Yoke Peng Leong

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Education

2012 - Present	**California Institute of Technology** Ph.D. in Control and Dynamical Systems *Adviser: Dr. John Doyle and Dr. Joel Burdick*	Pasadena, CA
2011 - 2012	**Northwestern University** M.S. in Mechanical Engineering (Specialization: Robotics & Control) *Thesis: Surface Feature Detection Based on Proprioception of a Robotic Finger during Haptic Exploration*	Evanston, IL
2008 - 2012	**Northwestern University** B.S. in Mechanical Engineering (Concentration: Mechatronics) Minor: Economics *Summa cum Laude*	Evanston, IL

Honors and Awards

- Caltech Computing and Mathematical Sciences (CMS) Fellowship, 2012-2013
- Tau Beta Pi Engineering Honors Society Fellow, 2012-2013
- Malaysian Public Service Department Scholarships for Undergraduate Education Abroad at USA, 2007-2012

Current Research Projects

Nonlinear Optimal Control
Adviser: Joel Burdick, John Doyle
- Synthesized control Lyapunov functions of stochastic nonlinear systems using Sum of Squares method
–> Constructed a novel general approach to compute suboptimal controller with guarantees on performance and approximation errors
- Solved high dimensional (> 6D) linear Hamilton Jacobi Bellman equation, a PDE, using tensor decomposition and alternating least squares in MATLAB
–> Increased the speed (hours to minutes) and stability of the alternating least squares algorithm

Control Engineering in Neuroscience
Adviser: Joel Burdick, John Doyle
- Designed and conducted human subject experiments to study human sensorimotor control feedback based on robust control theory
- Processed and analyzed motion capture data using Bash and MATLAB to confirm theoretical predictions
–> Discovered important trends (predicted by theoretical analysis and confirmed with experiments) that were neglected in previous studies

Research Experience

May 2014 - July 2014 **IMDEA Software Institute** Madrid Institute for Advanced Studies
Research Intern (Adviser: Dr. Pavithra Prabhakar)
- Synthesized optimal control strategy for hybrid dynamical systems using an abstraction-refinement procedure that preserves the transition cost
–> Developed a tool in Python for synthesizing the controller

July 2012 - Aug 2012 **Underwater Robotics Research Group** Universiti Sains Malaysia
Research Assistant (Adviser: Dr. Mohd Rizal Arshad)
- Modeled underwater acoustics wave propagation for jellyfish detection
- Developed a model to estimate backscattering wave strength of a jellyfish

Dec 2010 - Jun 2012 **Murphey Lab** Northwestern University
Undergraduate Researcher (Adviser: Dr. Todd Murphey)
- Created a 3D dynamic model of 3-joint finger tapping and sliding in Mathematica
- Extended the hybrid system switching time optimization to systems with mixed dynamics and impulses
–> Constructed a new smoothing algorithm to detect and localize surface feature from noisy proprioceptive measurements of a robotic finger using the impulsive hybrid system optimization technique

Publications

Journal Articles

[1] Y. P. Leong and T. D. Murphey, "Feature localization using kinematics and impulsive hybrid optimization," *IEEE Transactions on Automation Science and Engineering*, vol. 10, no. 4, pp. 957–968, 2013.

Refereed Conference Papers

[2] Y. P. Leong and J. C. Doyle, "Understanding robust control theory via stick balancing," in *IEEE Int. Conf. on Decision and Control (CDC)*, 2016.

[3] Y. P. Leong and P. Prabhakar, "Optimal control with regular objectives using an abstraction-refinement approach," in *American Controls Conf. (ACC)*, 2016.

[4] E. Stefansson and Y. P. Leong, "Sequential alternating least squares for solving high dimensional linear Hamilton-Jacobi-Bellman equation," in *IEEE Int. Conf. on Intelligent Robots and Systems (IROS)*, 2016.

[5] Y. P. Leong, M. B. Horowitz, and J. W. Burdick, "Suboptimal stabilizing controllers for linearly solvable system," in *IEEE Int. Conf. on Decision and Control (CDC)*, 2015.

[6] N. Matni, Y. P. Leong, Y.-S. Wang, S. You, M. B. Horowitz, and J. Doyle, "Resilience in large scale distributed systems," in *Conference on Systems Engineering Research*, 2014.

[7] Y. P. Leong and T. D. Murphey, "Second order switching time and magnitude optimization for impulsive hybrid systems," in *American Controls Conf. (ACC)*, 2013, pp. 6213–6218.

Posters/Abstracts

[8] Y. P. Leong, B. Christalin, J. W. Burdick, and J. C. Doyle, *The significance of measurement location in human stick balancing*, Poster presented at Neuroscience 2015.

Master's Thesis

[9] Y. P. Leong, "Surface feature detection based on proprioception of a robotic finger during haptic exploration," M. S. Thesis, Northwestern University, Jun. 2012.

