

Balajee Kannan

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OBJECTIVE

Distinguish myself as a researcher within the areas of distributed mobile robotics, autonomous learning, human-robot interaction, fault-tolerance, and intelligent systems utilizing abilities to:

- Collaborate and work on research projects in areas of expertise;
- Actively seek funding through proposal writing and presentation;
- Employ analytical skills to develop innovative solutions;
- Provide support as a technical team lead; and
- Continue the ongoing pursuit of knowledge.

EDUCATION

- Ph.D., Computer Science, Spring 2007; GPA: 4.0
“LeaF: A Learning-based Fault Diagnostic System for Multi-Robot Teams”
Advisor: Dr. Lynne Parker
Distributed Intelligence Lab
University of Tennessee, Knoxville, TN
- M.S., Computer Science, Fall 2003; GPA: 3.78
Advisor: Dr. Lynne Parker
Distributed Intelligence Lab
University of Tennessee, Knoxville, TN
- B.E., Computer Engineering, Fall 2000; GPA: 3.7
Advisor: Professor Mathiavanan
University of Madras, India

DISSERTATION

“LeaF – A distributed Learning based Fault-diagnostic framework for multi-robot teams”
The objective of my dissertation, in part, is to provide an adaptive approach that enables the robot team to autonomously detect and compensate for the wide variety of faults that could be experienced. The key feature of the developed approach is its ability to learn useful information from encountered faults, unique or otherwise, towards a more robust system. In addition, the research attempts to identify the influence of fault-tolerance towards achieving overall system goals of efficiency and robustness. Towards that purpose, application-independent metrics to measure the system performance and fault-tolerance are developed.

PROFESSIONAL EXPERIENCE

- **Carnegie Mellon University**, Pittsburgh, PA
- *Research Engineer*, **Robotics Institute**
[April 2007]
Responsibilities include exploring original research ideas, developing engineering mechanical and robotic systems and components in addition to designing and developing original software applications and requirement specifications for integration with experimental mobile robotic platforms. Additional responsibilities include guiding undergraduate interns in identifying and subsequently implementing related research projects.

- **University of Tennessee**, Knoxville, TN

- *Research Assistant*, **Distributed Intelligence Lab**, May 02 to April 07

Worked on “Heterogeneous Swarm Robotics for Search Applications” – A DARPA funded project. Developed behavior based autonomous robot control code using C++. Solely responsible for designing and developing software fault tolerance for a team of 100 robots including ATRV-Minis, Pioneers and AmigoBots using laser-based localization and vision-based navigational assistance. Responsible for designing and developing software for the communication and vision-based coordination of multirobot teams using ad-hoc mobile networks.

- *Teaching Assistant*, **Department of Computer Science**, Jan 05 to present

Responsible for design, development and maintenance of internal recruitment database (front end PHP; backend MySQL). In 2005, prepared and graded assignments, exams and conducted office hours for “CS380 - Theory of Computation”, an advanced undergraduate course that covers basics of theoretical computer science and computational models including Finite Automata, PDA, Turing machines, Decidability, Rice’s Theorem etc. In 2004, was responsible for preparing and grading labs, assignments and exams, in addition to conducting office hours, for “CS102 - Introduction to programming in C”, an undergraduate course.

- *Instructor*, **Department of Computer Science**, Sep 04 to Dec 04

Course: “CS300 - Scripts and Utilities”, an undergraduate level course to teach many of the practical tools available under Unix like Perl, Awk, Python, PHP, L^AT_EX, CVS etc. Gave lectures, prepared and graded labs, and conducted office hours. In addition, designed and updated existing course curriculum.

- *UNIX/LINUX Systems Admin*, **Office of Information Technology**, May 01 to Aug 02

Responsible for maintaining numerous Linux and Solaris servers. Other responsibilities included trouble-shooting Linux and Solaris desktop systems, installing and maintaining oracle database servers, maintaining CGI, PHP and HTML based web-pages for internal and external systems.

- *Research Assistant*, **Software Quality Research Lab**, May 01 to Aug 01

Worked on building statistical tools for automated testing, specifically on “TMLE The Modeling Language Editor”.

- *Research Assistant*, **Innovative Computing Lab**, Aug 00 to May 01

Was part of the IBP project and handled the design and implementation of UDP-File blasters for faster data-transfer. Had the opportunity to work on “Ex-node” for IBP and LOCI.

