

Mithun George Jacob

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Education

Doctor of Philosophy, Industrial Engineering, July 2014

CGPA: 3.88/4.0

School of Industrial Engineering, Purdue University, West Lafayette, IN

Advisor: Prof. Juan P. Wachs

Thesis: “*Optimal Modality Selection for Multimodal Human-Machine Systems using RIMAG*”

Relevant Courses: Theoretical Foundations of Optimization, Nonlinear Programming, Pattern Recognition

Master of Science in Engineering, Robotics, August 2009

GRASP Lab, School of Computer & Information Science, University of Pennsylvania, Philadelphia, PA

Advisor: Prof. Jianbo Shi

Thesis: “*Segmentation and Recognition in Driving Videos*”

Relevant Courses: Computer Vision, Advanced Robotics, Machine Learning, Convex Optimization, Algorithms

Bachelor of Technology, Mechanical Engineering, May 2007

School of Mechanical and Building Sciences, VIT University, India

Advisor: Prof. V.G. Sridhar

Thesis: “*Automated vision inspection system for a water bottling industry*”

Work Experience

Bosch Research and Technology Center, Palo Alto, CA

Lead Scientist

Jan 2018 — present

Senior Research Scientist

Aug 2016 — Dec 2017

Research Scientist 2

Jan 2016 — Jul 2016

Research Scientist

Jul 2014 — Dec 2015

- Precision localization and mapping for urban autonomous driving.

Technicolor Corporate Research, *Research Engineer Intern*, Princeton, NJ Aug 2009 — Aug 2010

- Developed multiple approaches for smart video compression by exploiting geometric redundancies.
- Implemented SSE2-optimized multithreaded applications for smart compression of HD videos

Thomson (Technicolor) Corporate Research, *Summer Intern*, Princeton, NJ Summer 2008

- Worked on improving low-bit rate mobile video content by tracking and enhancing objects of interest
- Designed and implemented a performance metric for algorithms within an existing architecture in C++
- Designed and implemented the architecture for optimal parameter selection on a cluster in Python
- Investigated single-frame and a priori knowledge-based grass detection algorithms
- Developed a field-line detection algorithm for soccer videos in MATLAB
- Investigated global motion estimation in soccer videos
- Accomplished and surpassed object detection and tracking efficiency goals

University of Pennsylvania, *Programmer*, Philadelphia, PA Fall 2007 — Spring 2009

- Designed a framework for creating a GUI for an existing S-PLUS project in biostatistics.
- Developed a GUI with Visual C++ 2005 with the R Project for Statistical Computing as the back-end

- Expanded the GUI past initial goals with utilities such as report generators, workspaces with a progress bar to dynamically interact with the back-end using anonymous pipes.
- MATLAB Consultant at the Institute for the Study of Citizens & Politics, Annenberg Public Policy Center

Rawdatain Water Bottling Co., *Project Trainee*, Kuwait

November 2006 — March 2007

- Developed and implemented a real-time automated vision-based bottle-cap quality inspection system using Visual C++ 6.0 and MFC with a highly user-friendly GUI for use by industry technicians.
- Designed an automated cup-packing machine using an Allen-Bradley PLC. Modeled required components in SolidWorks for manufacturing.
- Modeled several new water bottle product prototypes in SolidWorks.
- Created a maintenance database in MS Access for tracking, reporting, and notifying maintenance tasks.

EC Solutions, *Programmer*, Vellore, India

May 2007

- Developed several image-processing tools from scratch in MFC such as histograms, blob analysis, etc. to be used for educational training in machine vision for EC Solutions, a graduated incubatee of the Technology Business Incubator at the Vellore Institute of Technology, Vellore, India.

Technical Skills

Languages: C++, MATLAB, Python

Development environments: Linux, Windows

Misc: ROS, OpenCV, Eigen, PCL

Academic Research

ISAT (Intelligent Systems and Assistive Technologies) Lab, Purdue University

- Developed a novel methodology and algorithm to generate Pareto-optimal alternatives for cooperative, multimodal human-robot task completion.
- Developed a sterile, touchless, gesture-based MRI navigation system utilizing contextual cues in the operating room. A novel gesture training algorithm was developed for the interface.
- Developed a multimodal robotic scrub nurse capable of handling surgical instruments and safe human-robot collaboration.
- Conducted automated evaluation of buckling observed in selective catheterization across the aortic bifurcation in endografts using the FANUC LR Mate 200iC robot.

