Julian Straub

Citizenship: Germany	Birth Date: March 20, 1988 in Augsburg, Bavaria, Germany

CONTACT
INFORMATION

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EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY   2012 – present
Ph.D. Candidate, Computer Science and Artificial Intelligence Laboratory (CSAIL)
Advisors: Senior Research Scientist John W. Fisher III and Professor John J. Leonard
Research Focus: Perception for Robotics, Bayesian nonparametrics, Computer Vision
Cumulative GPA: 4.8/5.0

GEORGIA INSTITUTE OF TECHNOLOGY   2010 – 2011
Master of Science (M.Sc.), Electrical and Computer Engineering,
Research Project with Professor Frank Dellaert
Double Degree Program with the Technische Universität München
Cumulative GPA: 4.0/4.0

TECHNISCHE UNIVERSITÄT MÜNCHEN   2007 – 2012
Dipl. Ing. with High Distinction, Electrical Engineering and Information Technology
Major in Signals and Systems as well as Controls
Cumulative GPA: 1.26 (on a scale from 1 to 5, with 1 being the highest score)
Average Rank: 3/155 students

RESEARCH
INTERESTS

FAST AND FLEXIBLE PERCEPTION FOR AUTONOMOUS SYSTEMS

The ability of autonomous agents to mimic human perception and scene understanding beyond the task of mere localization and mapping lacks far behind to a degree that it is hindering the progress of the field of robotics. In addressing these challenges, I am investigating models that effectively capture the structure of complex, potentially dynamic as well as evolving environments. In seeking representations that lend themselves to efficient inference, I investigate the utility of manifold-aware probabilistic generative models. Modeling parameters in their natural manifold leads to efficient minimal representations which are indispensable to achieve scalability of the model.

My current focus is on Bayesian nonparametric (BNP) models that are able to adapt to a steadily increasing amount of observed data – a desirable property for continuously sensing mobile agents. I am working on hierarchical as well as time- and spatially-dependent BNP models which lend themselves to expressive world representation models. Recognizing the time constraints of mobile agents, I develop efficient inference algorithms for such nonparametric representations. To deal with the vast amount of multi-modal streaming data often encountered on mobile agents, I investigate efficient exact MCMC-based as well as real-time approximate inference algorithms.

RESEARCH
EXPERIENCE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY   2012 – present
Ph.D. Candidate
Advisors: Senior Research Scientist John W. Fisher III and Professor John J. Leonard
Current research focus is on 3D environment models for fast and flexible perception for autonomous systems. Specifically, I am working on real-time low-variance-asymptotic Bayesian nonparametric (BNP) directional clustering algorithms for streaming data as well as highly-scalable inference algorithms. Major contributions include a novel manifold-aware probabilistic model describing man-made environments and BNP models for directional data.

TECHNISCHE UNIVERSITÄT MÜNCHEN MEDIA TECHNOLOGY GROUP   02/12 – 08/12
Diploma Thesis "Visual Localization based on Binary Features"
Advisors: S. Hilsenbeck, Dipl. Ing. and G. Schroth, M.Sc.
Investigated deployment of binary features, which can be compute very efficiently, for global and purely visual pose recovery as well as relocalization within a visual odometry system. We show that relocalization using binary features is accurate, fast and robust even in sparsely textured and repetitive indoor environments. Furthermore utilizing Locality Sensitive Hashing we demonstrated state of the art large scale visual localization accuracies.

TECHNISCHE UNIVERSITÄT MÜNCHEN REAL-TIME COMPUTER SYSTEMS GROUP   03/09 – 08/10
Undergraduate Research Assistant
Supervisors: Martin Schäfer, Dipl. Ing.
Developed the hard- and software for a multi-robot soccer lab. On the hardware side, this involved designing an Bluetooth-adapter board as well as distance sensor adapter-boards for a third party robot platform, the Pololu 3Pi robot. On the software side, I wrote the microcontroller C code as well as the infrastructure C++ code on a central computer to allow remote-control over six robots at the same time via Bluetooth.

Bachelor Thesis
"Pedestrian Indoor Localization and Tracking using a Particle Filter combined with a learning Accessibility Map"
Supervisor: Martin Schäfer, Dipl. Ing.
Developed a particle-filter-based indoor localization algorithm that uses the number of foot-steps and the heading of a person combined with a rough floor-plan. Additionally, investigated ways of learning the accessibility of areas in the map from using movement patterns of people traversing the environment.

Publications

Refereed Conference Publications

- **J. Straub**, T. Campbell, J. P. How and J. W. Fisher III. "Small-Variance Nonparametric Clustering on the Hypersphere". IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2015. **(oral presentation)**
- T. Campbell, **J. Straub**, J. W. Fisher III, and J. P. How. "Streaming, Massively Parallel Variational Inference for Bayesian Nonparametrics". Conference on Neural Information Processing, 2015.
- R. Cabezas, **J. Straub**, J. W. Fisher III. "Semantically-Aware Aerial Reconstruction from Multi-Modal Data". International Conference on Computer Vision (ICCV), 2015.
- **J. Straub**, N. Bhandari, J. J. Leonard, J. W. Fisher III. "Real-time Manhattan World Rotation Estimation in 3D". IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2015.
- **J. Straub**, G. Rosman, O. Freifeld, J. J. Leonard and J. W. Fisher III. "A Mixture of Manhattan Frames: Beyond the Manhattan World". IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014. **(oral presentation, 5.76% acceptance rate)**
- **J. Straub**, S. Zheng and J. W. Fisher III. "Bayesian Nonparametric Modeling of Driver Behavior". IEEE Intelligent Vehicles Symposium, 2014.
- **J. Straub**, S. Hilsenbeck, G. Schroth, R. Huitl, A. Möller and E. Steinbach. "Fast Relocalization for Visual Odometry using Binary Features". 20th IEEE International Conference on Image Processing (ICIP), 2013.
- R. Roberts, D. Ta, **J. Straub**, K. Ok and F. Dellaert. "Saliency detection and model-based tracking: a two part vision system for small robot navigation in forested environment". SPIE Defense, Security, and Sensing, 2012.
- M. Schäfer, **J. Straub** and S. Chakraborty. "Pedestrian Indoor Navigation Using a Wireless Pocket-IMU and User-augmented Maps". MobiHeld, 2010.

