Pedro Hespanhol

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Professional Summary

Ph.D student in Industrial Engineering and Operations Research at UC Berkeley. My research is focused on the interplay between control, learning and optimization, with emphasis on autonomous systems applications. I have work experience with software development of embedded algorithms for real-time applications, including nonlinear, hybrid, and stochastic systems. I am also interested in all aspects of computational optimization, from modeling techniques to state-of-the-art practical implementations.

Current research interests: Real-Time Optimal Control; Learning & Control; Algorithmic Mechanism Design.

Education

Ph.D.: Industrial Engineering and Operations Research, 08/2015 - Current
University Of California, Berkeley - Berkeley

- **MS** in Industrial Engineering and Operation Research (08/2015-08/2016)
- 3.94/4.0 GPA
- Advisor: Professor Anil Aswani
- Minors: Statistics and Economics

Relevant research (coursework) experience in the following areas:

- Optimization Theory and Optimal Control (Math Programming I & II / Computational Optimization / Graph Algorithms and Network Flows / Predictive Control / Learning and Optimization / Applied Dynamic Programming)
- Statistical Learning and Deep Learning (Statistical Learning Theory / Deep Time-Series Learning)
- Game Theory and Mechanism Design (Microeconomics and Game Theory / Mechanism Design and Agency Theory)
- Financial Engineering and Stochastic Processes (Financial Engineering I & II /Stochastic Processes I & II)

Bachelor of Science: Industrial Engineering, 01/2010-12/2014
Pontifical Catholic University Of Rio De Janeiro - Rio de Janeiro, Brazil

- Minor in Risk Analysis and Statistics
- 9.6/ 10.0 GPA

Publications

Surrogate Optimal Control for Strategic Multi-Agent Systems
Pedro Hespanhol and Anil Aswani
Submitted to 2019 Conference on Decision and Control (CDC)

Statistical Consistency in Switching System Identification
Pedro Hespanhol and Anil Aswani
Submitted to 2019 Conference on Decision and Control (CDC)

Adjoint-based SQP Method with Block-wise quasi-Newton Jacobian Updates for Nonlinear Optimal Control
Pedro Hespanhol and Rien Quirynen
Submitted to Optimization Methods and Software Journal

Finite-Time Dynamic Watermarking for General LTI Systems with Switching
Pedro Hespanhol, Matthew Porter, Ramanarayan Vasudevan, Anil Aswani
To be submitted to IEEE Transactions on Automatic Control Journal

A Structure Exploiting Branch-and-Bound Algorithm for Mixed-Integer Model Predictive Control
Pedro Hespanhol , Rien Quirynen, Stefano Di Cairano
Accepted. To appear in the 2019 European Control Conference (ECC)

Statistical Watermarking for Networked Control Systems
Pedro Hespanhol, Matthew Porter, Ramanarayan Vasudevan, Anil Aswani
In the Proceedings of 2018 Annual American Control Conference (ACC), pp. 5467-5472. IEEE, 2018

Dynamic Watermarking for General LTI Systems
Pedro Hespanhol, Matthew Porter, Ramanarayan Vasudevan, Anil Aswani
In the Proceedings of Decision and Control (CDC), 2017 IEEE 56th Annual Conference on (pp. 1834-1839)

Quasi-Newton Jacobian and Hessian Updates for Pseudospectral based NMPC
Pedro Hespanhol and Rien Quirynen
In the Proceedings of 2018 International Federation of Automatic Control (IFAC). IFAC-PapersOnLine, 51(20), 22-27.

A Real-Time Iteration Scheme with Quasi-Newton Jacobian Updates for Nonlinear Model Predictive Control
Pedro Hespanhol and Rien Quirynen
In the Proceedings of 2018 Annual European Control Conference (ECC). IEEE, 2018

Family-Personalized Dietary Planning with Temporal Dynamics
Pedro Hespanhol and Anil Aswani
In the Proceedings of 2018 Annual American Control Conference (ACC) (pp. 2163-2169). IEEE.

Simulation and Real-World Evaluation of Attack Detection Schemes
Porter, Matthew, Arnav Joshi, Pedro Hespanhol, Anil Aswani, Matthew Johnson-Roberson, and Ram Vasudevan
Accepted. To appear in the 2019 American Control Conference (ACC)

Impact of Occupancy Modeling and Horizon Length on HVAC Controller Efficiency
Christian Rabbi Garaza, Pedro Hespanhol, Yonatan Mintz, Jhoanna Rhodette Pedrasa,and Anil Aswani
In the Proceedings of 2018 Annual European Control Conference (ECC). IEEE, 2018

Work History

Research Intern, 05/2018 to 08/2018
Mitsubishi Electric Research Laboratories (MERL) – Cambridge, MA
- Research on mixed-integer optimization algorithms. Developed efficient mixed integer software for fast online optimal control problems, focusing on implementation in embedded platforms.
- Developed algorithm in C and evaluated it's performance on realistic optimal control problems, beating state-of-art solvers/methods across several different problems.

