

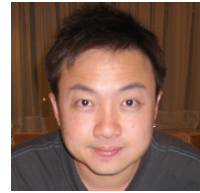
LOW, BRYAN KIAN HSIANG

CURRICULUM VITAE

Department of Computer Science
School of Computing, National University of Singapore
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RESEARCH INTERESTS

- Adaptive sampling and active learning
- Multi-agent systems (i.e., multi-agent coordination, planning, and learning)
- Statistical machine learning
- Optimization
- Game theory

EDUCATIONAL BACKGROUND

Sep 2004 - Aug 2009 Carnegie Mellon University

PH.D. IN ELECTRICAL AND COMPUTER ENGINEERING

- Thesis Title: Multi-Robot Adaptive Exploration and Mapping for Environmental Sensing Applications
- Advisors: Prof. Pradeep K. Khosla and Dr. John M. Dolan

Jul 2001 - Jul 2002 National University of Singapore

MASTER OF SCIENCE IN COMPUTER SCIENCE (ACCELERATED M.SC. BY RESEARCH)

- Advisors: Assoc. Prof. Leow, Wee Kheng and Assoc. Prof. Marcelo H. Ang, Jr.
- Award: Winner of Singapore Computer Society Prize for Best M.Sc. Thesis in School of Computing

Jul 2000 - May 2001 National University of Singapore

BACHELOR OF SCIENCE IN COMPUTER SCIENCE (HONOURS 2ND UPPER)

Jul 1997 - Jul 2000 National University of Singapore

BACHELOR OF SCIENCE IN COMPUTER SCIENCE (PASS WITH MERIT)

- Cumulative Grade-Point Average: 3.78 / 4 or 4.65 / 5

HONORS AND AWARDS

- Jun 2010 Featured in AUVSI Unmanned Systems Magazine "Ones to Watch" June 2010 issue
- 2006 Andrew P. Sage Best Transactions Paper Award for the best paper published in all 3 of the IEEE Transactions on Systems, Man, and Cybernetics - Parts A, B, and C in 2006
- Sep 2004 - Aug 2009 National University of Singapore Overseas Graduate Scholarship for Ph.D. studies in ECE, CMU
- Mar 2004 Gold Medalist in 8th National IT Awareness Project Competition (Postgraduate Category) for Overall Best Project "Task Allocation via Self-Organizing Swarm Coalitions in Distributed Mobile Sensor Network", held by National University of Singapore in conjunction with Ministry of Education
- Jul 2002 - Jul 2003 Winner of Singapore Computer Society Prize for Best M.Sc. Thesis (among 81 graduates of M.Sc. by research) in School of Computing, National University of Singapore

- Jun 2003 1st Runner-up Team in Cooperative Robotic Search Competition held by Defense Science Organization National Laboratories during Singapore Robotic Games 2003
- Jul 2001 - Jul 2002 Research Scholarship for Accelerated M.Sc. (Comp. Sci.) by Research in National University of Singapore with Top-up Supplement from National Science and Technology Board Award
- Jul 1997 - Jun 2000 Invitation to Talent Development Programme (Top 5% in National University of Singapore)
- Jul 1998 - Dec 1998 Dean's List
- Jul 1997 - Dec 1997 Dean's List
- Jul 1997 - Jun 1998 National University of Singapore Undergraduate Scholarship awarded by Microcomputer Trade Association of Singapore

RESEARCH EXPERIENCE AND GRANTS

Oct 2011 - Sep 2012 Singapore-MIT Alliance for Research & Technology (SMART)
 PRINCIPAL INVESTIGATOR, **Spatiotemporal Modeling and Prediction of Traffic Patterns** Project
SMART Subaward Agreement No. 14 – Future Urban Mobility (FM) IRG, SGD \$66,000
 Collaborator: Prof. Patrick Jaillet (MIT)

Jul 2011 - Present The Robotics Institute, Carnegie Mellon University (CMU)
 Robotic Embedded Systems Laboratory, University of Southern California (USC)
 Autonomous Systems Group, Monterey Bay Aquarium Research Institute (MBARI)
 COLLABORATOR, **Collaborative Multi-robot Exploration of the Coastal Ocean (COMECO)** Project
U.S. National Science Foundation (NSF): Cyber-Enabled Discovery and Innovation (CDI) Program
 Investigators: Dr. John M. Dolan (CMU), Prof. Gaurav S. Sukhatme (USC), and Dr. Kanna Rajan (MBARI)