In The Media

- Research featured on the MIT front page in April 2014. "Orienteering for Robots".
  Online: `http://newsoffice.mit.edu/2014/orienteering-for-robots-0404`
- Oral Presentation at CVPR about "A Mixture of Manhattan Frames: Beyond the Manhattan World" in June 2014.
  Online: `http://techtalks.tv/talks/a-mixture-of-manhattan-frames-beyond-the-manhattan-world/60355/`

Honors

- 2013 Runner-up best presentation at the Autonomous Vehicle Symposium
- 2010 Fulbright Scholarship
- 2010 ATLAS Double Degree Program of the European Union
- 2010 Max Weber-Program of Bavaria
- 2010 Heinrich and Lotte Mühlfenzl Foundation
- 2010 MAN SE Scholarship
- 2008 Talent Support Program of the Technische Universität München

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Service

Professional Service

- Chair for a Computer Vision session at the International Conference on Intelligent Robots and Systems (IROS)
- Reviewer for the Conference on Computer Vision and Pattern Recognition (CVPR)
- Reviewer for the Conference on Neural Information Processing Systems (NIPS)
- Reviewer for the Artificial Intelligence and Statistics Conference (AISTATS)
- Reviewer for the International Conference on Machine Learning (ICML)
- Teaching Assistant for "Introduction to Inference" with Professors Polina Golland and Gregory W. Wornell at MIT

Leadership in Student Organizations

- 2014 President of the MIT EECS Graduate Student Association
- 2013 Vice President for Social Events and Orientation of the MIT EECS Graduate Student Association
- 2012 Mentor for International Exchange Students at Technische Universität München
- 2010 Officer in the World Student Fund Exchange Club at the Georgia Institute of Technology
- 2009 Softskill-tutor for freshman within the so called AdvEIsor program at the Technische Universität München

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Other Relevant Experience	**Apple**	05/15 – 08/15

Apple   05/15 – 08/15
Intern
Software development.

Evolution Robotics   05/11 – 09/11
Robotics Intern
Supervisors: Mario E. Munich (Chief Technology Officer).
Software development in the field of Computer Vision: Created a camera calibration tool with GUI to give intuitive feedback about calibration quality; Coded a working monocular visual SLAM system.

AdvEIsor-Program of the Technische Universität München   10/07 – 07/08
Team Leader
Led a team of ten students to victory in a robot line-following competition against four other student teams. Lead the development of the robot as well as the strategy for the competition.

KUKA Robotics Corp. – development department   10/07 – 12/08
Robotics Intern
Supervisor: Christian Tarragona (Head of Robot Control Development).
Developed and implemented several circuit-boards for energy and motor control as well as the communication infrastructure for prototypes of the commercially-available robot platform KUKA youBot.

KUKA Robotics Corp. – development department   08/07 – 09/07
Robotics Intern
Supervisor: Christian Tarragona (Head of Robot Control Development).
Implemented a pose controller for an omni-directional robot platform on an Atmel microprocessor using sensor feedback from optical mouse sensors.

Additional Skills

Programming: C/C++ (10 years), MATLAB (5 years), Python (2 years), CUDA (2 years), Bash (5 years), LaTeX (5 years)

Robotics: Microcontroller programming (6 years), electrical circuit and layout design as well as component selection and dimensioning (5 years), mechanical design, soldering (5 years). Platforms: Turtlebot V2, KUKA YouBot, five different self-built robots.

Leadership: Professional leadership training (4 weeks total, full-day practical training), team leader for several robotics as well as student competitions, leadership roles in several student organizations.

References

John W. Fisher III   **Phone:** (617) 253-0788
Senior Research Scientist   **Email:** fisher@csail.mit.edu
Director of the Sensing, Learning and Inference Group
Computer Science and Artificial Intelligence Laboratory (CSAIL)
Massachusetts Institute of Technology

John J. Leonard   **Phone:** (617) 253-5305
Professor of Mechanical and Ocean Engineering   **Email:** jleonard@mit.edu
Director of the Marine Robotics Group
Computer Science and Artificial Intelligence Laboratory (CSAIL)
Massachusetts Institute of Technology

Frank Dellaert   **Phone:** (404) 385-2923
Professor of Computer Science   **Email:** frank@cc.gatech.edu
Institute for Robotics and Intelligent Machines (RIM)
Georgia Institute of Technology

Eckehard Steinbach   **Phone:** +49 (89) 289-23500
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Chair for Media Technology
Technische Universität München

Mario E. Munich   **Email:** mario@evolution.com
Chief Technology Officer
Evolution Robotics

Christian Tarragona   **Email:** Christian.Tarragona@kuka.com
Head of Robot Control Development
KUKA Robotics Corporation