GRASP (General Robotics, Automation, Sensing and Perception) Lab, University of Pennsylvania

- Designed an accurate RANSAC-based pose estimation algorithm for calibrated stereo videos of a car driving in an urban environment under the assumption of dominant pixel flow by ego-motion.
- Investigated algorithms for segmentation and recognition of driving videos learned visual cues in noisy 3D reconstructions of street scenes from calibrated stereo videos.

VIT University, India

- Developed an automated computer-vision based water bottle quality control system.

Selected Awards

- 2016 Innovation Award — Bosch Research and Technology Center, July 2016, Palo Alto
- 2014 Outstanding Graduate Student Research Award — College of Engineering, April 2014, Purdue University
- Best Poster Award — Industrial Engineering Research Symposium, April 2013, Purdue University
- Best Poster Award — Industrial Engineering Research Symposium, April 2012, Purdue University
- Student Travel Award — IE Graduate Student Organization, September 2011, Purdue University.
- Best Student Paper Finalist and awarded Student Travel Grant — 2011 IEEE International Conference on Systems, Man, and Cybernetics (SMC), September 2011, Anchorage, Alaska.
- Second place in GETC (C++ Programming) in Phreak, a National Level Programming Contest in 2005, India
- First place in Panacea (C++ Debugging & Programming) at, ISTE Confluence 2004, India

Publications

- Lorenz Wellhausen, **Mithun George Jacob**, “[Map-optimized Probabilistic Traffic Rules](#)” in the 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), October 9-14, Daejeon, Korea.
- **Mithun George Jacob**, Juan P. Wachs, “[Optimal Modality Selection for Cooperative Human-Robot Task Completion](#)” in the IEEE Transactions on Cybernetics, vol. 46, no. 12, pp. 3388-3400, Dec. 2016 (published online in Dec. 2015).
- **Mithun George Jacob**, Juan P. Wachs, “[Optimal Modality Selection for Multimodal Human-Machine Systems using RIMAG](#)” in the Proceedings of the 2014 IEEE International Conference on Systems, Man, and Cybernetics, October 5-8, 2014, San Diego, CA.
- **Mithun George Jacob**, Juan P. Wachs, “[Context-based hand gesture recognition for the operating room](#)” in Pattern Recognition Letters (PRL), June 2013.
- **Mithun George Jacob**, Yu-Ting Li, Juan P. Wachs, “[Surgical Instrument Handling and Retrieval in the Operating Room with a Multimodal Robotic Assistant](#)” in the Proceedings of the 2013 IEEE International Conference on Robotics and Automation (ICRA), May 6-10 2013, Karlsruhe, Germany.
- **Mithun George Jacob**, Yu-Ting Li, Juan P. Wachs, A. George Akingba, “[Collaboration with a Robotic Scrub Nurse](#)” in Commun. ACM 56(5): 68-75 (2013).
- **Mithun George Jacob**, Juan P. Wachs, Rebecca A. Packer, “[Hand Gesture-based Sterile Interface for the Operating Room Using Contextual Cues for the Navigation of Radiological Images](#)”, in the Journal of the American Medical Informatics Association (JAMIA), December 2012.
- Yu-Ting Li, **Mithun George Jacob**, Juan P. Wachs, “[A Cyber-Physical Management System for Delivering and Monitoring Surgical Instruments in the OR](#)” in Surgical Innovation, October 2012.
- **Mithun George Jacob**, Christopher Cange, Juan Wachs, Rebecca Packer, “[Intention, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room](#)” in Proceedings of the 16th Iberoamerican Congress conference on Progress in Pattern Recognition (CIARP), Image Analysis, Computer Vision, and Applications, Buenos Aires, Argentina, pp. 220—227.
- **Mithun George Jacob**, Yu-Ting Li, Juan P. Wachs, “[Gestonurse: a multimodal robotic scrub nurse](#)” in Proceedings of the Seventh Annual ACM/IEEE International Conference on Human-Robot Interaction (HRI), Boston, MA, 2012, pp. 153 —154.