Aug 2010 - Sep 2011 Singapore-MIT Alliance for Research & Technology (SMART)
 PRINCIPAL INVESTIGATOR, **Autonomy in Mobility-On-Demand Systems** Project
SMART Subaward Agreement No. 03 – Future Urban Mobility (FM) IRG, SGD \$139,200
 Collaborators: Prof. Emilio Frazzoli (MIT) and Prof. Daniela Rus (MIT)

Apr 2010 - Mar 2013 Department of Computer Science, National University of Singapore
 PRINCIPAL INVESTIGATOR, **Active Robotic Exploration and Mapping for Environmental Sensing Applications** Project
Ministry of Education (MOE) Academic Research Fund (AcRF) Tier 1, SGD \$165,377

Sep 2006 - Sep 2009 The Robotics Institute, Carnegie Mellon University
 GRADUATE STUDENT, **Telesupervised Adaptive Ocean Sensor Fleet (TAOSF)** Project
NASA Science Mission Directorate: Advanced Information Systems Technology (AIST) Program

- Devise multi-robot adaptive sampling algorithms for monitoring of ocean phenomena (e.g., algal bloom)
- Perform map inference of ocean and freshwater sensing data collected by robotic sensor boats

Jul 2005 - Sep 2006 The Robotics Institute, Carnegie Mellon University
 GRADUATE STUDENT, **Wide Area Prospecting Using Supervised Autonomous Robots** Project
NASA Exploration Systems Mission Directorate: Research and Technology Development Program - Human and Robotic Technology Formulation Plan Control No. 4120

- Develop adaptive sampling techniques for multi-robot wide-area mineral prospecting

Jul 2002 - Jul 2003 Institute of Engineering Science, National University of Singapore
RESEARCH ENGINEER, **Trainable Computer Vision Systems for Surveillance and Mobile Robot Control**
National University of Singapore Research Project No. 960684

- Develop multi-robot task allocation mechanisms based on swarm intelligence principles
- Improve performance and convergence of an ensemble of self-organizing neural networks with second-order learning method
- Enhance the action selection capabilities of robots in single- and multi-robot tasks by cooperation and competition of self-organizing neural networks

May 2001 - Jul 2001 Department of Computer Science, National University of Singapore
RESEARCH ASSISTANT, **Trainable Computer Vision Systems for Surveillance and Mobile Robot Control**
National University of Singapore Research Project No. 960684

- Evaluate quantitatively the performance of self-organizing neural networks in learning robot motion control

TEACHING EXPERIENCE

Fall 2010-11 Department of Computer Science, National University of Singapore
LECTURER, **CS4246 AI Planning and Decision Making** module

Fall 2009-11 Department of Computer Science, National University of Singapore
LECTURER, **CS1231 Discrete Structures** module

Spring 2011 Department of Computer Science, National University of Singapore
LECTURER, **CS3243 Introduction to Artificial Intelligence** module

Fall 2007 Department of Electrical and Computer Engineering, Carnegie Mellon University
TEACHING ASSISTANT, **18-100 Introduction to Electrical and Computer Engineering** course

- Conduct recitations and lab sessions

Fall, Spring 2003-4 Department of Computer Science, National University of Singapore
TEACHING ASSISTANT, **CS1101C Programming Methodology in C** module

- Assume dual roles of course tutor and lab coordinator (conduct practical exam, set weekly lab assignments)

PUBLICATIONS

REFEREED JOURNAL ARTICLES

1. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2006). **Autonomic Mobile Sensor Network with Self-Coordinated Task Allocation and Execution**. In *IEEE Transactions on Systems, Man, and Cybernetics - Part C: Applications and Reviews* (Special Issue on Engineering Autonomic Systems), volume 36, issue 3, pp. 315-327 [Andrew P. Sage Best Transactions Paper Award for the best paper published in all 3 of the IEEE Transactions on Systems, Man, and Cybernetics - Parts A, B, and C in 2006].
2. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2005). **An Ensemble of Cooperative Extended Kohonen Maps for Complex Robot Motion Tasks**. In *Neural Computation*, volume 17, issue 6, pp. 1411-1445.