Teaching Experience

Teaching Assistant

- ME 115 Introduction to Kinematic and Robotics (Spring 2015)
- CNS 186 Vision: From Computational Theory to Neuronal Mechanisms (Winter 2015)
- ACM 104 Linear Algebra (Fall 2014)

Guest Lecturer

- CDS 240 Nonlinear Dynamical Systems (April 22, 2016)
- CDS 212 Introduction to Modern Control (May 14, 2015)

Students Advised

- Elis Stefansson (KTH Institute of Technology, Caltech Summer Undergraduate Research Fellowship, 2015)

Work Experience

May 2016 - Sept 2016 **Datascope Analytics** Chicago, IL
Data Science Intern
- Developed a survey analysis website application that can automatically generate useful data relationships using Django and AngularJS
- Facilitated group discussions with the executive team of a client in a brainstorming workshop
- Created a website application that displays the train rumbling by the office using the Chicago Transit Authority's Train Tracer API
- Released a Python package that simplifies analysis of time series data at irregular time intervals
- Wrote a blog post that discusses the rise of the Internet of Things

Sept 2010 - Jun 2012 **Northwestern University Athletic Department** Evanston, IL
N'CAT Tutor
- Assisted student athletes in improving their academics performances in various freshman engineering classes (e.g. MATLAB, Linear Algebra, Physics) and Mechanical Engineering classes (e.g. Fluid Mechanics, Thermodynamics) via weekly one-to-one tutoring sessions
- Motivated student athletes to do well in both sports and academics by giving advice on time management and stress management

Feb 2009 - Jun 2012 **Northwestern University Information Technology** Evanston, IL
Technology Lab Consultant of Academic & Research Technology (A&RT)
- Aided users with A&RT-supported applications and utilities including Internet based applications, word processing, spreadsheet generation and manipulation, document format conversion, and information recovery
- Developed a student job applications website which involves database management, browser scripting, and server scripting

Jun 2011 - Sept 2011 **Murphey Lab** Evanston, IL
Undergraduate Researcher
(Experience summarized above)

Jun 2010 - Sept 2010 **Ethos & Company** Malaysia
Strategy & Management Consulting Intern
- Collaborated with colleagues on two projects:
  (a) Developed a framework to capture key synergies within the national automotive industry
  (b) Assisted a global agribusiness corporation to achieve 5-year growth and profitability target
- Conducted company/industry research and performed data analysis using Excel to discover trends and test hypotheses
- Developed and conducted presentations for both the client and project team

Leadership Experience

Jun 2014 - May 2016 **Caltech Graduate Student Council**
CDS Option Representatives
Research Communication Chair (2015-2016)
- Advocated for graduate students in CDS option (major) and international graduate students
- Organized the 2016 GSC Graduate Student Poster Session
- Organized two lunches for "Take an alumni to lunch" series
- Coordinated off campus concert trips for 20 - 30 graduate students per trip

Summer 2014, 2015 **Caltech Teaching Conference**
Committee Member
- Organized and facilitated a session that discusses teaching and mentoring (2015)
- Facilitated a session on creating an academic career portfolio (2014)

Feb 2011 - Feb 2012 **Tau Beta Pi Engineering Honors Society, IL-Gamma Chapter**
Recording Secretary
- Reformed project management and record-keeping of the group using Google products for more efficient communication and exec board transition
- Organized various community service activities
- Created a graduate school mentoring program for members interested in pursuing a graduate degree

Sept 2009 - Apr 2011 **Engineers for a Sustainable World**
Webmaster & Project Team Member
- Designed a lever mechanism which assists technicians in priming a ram pump using NX for a hydraulic ram pump installation project in Philippines
- Redesigned layout of ESW's official website (http://www.eswnu.org) to ease user navigation
- Reconstructed the website by incorporating CSS in style designing and PHP in scripting

Sept 2009 - Dec 2010 **Gateway Science Workshop**
Facilitator (Engineering Analysis)
- Facilitated weekly two-hour group study workshops for engineering freshmen enrolled in Engineering Analysis (MATLAB, Linear Algebra, Mechanics, Ordinary Differential Equations)
- Engaged students in group discussions to encourage critical thinking on engineering concepts and applications
- Monitored students' progress and made changes to the workshop accordingly

Sept 2008 - Jun 2009 **Northwestern University Solar Car Team** (NUsolar)
Electrical Team Member & Business Team Member
- Worked on a solar powered car that won 3rd place in the Formula Sun Gran Prix 2009
- Designed and built circuitry for the solar car's new electrical system
- Researched sponsorship opportunities for the solar car project

Community Service

Dec 2008 - Present **Alternative Student Breaks**
- Participated in a week-long service learning trip during school breaks
- Volunteered at children hospital, national parks, and various local non-profit organizations in the United States

Oct 2013 - Present **Caltech RISE Program**
- Assisted high school students who are weak in mathematics and sciences to learn the subjects

Language Skill

English (Fluent), Mandarin (Fluent), Cantonese (Native), Malay (Fluent), Japanese (Basic)

Computer Skill

Advanced: Mathematica, MATLAB
Intermediate: Python, Javascript, HTML, CSS
Basic: Simulink, C/C++, Bash, NX (Unigraphics), ANSYS

Last updated: October 21, 2016