- Juan P. Wachs, **Mithun George Jacob**, Yu-Ting Li, A. George Akingba, “Does a robotic scrub nurse improve economy of movements?” in Medical Imaging 2012: Image-Guided Procedures, Robotic Interventions, and Modeling. Proceedings of the SPIE, Volume 8316, pp. 83160E-83160E-7 (2012).
- **Mithun George Jacob**, Yu-Ting Li, Juan P. Wachs, “Gestonurse: a robotic surgical nurse for handling surgical instruments in the operating room” in Journal of Robotic Surgery (27 Nov 2011), pgs. 1-11.
- **Mithun George Jacob**, Yu-Ting Li, Juan P. Wachs, “A Gesture Driven Robotic Scrub Nurse” In Proceedings of the 2011 IEEE International Conference on Systems, Man, and Cybernetics (SMC), pp. 2039-2044.
- V.G. Sridhar, **Mithun George Jacob**, “Automated vision inspection system for a water bottling industry” in Proceedings of the 9th International Symposium on Measurement and Quality Control (ISMQC) 2007, India.
- **Mithun George Jacob**, V.G. Sridhar, “Multiple Object Recognition on the Assembly Line” in Proceedings of the 22nd International Conference on CAD/CAM, Robotics & Factories of the Future (CARS&FOF) July 2006, India, pg. 1066.

Patents

- **Mithun George Jacob**, Sitaram Bhagavathy, “Motion compensating transformation for video coding”, Patent PCT/US2012/020888 pending, January 2012.
- Dong-Qing Zhang, Sitaram Bhagavathy, **Mithun George Jacob**, “Methods and Apparatus for Encoding Video Signals using Motion compensated Example-based Super-resolution for Video Compression”, Patent PCT/US2011/050913 pending, September 2011.
- Dong-Qing Zhang, Sitaram Bhagavathy, **Mithun George Jacob**, “Methods and Apparatus for Decoding Video Signals using Motion compensated Example-based Super-resolution for Video Compression”, Patent PCT/US2011/050915 pending, September 2011.
- Jesus Barcons-Palau, Sitaram Bhagavathy, Joan Llach, **Mithun George Jacob**, “Segmenting grass regions and playfield in sports videos”, Patent PCT/US2010/000004 pending, April 2010.
- **Mithun George Jacob**, Sitaram Bhagavathy, Jesus Barcons-Palau, Joan Llach, “Detection of field lines in sport videos”, Patent PCT/US2010/000032 pending, July 2010.

Teaching Assistantships

- **IE 335: Operations Research - Optimization**
Deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs.
- **IE 336: Operations Research - Stochastic Models**
Probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queuing systems.
- **IE 474: Industrial Controls Systems**
Automatic controls with reference to automation of industrial machines and processes, including linear dynamic systems, feedback control, and elements of systems analysis.
- **IE 332: Computing in Industrial Engineering**
Reinforcement of scientific programming skills on typical IE tasks, together with introduction to simulation and related computer tools.

Other Activities

- Reviewer for the IEEE International Conference on Robotics and Automation (ICRA), IEEE International Conference on Intelligent Robots and Systems (IROS), Intelligent Vehicles (IV) Symposium, Intelligent Transportation Systems Conference (ITSC), and International Conference on Systems, Man & Cybernetics (SMC).
- Reviewer for the IEEE Transactions on Systems, Man & Cybernetics: Systems, Journal of Real-Time Image Processing, Expert Systems with Applications, Machine Visions and Applications.
- Treasurer of INFORMS (Institute for Operations Research and the Management Sciences) and Omega Rho Purdue University Chapter (2013—2014)
- Member, Technical Committee on Human-Computer Interaction, IEEE Systems, Man & Cybernetics Society (2011 — 2013)
- Head of Design and Multimedia Committee of Saadhana, a National Level Technical Symposium at VIT University, India (September 2005)
- Vice-Head Boy of the Student Council, Jabriya Indian School, Kuwait (2002—2003)

Selected Press

- [“Surgeons could use his hand-gesture system to control robots”](#) — IEEE Spectrum
- [“Gesture recognition system could reduce surgical delays”](#) — TheEngineer.co.uk
- [“Robots and people can all get along”](#) —NPR Marketplace
- [“Robotic Nurse in Development at Purdue”](#)—Fox News
- [“Future surgeons may use robotic nurse, ‘gesture recognition’ ”](#) —Forbes.com