- **Evolution Robotics**

- *Intern*, May 05 to Aug 05

Worked with Dr. Mario Munich and Dr. Jim Ostrowski towards developing a Kalman filter system for sensor-fusion and noise elimination from a proprietary infrared based positioning device for fast and stable indoor localization. Other responsibilities included performing quality analysis for Evolution robotics SDK, ERSP (ver 2.0). Specifically, was expected to evaluate the performance of the vision-based mapping and localization software.

- **University of Madras, India**

- *Research Assistant*, Dec 99 to June 00

Worked on an *AICTE: All India Council for Technical Education* funded project, “Non-invasive diagnostic system using neural nets, fuzzy logic and genetic algorithms for medical prognosis”. Developed system for automating traditional medical approach for more efficient diagnosis using neural networks and genetic algorithms. Also responsible for system administration and overall coordination of the project.

BOOK CHAPTERS

- L. Parker, and B. Kannan, “Using Causal Models for Fault-Diagnosis in Multi-robot Teams — A Feasibility Study” (*To be published in Search and Rescue Robotics*).

JOURNAL PUBLICATIONS

- B. Kannan, and L. Parker, “Developing Fault-Tolerance Based Metrics for Multi-Robot Teams” (*in preparation*).
- B. Kannan, and L. Parker, “Measuring the quantity and quality of system performance for intelligent multi-robot teams” (*in preparation*).

REFEREED CONFERENCE PROCEEDINGS

- B. Kannan and M. Bernardine Dias, “Evaluation Methodology for Peer-to-Peer Human-Robot Teams” *in preparation*, 2008.
- M. Bernardine Dias, B. Kannan, Brett Browning, E. Gil Jones, Brenna Argall, M. Freddie Dias, Marc Zinck, Manuela M. Veloso, and Anthony J. Stentz, “Sliding Autonomy for Peer-To-Peer Human-Robot Teams” *International Conference on Intelligent Autonomous Systems (IAS)*, 2008.
- B. Kannan, and L. Parker, “Metrics for quantifying system performance in intelligent, fault-tolerant multi-robot teams” *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (One of the top 2 conferences in the robotics field with an acceptance rate of 43%)*, 2007.
- L. Parker, and B. Kannan, “Adaptive Causal Models for Fault Diagnosis and Recovery in Multi-Robot Teams,” *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (One of the top 2 conferences in the robotics field with an acceptance rate of 43%)*, 2006.
- L. Parker, B. Kannan, F. Tang and M. Bailey, “Tightly-Coupled Navigation Assistance in Heterogeneous Multi-Robot Teams,” *in the Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (One of the top 2 conferences in the robotics field.)*, 2004.
- L. Parker, B. Kannan, X. Fu and Y. Tang, “Heterogeneous Mobile Sensor Net Deployment Using Robot Herding and Line-of-Sight Formations,” *in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (One of the top 2 conferences in the robotics field)*, 2003.

REFEREED WORKSHOP PAPER

- B. Kannan, and L. Parker, “Fault-Tolerance Based Metrics for Evaluating System Performance in Multi-Robot Teams,” *in Proceedings of Performance Metrics for Intelligent Systems Workshop (PerMIS)*, 2006.

INVITED TALKS

- “Developing a Generic Fault-Tolerance Architecture for Multi-Robot Teams,” Center for Intelligent Systems, Vanderbilt University, October 27, 2006, Nashville, TN

PRESENTATIONS

- “Sliding Autonomy for Peer-To-Peer Human-Robot Teams” *to be presented in International Conference on Intelligent Autonomous Systems (IAS)*, July 2008, Baden Baden, Germany.
- “Fault-Tolerance Based Metrics for Evaluating System Performance in Multi-Robot Teams,” *Performance Metrics for Intelligent Systems Workshop (PerMIS)*, 2006, Gaithersburg, MD.
- “Heterogeneous Mobile Sensor Net Deployment Using Robot Herding and Line-of-Sight Formations,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2003, Las Vegas, NV.
- “Robot Control”, guest speaker for “CS 594, Artificial Intelligence,” 2004, Knoxville, TN Instructor: Professor Lynne E. Parker.
- “Good practice methods to prepare for a successful career in research,” Sathyabama Engineering College, 2001, Chennai, India.
- “Studying abroad - Opportunities and difficulties,” Farragut High School, 2000, Farragut, TN.