REFEREED CONFERENCE AND WORKSHOP PROCEEDINGS

1. Kian Hsiang Low, Jie Chen, John M. Dolan, Steve Chien, and David R. Thompson (2012). **Decentralized Active Robotic Exploration and Mapping for Probabilistic Field Classification in Environmental Sensing**. To appear in *11th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS-12)* [20.4% Acceptance Rate]. Also appeared in *IROS'11 Workshop on Robotics for Environmental Monitoring (WREM-11)*.

2. Prabhu Natarajan, Trong Nghia Hoang, Kian Hsiang Low, and Mohan Kankanhalli (2012). **Decision-Theoretic Approach to Maximizing Observation of Multiple Targets in Multi-Camera Surveillance**. To appear in *11th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS-12)* [20.4% Acceptance Rate].
3. Trong Nghia Hoang and Kian Hsiang Low (2012). **Intention-Aware Planning under Uncertainty for Interacting with Self-Interested, Boundedly Rational Agents**. To appear in *11th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS-12)* [Extended abstract].
4. Zhuang Jie Chong, Baoxing Qin, Tirthankar Bandyopadhyay, Tichakorn Wongpiromsarn, Edward Samuel Rankin, Marcelo H. Ang, Jr., Emilio Frazzoli, Daniela Rus, David Hsu, and Kian Hsiang Low (2011). **Autonomous Personal Vehicle for the First- and Last-Mile Transportation Services**. In *Proceedings of the 5th IEEE International Conference on Cybernetics and Intelligent Systems and 5th IEEE International Conference on Robotics, Automation and Mechatronics (CIS-RAM'11)*, pp. 253-260. Also appeared in *IROS'11 Workshop on Perception and Navigation for Autonomous Vehicles in Human Environment*.
5. Kian Hsiang Low, John M. Dolan, and Pradeep K. Khosla (2011). **Active Markov Information-Theoretic Path Planning for Robotic Environmental Sensing**. In *Proceedings of the 10th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS-11)*, pp. 753-760 [22.1% Acceptance Rate].
6. Gregg Podnar, John M. Dolan, Kian Hsiang Low, and Alberto Elfes (2010). **Telesupervised Remote Surface Water Quality Sensing**. In *Proceedings of the IEEE Aerospace Conference*.
7. Kian Hsiang Low, John M. Dolan, and Pradeep K. Khosla (2009). **Information-Theoretic Approach to Efficient Adaptive Path Planning for Mobile Robotic Environmental Sensing**. In *Proceedings of the 19th International Conference on Automated Planning and Scheduling (ICAPS-09)*, pp. 233-240 [33.9% Acceptance Rate]. Also appeared in *IPSN-09 Workshop on Sensor Networks for Earth and Space Science Applications (ESSA-09)*. Also presented orally in *RSS-09 Workshop on Aquatic Robots and Ocean Sampling*.
8. Kian Hsiang Low, Gregg Podnar, Stephen Stancliff, John M. Dolan, and Alberto Elfes (2009). **Robot Boats as a Mobile Aquatic Sensor Network**. In *Proceedings of the IPSN-09 Workshop on Sensor Networks for Earth and Space Science Applications (ESSA-09)*.
9. John M. Dolan, Gregg W. Podnar, Stephen Stancliff, Kian Hsiang Low, Alberto Elfes, John Higinbotham, Jeffrey C. Hosler, Tiffany A. Moisan, and John Moisan (2009). **Cooperative Aquatic Sensing Using the Telesupervised Adaptive Ocean Sensor Fleet**. In *Proceedings of the SPIE Conference on Remote Sensing of the Ocean, Sea Ice, and Large Water Regions*, volume 7473.
10. Kian Hsiang Low, John M. Dolan, and Pradeep K. Khosla. (2008). **Adaptive Multi-Robot Wide-Area Exploration And Mapping**. In *Proceedings of the 7th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS-08)*, pp. 23-30 [22.2% Acceptance Rate]. Also presented as a poster in *RSS-09 Workshop on Aquatic Robots and Ocean Sampling*.
11. Kian Hsiang Low, Geoffrey J. Gordon, John M. Dolan, and Pradeep K. Khosla. (2007). **Adaptive Sampling for Multi-Robot Wide-Area Exploration**. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA'07)*, pp. 755-760.
12. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2004). **Task Allocation via Self-Organizing Swarm Coalitions in Distributed Mobile Sensor Network**. In *Proceedings of the 19th National Conference on Artificial Intelligence (AAAI-04)*, pp. 28-33 [26.7% Acceptance Rate].
13. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2004). **Reactive, Distributed Layered Architecture for Resource-Bounded Multi-Robot Cooperation: Application to Mobile Sensor Network Coverage**. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA'04)*, pp. 3747-3752.

14. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2004). **Continuous-Spaced Action Selection for Single- and Multi-Robot Tasks Using Cooperative Extended Kohonen Maps**. In *Proceedings of the IEEE International Conference on Networking, Sensing and Control (ICNSC'04)* (Invited Paper to Special Session on Visual Surveillance), pp. 198-203.
15. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2003). **Action Selection for Single- and Multi-Robot Tasks Using Cooperative Extended Kohonen Maps**. In *Proceedings of the 18th International Joint Conference on Artificial Intelligence (IJCAI-03)*, pp. 1505-1506 [27.6% Acceptance Rate].
16. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2003). **Action Selection in Continuous State and Action Spaces by Cooperation and Competition of Extended Kohonen Maps**. In *Proceedings of the 2nd International Joint Conference on Autonomous Agents and MultiAgent Systems (AAMAS-03)*, pp. 1056-1057.
17. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2003). **Enhancing the Reactive Capabilities of Integrated Planning and Control with Cooperative Extended Kohonen Maps**. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA'03)*, pp. 3428-3433.
18. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2002). **A Hybrid Mobile Robot Architecture with Integrated Planning and Control**. In *Proceedings of the 1st International Joint Conference on Autonomous Agents and MultiAgent Systems (AAMAS-02)*, pp. 219-226 [26% Acceptance Rate].
19. Kian Hsiang Low, Wee Kheng Leow, and Marcelo H. Ang, Jr. (2002). **Integrated Planning and Control of Mobile Robot with Self-Organizing Neural Network**. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA'02)*, pp. 3870-3875 [33% Acceptance Rate in Neural Networks Track].

TECHNICAL REPORTS AND THESES

1. Kian Hsiang Low (2009). **Multi-Robot Adaptive Exploration and Mapping for Environmental Sensing Applications**. *Ph.D. Thesis, Technical Report CMU-ECE-2009-024*, Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA.
2. Kian Hsiang Low, Geoffrey J. Gordon, John M. Dolan, and Pradeep K. Khosla (2005). **Adaptive Sampling for Multi-Robot Wide Area Prospecting**. In *Technical Report CMU-RI-TR-05-51*, Robotics Institute, Carnegie Mellon University, Pittsburgh, PA.
3. Kian Hsiang Low (2002). **Integrated Robot Planning and Control with Extended Kohonen Maps**. *M.Sc. Thesis*, Department of Computer Science, National University of Singapore [Singapore Computer Society Prize for best M.Sc. Thesis 2002-2003].
4. Kian Hsiang Low (2001). **Mobile Robots That Learn to Navigate**. *Honors Thesis*, Department of Computer Science, National University of Singapore.

