitzenmacher (Hashing Algorithms);
- Sergei Vassilvitskii (Algorithms for Modern Parallel Systems).

- **UBC, University of British Columbia** Vancouver, Canada
Invited researcher by Prof. Vikram Krishnamurthy Summer 2015
- **UBC, University of British Columbia** Vancouver, Canada
Master thesis with Prof. Vikram Krishnamurthy Autumn 2014
- **Caltech, California Institute of Technology** Pasadena, USA
SURF in the Control and Dynamical Systems (CDS) group Summer 2014
 - Supervisors: Prof. Richard M. Murray and Asst. Prof. Yilin Mo
 - Developed an improved abstraction algorithm for the correct-by-construction controller synthesis framework TuLiP (implemented in Python).
- **KTH, Royal Institute of Technology** Stockholm, Sweden
Research intern for Prof. Bo Wahlberg Summer 2013
- **ZJU, Zhejiang University** Hangzhou, China
Participated in the Joint Research Center of Photonics Workshop Summer, 2012
 - Implemented optical logic gates exploiting non-linearities in fibers.

Industry Experience

- **Stockholm Vatten AB** Stockholm, Sweden
Summer intern Summer 2012
- **Stockholm Vatten AB** Stockholm, Sweden
Summer intern Summer 2011
 - Warehouse work including: collecting and delivering items; cleaning and repairing machines; contacting customers; administrative work in the supply system Agresso.

Teaching

- **Bachelor Thesis** KTH
Supervisor of two projects on inverse Markowitz portfolio selection Spring 2018
- **EL2800 Stochastic Control and Optimization** KTH
Teaching assistant Autumn 2017
- **Master Thesis** KTH
Supervisor of Daniel Merkoulouva Spring 2017
- **EL1000 Automatic Control** KTH
Teaching assistant Autumn 2016
- **EH1010 Project Course in Electrical Engineering** KTH
Supervisor Spring 2016
- **EL1000 Automatic Control** KTH
Teaching assistant Autumn 2015

PhD Courses

- Partially observed Markov decision processes
- Game theory
- Mathematical methods in signals, systems and control
- Bayesian networks
- Hybrid systems (stability, stabilization, abstraction and formal verification)
- Probabilistic verification and synthesis
- Matrix algebra
- Probability and random processes
- Convex optimization
- Stochastic control and optimization
- Deep learning in data science (attended lectures)