DEMO AND VIDEOS

- “Dynamic Human-Robot Teams Engaged in Complex Adversarial Tasks Using Language- Based Communication”, Demonstration performed by a team comprising of rCommerce Lab, CORAL and LTI group of Carnegie Mellon University, 2007, Robotics Institute, CMU, Pittsburgh.
- “DARPA/SDR Project Demonstration – large numbers (100+) of physical heterogeneous robots cooperating to solve indoor search applications,” Demonstration performed by a team comprising of Distributed Intelligence Lab (University of Tennessee), SAIC and Robotics Lab of USC, 2004, Mclean, VA.
- L. Parker, B. Kannan, X. Fu and Y. Tang, “Heterogeneous Mobile Sensor Net Deployment Using Robot Herding and Line-of-Sight Formations,” *in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2003, Las Vegas, NV.

STUDENTS

- Victor Marmol - Freshman in the Robotics Institute, Carnegie Mellon University. Intel IFYRE fellowship grant awardee for Spring 2008, SURG summer fellowship awardee for Summer 2008.

SPECIAL SKILLS

- **Spoken Languages:** English, Hindi, Tamil and Sanskrit.
- **Programming:** C, C++, Matlab, Java, Java Swing, Open-GL, Pascal, FORTRAN, Visual Basic.
- **Database:** Oracle, Excel, SQL, my-SQL.
- **Scripts:** Perl, PHP, Bash, Csh.

- **OS:** Windows 95, 98, NT, Win2K, XP, Sun-Solaris (7.0, 8.0, 9.0), Linux (Red-Hat, Mandrake, SUSE, Debian, Gentoo), Arm Linux for IPAQ, VMWARE for Linux, OS X Tiger, and OS X Leopard.
- **Web Design:** HTML, DHTML, CGI (with Perl) and CGIC.
- **Protocols:** DNS and BIND.
- **Robotic Platforms:** Player-Stage, Evolution Robotics Software Package (ERSP), Nomad200 Robot Simulator, Mobility software.
- **Robot Hardware:** ATRV-Minis, Pioneers (2dx and 3dx), LAGRs, E-Gators, Amigo Bots and Nomads.
- **Sensors:** SICK LMS 200, SONARS, KVH E-Core 100/300 gyros, Xsens 6-axis IMU, CMU cams, Crossbow IMUs
- Expert knowledge of the professional typesetting package \LaTeX .
- Strong writing, grammar, and linguistic skills.
- Strong graphic-design skills useful in presentations, publications, and schematics.

HONORS

- Chancellor's citation for Outstanding Professional Promise (2007, University of Tennessee)
- The National Scholars Honor Society.
- UPSILON PI EPSILON (UPE) – Computer Science Honor Society.
- SIGMA XI – Scientific Research Society.
- Member of ACM.
- Member of the Robotics chapter of IEEE.
- Secretary for CSI (Computer Society for India), 1999.
- Served the Army wing of National Cadet Corps of India (91 Battalion) honorably for a period of 2 years.
- Member of the College Cricket team, winner of the Sathyabama Cricket Trophy, awarded to “Best Team” among professional colleges in the state of Tamil Nadu, in 97, 98 and 00.

RELEVANT
COURSE WORK:

- Artificial Intelligence, Software for Distributed Robotics, Distributed Intelligence in Autonomous Robotics, AI Analysis, Advanced Topics in AI, Foundations of Computer Theory and Algorithms, Markov Chains, Software Engineering.

REVIEWER FOR
PUBLICATIONS:

- IEEE Transactions on Systems, Man, and Cybernetics, 2006 - till date.
- ACM Reviewer for Computing Reviews, 2006.
- Journal of Robotics and Autonomous Systems, 2005.
- IEEE International Conference on Robotics and Automation (ICRA), 2006-2007.
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2005-2006.
- IEEE Network Magazine, 2006.
- IEEE Network Special Issue on Wireless Sensor Networking, 2006.

**Academic
Outreach
Services**

- Judge, East Tennessee FIRST (For Inspiration and Recognition of Science and Technology) LEGO League Robotics State Tournament, 2006.
- Visits of Robertsville Middle School students to the University of Tennessee, 2005, Knoxville, TN.
- University of Tennessee Pre-Game Faculty Showcase Lecture, 2004, Knoxville, TN.

Other Activities

- Member USTA – United States Tennis Association, 2006 to present.
- Member SCCA – Southern California Cricket Association, 2005.
- Member ADC – Apple Developer Connection, 2004 to present.
- Treasurer, Manthan – The Indian Students Organization at University of Tennessee, Knoxville, 2002.
- Founder and member of Manthan’s cricket team that has successfully partaken in several inter-collegiate tournaments, 2000 to present.