Research Intern, 06/2017 to 09/2017
Mitsubishi Electric Research Laboratories (MERL) – Cambridge, MA
- Worked on research of efficient optimization algorithms tailored to solve non-linear optimal control problems, with emphasis on computational performance and solution tractability.
- Worked on implementation in C/C++ of such algorithms in embedded platforms, focusing on rigorously analyzing computation times and memory usage of the developed methods.

Graduate Student Instructor, 01/2017 to Current
UC Berkeley – Berkeley
- Graduate Student Instructor for IEOR 262A - Math Programming I. A graduate-level course which covers linear and nonlinear optimization theory and algorithms.
- Graduate Student Instructor for IEOR 265 - Learning and Optimization. A graduate-level course which covers optimal control and high-dimensional statistics with applications in control and machine learning.
- Graduate Student Instructor for IEOR 165 - Engineering Statistics, Quality Control, and Forecasting. A senior undergraduate-level course which covers classical statistical and modern machine learning techniques applied to several industrial applications .
- Graduate Student Instructor for IEOR 151 - Service Design and Operation Analysis. A senior undergraduate-level course which covers the analysis and modelling of service-based systems.

Analyst, 08/2014 to 08/2015
PSR - Energy Consulting and Analytics – Rio de Janeiro, Brazil

- Worked in the development team (SDDP software): Extensive use of C/C++ and high-level mathematical modelling languages and statistical tools to improve software performance, decrease run-time, and solution output.
- Programmed the optimization algorithm for HERA software: HERA is a geographical and financial analysis software to evaluate the construction of hydro power-plants. HERA team won ENGIE Brazil Innovation Prize in 2015.
- Developed mathematical models and algorithms to support decision making in: energy trading, portfolio optimization, operation planning and capacity expansion in power systems.

Analyst (Internship program), 01/2012 to 07/2013
NexO – Rio de Janeiro, Brazil

- Worked in development team: Implemented a mathematical algorithm to optimally operate oil refineries. Work done together with CENPES (Petrobras' Research Center).
- Developed of a graphical interface to show the refineries products flows.

Presentations and Invited Talks

Statistical Watermarking for Networked Control Systems
Annual American Control Conference, Milwaukee, USA, June 27-29, 2018.

Newton Jacobian Updates for Nonlinear Model Predictive Control
Annual European Control Conference, Lymassol, Cyprus, June 12-15 2018.

Family-Personalized Dietary Planning with Temporal Dynamics
Annual American Control Conference, Milwaukee, USA, June 27-29, 2018.

Dynamic Watermarking for General LTI Systems
56th IEEE Conference on Decision and Control, Melbourne, Australia, December 12-15, 2017.

Deterministic Approximation Algorithm For Population-Scale Personal Dietary Management
INFORMS Computing Society Conference, Austin, TX, 2017.
Approximation Algorithms For Population-scale Personal Dietary Management
INFORMS Annual Meeting, Nashville, TN, 2016.

Honors and Awards

ENGIE Brazil Innovation Prize - granted by ENGIE Group for the development of the HERA software.
PUC's Academic Performance Premium - granted by Pontifical Catholic University of Rio de Janeiro.
Medal Graça Couto - granted by the Military School of Rio de Janeiro.
Medal Thomaz Coelho - granted by the Military School of Rio de Janeiro.

Skills

- **Mathematical Programming:** Xpress, Gurobi,CPLEX, GAMS, AMPL
- **Programming Languages:** C/C++ , Python, R, Matlab
- **Machine Learning & Big Data:** TensorFlow, Pandas, Keras
- **Software\Algorithm Development**
- **Statistical and Risk Analysis**
- **Soft Skills:** Communicative team member. Proactive leader. Problem-solving attitude.
- **Languages:** English, Portuguese, Spanish
- Others: VBA, @Risk, Eviews, MS Office

Volunteer Work

Associação Paulo Cesar

- Worked with a group of students to recover and repair computers for children in the community of Morro do Adeus in Rio de Janeiro, Brazil.