Alex Burka

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Core Competencies

Robot design

- Designed and built portable visuo-haptic sensing platform (sensing hardware, visual state estimation, and data acquisition)
- Instrumented airplane engine repair tool and collected data during operation

Software development

- Wrote data acquisition, processing and machine learning pipeline using Rust, C and MATLAB
- Analyzed force/torque, accelerometer, and visual data in various projects
- Built several web applications (desktop and mobile): a hardware controller, a document management system and an online silent auction
- Contributed to open-source projects including the Rust compiler

Education

University of Pennsylvania, Philadelphia, PA
Ph.D. in Electrical & Systems Engineering — *August 2018*
M.S. in Robotics — *May 2015*
IMPRS-IS Associated Scholar
Research: Robotics/Haptics Advisor: Katherine J. Kuchenbecker

Swarthmore College, Swarthmore, PA
B.S. in Engineering — *May 2012*
Concentration in Electrical and Computer Engineering
Minors in Cognitive Science and Mathematics

Experience

Ph.D. Research, University of Pennsylvania, Philadelphia, PA — *2012 - present*

- Visuo-haptic surface classification
  - Designed, built and tested a multimodal sensor device to build a texture dataset with applications to textural surface understanding for autonomous robots
  - Applied various machine learning techniques from the literature to our dataset, using Caffe and PyTorch
- Robotic technology for airplane engine repair
  - Designed and implemented a sensor package to characterize human-operated equipment
  - Collaborated with a major engine manufacturer looking to mechanize their process
- Developed a collision warning system for public transit buses
  - Designed and built a parametric speaker
  - Implemented a prototype pedestrian detector for automatic warnings
- Member of Team THOR for the 2013 DARPA Robotics Challenge
  - Managed software and networking during dress rehearsal
  - Constructed test equipment to approximate competition tasks
- Computer vision and structure learning
  - Developed mathematical representation for complex articulated objects
  - Implemented a visual kinematic learning system for autonomous robots

Robotics Research Intern, Swarthmore College, Swarthmore, PA — *2011*

- Developed visual navigation algorithm for a general purpose mobile robot (Turtlebot)
- Worked with ROS (the Robot Operating System) and OpenCV

Peer Tutoring "Wizard," Swarthmore College, Swarthmore, PA — *2009 - 2012*

- Led study sessions and assisted with laboratory instruction in engineering courses
- Courses: Mobile Robotics, Linear Physical System Design, and Electrical Circuit Analysis

Laser Laboratory Intern, Swarthmore College, Swarthmore, PA — *2009*

- Developed automated waveguide testing apparatus using LabVIEW
- Simulated coupled waveguide arrays using C
- Sponsored through an HHMI Research Fellowship

Sysadmin, Swarthmore College Computing Society, Swarthmore, PA *2008 - 2012*

- Spearheaded web application for equipment reservation
- Developed RFID card entry system
- Administered Linux servers and macOS clients

Summer Intern, MIT Lincoln Laboratory, Lexington, MA *2008*

- Developed web application for publication tracking
- Planned and implemented a robotics workshop for high school students

Leadership Activities

Village Education Project *2009 - 2012*

- Student-run nonprofit working against educational inequality in rural Ecuador
- Developed and taught computer curriculum in Ecuador (summer 2009)
- Assisted with supervising volunteers in Ecuador (summer 2011)

IEEE Swarthmore Student Chapter (elected chapter president) *2010 - 2011*

Awards and Honors

NSF Graduate Research Fellowship *awarded 2013*

Tau Beta Pi, The Engineering Honor Society *initiated 2011*

Sigma Xi, The Scientific Research Society *inducted 2009*

Skills

Engineering Skills:	Robotics, Circuit design, Embedded processor development
Programming:	Rust, C/C++ (CMake, Boost), Python, Java, HTML/JS, LaTeX
Computer Software:	Linux/macOS/Windows, Android, MATLAB, PCB Artist
Languages:	English (native), Spanish (conversational)

Publications

Alex Burka and Katherine J. Kuchenbecker (2018). *Can humans infer haptic surface properties from images?* Haptics Symposium; San Francisco, CA.

Alex Burka and Katherine J. Kuchenbecker (2017). *Handling scan-time parameters in haptic surface classification.* IEEE World Haptics Conference (WHC); Fürstenfeldbruck, Germany. (Candidate for Best Poster Paper.)

Alex Burka, Abhinav Rajvanshi, Sarah Allen and Katherine J. Kuchenbecker (2017). *Proton 2: Increasing the sensitivity and portability of a visuo-haptic surface interaction recorder.* International Conference on Robotics and Automation (ICRA); Singapore.

Alex Burka and Katherine J. Kuchenbecker (2017). *How much haptic surface data is enough?* Association for the Advancement of Artificial Intelligence (AAAI) Spring Symposium; San Francisco, CA.

Alex Burka, Siyao Hu, Stuart Helgeson, Shweta Krishnan, Yang Gao, Lisa Anne Hendricks, Trevor Darrell and Katherine J. Kuchenbecker (2016). *Proton: A visuo-haptic data acquisition system for robotic learning of surface properties.* Multisensor Fusion and Integration (MFI); Baden-Baden, Germany.

Alex Burka, Siyao Hu, Stuart Helgeson, Shweta Krishnan, Yang Gao, Lisa Anne Hendricks, Trevor Darrell and Katherine J. Kuchenbecker (2016). *Design and implementation of a visuo-haptic data acquisition system for robotic learning of surface properties.* Haptics Symposium; Philadelphia, PA.

Alex Burka, Siyao Hu, Shweta Krishnan, Lisa Anne Hendricks, Yang Gao, Trevor Darrell and Katherine J. Kuchenbecker (2015). *Toward a large-scale visuo-haptic dataset for robotic learning.* Computer Vision and Pattern Recognition (CVPR); Boston, MA.

Alex Burka, Alaric Qin and Daniel D. Lee (2014). *An application of parametric speaker technology to bus-pedestrian collision warning.* Intelligent Transportation Systems Conference (ITSC); Qingdao, China.

Alex Burka, Keliang He, Jacqueline Kay and Matt Zucker (2011). *Vision-based localization for mobile robots.* Poster presentation at Sigma Xi; Swarthmore, PA.

Alex Burka, Lucas Janes, Bo Sun, and Lynne Molter (2009). *Non-linear transmittance properties of dielectric slab waveguides.* Poster presentation at Sigma Xi; Swarthmore, PA.

Alex Burka, Lucas Janes, Bo Sun, and Lynne Molter (2009). *Numerical simulation of loosely coupled circular waveguide arrays.* Poster presentation at Sigma Xi; Swarthmore, PA.