PROFESSIONAL SERVICE

- Associate editor for *2011 IEEE International Conference on Robotics and Automation (ICRA'11)*, 2011
- Program committee member for
 1. *11th International Conference on Autonomous Agents and Multiagent Systems (AAMAS-12)*, 2012
 2. *22nd International Conference on Automated Planning and Scheduling (ICAPS-12)*, 2012
 3. *22nd International Joint Conference on Artificial Intelligence (IJCAI-11)*, 2011
 4. *21st International Conference on Automated Planning and Scheduling (ICAPS-11)*, 2011
 5. *10th International Conference on Autonomous Agents and Multiagent Systems (AAMAS-11)*, 2011
 6. *24th AAAI Conference on Artificial Intelligence (AAAI-10), Main Technical Track*, 2010
 7. *20th International Conference on Automated Planning and Scheduling (ICAPS-10)*, 2010
 8. *11th International Conference on Intelligent Autonomous Systems (IAS-11)*, 2010
- Journal reviewer for
 1. *IEEE Transactions on Robotics (T-RO)*, 2004, 2011
 2. *International Journal of Sensor Networks (IJSNet)*, Special Issue on Interdisciplinary Design of Algorithms and Protocols in Wireless Sensor Networks, 2007, 2011
 3. *International Journal of Vehicle Autonomous Systems (IJVAS)*, Special Issue on Modelling and Simulation of Complex Mechatronic Systems, 2007
 4. *Control and Intelligent Systems*, 2006
- Conference reviewer for
 1. *2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'11)*, 2011
 2. *9th International Conference on Control, Automation, Robotics and Vision (ICARCV'06)*, 2006
 3. *IEEE International Conference on Networking, Sensing and Control (ICNSC'06)*, 2006
- Co-chair for *Defense, Science & Research Conference (DSR'11) Workshop on Multi-UAV Coordination and Path Planning*, 2011
- Ph.D. thesis committee member for
 1. Yin, Hongli (NUS CS) Thesis Title: A model driven approach to imbalanced data learning, 2011
 2. Wang, Xiangyu (NUS CS) Thesis Title: Multimedia decision fusion, 2011
 3. Ehsan Rehman (NUS CS) Thesis Title: Bounded uncertainty roadmaps, 2011
 4. Achudhan Sivakumar (NUS CS) Thesis Title: UAV swarm coordination and control under realistic weather and network conditions for establishing a wireless communications backbone, 2011
 5. Lau, Qiangfeng Peter (NUS CS) Thesis Title: Effective reinforcement learning for collaborative multi-agent domains
 6. Ye, Nan (NUS CS) Thesis Title: Theory and Applications of Conditional Exponential Families

INVITED TALKS

- “Machine learning seminars”. University of Information Technology (UIT), Vietnam National University (VNU), Ho Chi Minh City, Jun 29 - Jul 2, 2011

STUDENTS ADVISED

1. Zhang, Haojie (1st year PhD)
2. Wang, Hancheng (1st year PhD)
3. Ouyang, Ruofei (2nd year PhD)
4. Xu, Nuo (2nd year PhD)
5. Hoang, Trong Nghia (2nd year PhD, NUS President's Graduate Fellowship)
6. Yu, Jiangbo (3rd year PhD)
7. Chen, Jie Arik (4th year PhD, co-advised with Colin Tan)
8. Prabhu Natarajan (4th year PhD, co-advised with Mohan Kankanhalli)

9. Cao, Nannan (3rd year MSc)
10. Shailendra Khemka (UROP, von Neumann Program for BComp (CS), NUS University Scholars Programme)
11. Shubham Goyal (UROP, Turing Programme for BComp (CS))
12. Dai, Yuan (UROP, BEng (CE))
13. Nguyen, Quoc Phong (UROP, BEng (CE))

REFEREES

PROF. PRADEEP K. KHOSLA

Dean, College of Engineering

Philip and Marsha Dowd Professor, Department of Electrical and Computer Engineering and the Robotics Institute

Carnegie Mellon University

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Email: pkk@ece.cmu.edu

Web: <http://www.ece.cmu.edu/directory/details/79>

DR. JOHN M. DOLAN

Principal Systems Scientist, The Robotics Institute

Carnegie Mellon University

Phone: +1-412-268-7988

Email: jmd@cs.cmu.edu

Web: <http://www.cs.cmu.edu/~jmd>

DR. ALBERTO ELFES

Principal Member of Technical Staff, Jet Propulsion Laboratory

California Institute of Technology, NASA

Phone: +1-818-393-6487

Email: Alberto.Elfes@jpl.nasa.gov

Web: http://www-robotics.jpl.nasa.gov/people/Alberto_Elfes/