Kirk R. Busche

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EDUCATION:

Master of Science in Electrical and Computer Engineering   **August 2016 - December 2019**
University of Illinois Urbana-Champaign   College of Engineering
GPA: 3.94
Thesis: *Frequency-Modulated Continuous-Wave Radar Processing Fundamentals*
Adviser: Professor Minh Do
Relevant Coursework: Pattern Recognition, Digital Signal Processing II, Vector Space Signal Processing, Topics in Image Processing, Random Processes, Optimization for Computer Vision, Digital Imaging

Bachelor of Electrical Engineering   **September 2012 - May 2016**
Minors: Product Design, Math
University of Minnesota-Twin Cities   College of Science and Engineering
Honors: Summa Cum Laude with High Distinction

SKILLS:

Python with TensorFlow and Keras experience, OpenCV, MATLAB, ROS, Microsoft Office Suite, LaTeX, Linux/Ubuntu, git, svn

RESEARCH EXPERIENCE:

Frequency-Modulated Continuous-Wave Radar *(UIUC)*   November 2017 - December 2019

- Worked with Professor Minh Do to develop fusion algorithms to generate high resolution depth maps from radar, video, and egomotion data for autonomous vehicle applications

- Investigated Frequency-Modulated Continuous-Wave (FMCW) radar chirp parameters using Texas Instruments mmWave platform for raw ADC data collection

Small Target Detection and Background Estimation *(UIUC)*   October 2018 - December 2019

- Worked with Professor Minh Do and collaborators at Sandia National Laboratories to investigate unsupervised background estimation methods for video sequences with small, low-resolution targets (e.g. satellite video)

Video Segmentation *(UIUC)*   January 2017 - September 2017

- Worked with Professor Minh Do to develop online, unsupervised video object segmentation algorithm for the DAVIS dataset using clustering of dense optical flow (partnership with Sandia National Laboratories)

VLSI Design and Evaluation of a Massive MIMO Detection Algorithm *(UMN)*   September 2015 - May 2016

- Worked with Professor Gerald Sobelman on surveying and evaluating proposed massive MIMO detection algorithms and implementing one in Verilog for VLSI (project for Honors Thesis)

PRIOR WORK EXPERIENCE

Graduate Student Intern *(Sandia National Laboratories)*   September 2018 - December 2019

- Member of the Sensor Specific Processing team working on the transient detection pipeline

- Developed transient event data simulator with ground truth for multiple profiles

- Developed preliminary precision-recall testing with synthesized data for cloud-based detection pipeline

- Investigated unsupervised background estimation for small moving targets

Graduate Student in Critical Systems Department *(Southwest Research Institute)*   May 2017 - August 2018

Summer 2017

- Trained and tested convolutional neural networks for methane leak detection and segmentation to be implemented on an NVIDIA Tegra embedded platform
- Implemented a parallelized data simulator from MATLAB code in Python to generate datasets
- Trained several shallow, efficient networks for preliminary investigation for an internal research project

Summer 2018

- Investigated the use of computer vision features with convolutional neural networks for gas leak flow rate quantification
- Developed algorithms for predicting anomalous events in high dimensional, multi-sensor time series data

Research Assistant *(UIUC)*   August 2017 - December 2019

- Developed online algorithm for unsupervised video object segmentation based on clustering of dense optical flow

- Investigated real-time trackers based on discriminative correlation filters

- Developed radar-video fusion algorithms to generate high resolution depth maps using electronically scanning radar (ESR) sensors found on modern cars paired with video

Introduction to Electronics Lab Teaching Assistant *(UIUC)*   August 2016 - December 2017

- Led basic electronics lab sessions weekly and graded lab reports weekly

Introduction to Circuits and Electronics Lecture Assistant *(UMN)*   January 2016 - May 2016

- Held weekly office hours to help students learn the basics of circuits and electronics and graded exams

Introduction to Digital System Design Lecture Assistant *(UMN)*   September 2015 - December 2015

- Held weekly office hours to assist students with learning the basics of digital system design and graded homeworks and exams

Commercial Electrical Engineering Intern *(The Toro Company)*   May 2015 - August 2015

- Investigated warranty claims on field-return control boards to determine possible failure modes and the statistics of the failure rates

- Designed prototype wireless test platforms, including a GPS and Bluetooth-based asset tracker and a wireless joystick control platform

- Investigated the internal components and safety ratings for high-current, three-phase AC motor controllers for comparison against the various vendor ratings, to provide a final recommendation for use in the fully electric mid-duty Toro Workman

Taylor Center Tutor *(UMN)*   September 2013 - December 2014

- Tutored freshmen in Physics I & II, Calculus I, II, & III, and Linear Algebra at Frontier Residence Hall

AWARDS

- Qualcomm Innovation Fellowship 2018 Finalist

ACTIVITIES AND LEADERSHIP EXPERIENCES:

IEEE - Eta Kappa Nu *(UMN)*

President, Omicron Chapter — May 2015 - May 2016

- Organized tutoring schedule for members and worked with the Electrical and Computer Engineering Department to provide funding for members meeting enough tutoring hours per semester
- Extended invitations to new members and organized induction ceremony and dinner

Member, Omicron Chapter — December 2015 - May 2016

- Tutored lower level electrical engineering courses weekly as a part of the IEEE Honors society

Tau Beta Pi *(UMN)*

Member, Minnesota Alpha Chapter — April 2013 - May 2016

- Developed team chartering skills through Engineering Futures sessions and developed other engineering skills as a member of the oldest engineering honors society in the nation

Marching Band *(UMN)*

Leader, University of Minnesota Marching Band — May 2014 - December 2015

- Taught marching fundamentals and expectations to the 2014 and 2015 rookie classes and led weekly small group sectionals

Member, University of Minnesota Marching Band — August 2012 - December 2015

- Rehearsed for 500+ hours each fall semester to build strong discipline, personal motivation, teamwork, self-awareness, and musicianship to foster a strong sense of Gopher Pride at the University of Minnesota

Pep Band *(UMN)*

Member, University of Minnesota Gold Pep Band — September 2013 - May 2016

- Performed at men's basketball games and other sporting events, including several NCAA championship games (women's hockey and women's volleyball) and the Big Ten men's basketball tournament

Member, University of Minnesota Gopher Pep Band — September 2012 - May 2013

- Performed at women's hockey, women's basketball, and women's volleyball sporting events, including the women's hockey NCAA and WCHA championships

Colleges Against Cancer *(UMN)*

Director of Event Development — May 2014 - May 2016

- Organized the 2015 and 2016 Relay for Life fundraisers at the University of Minnesota, with each having over 1,000 participants attending

Chair of Event Logistics — October 2013 - May 2014

- Worked with the Director of Event Development to organize and coordinate the 2014 Relay for Life event at the University of Minnesota