

# Gavin Strunk

Lead Research Scientist

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## EDUCATION

**M.S. APPLIED MATHEMATICS** | JOHNS HOPKINS UNIVERSITY  
Expected Graduation: 2029 | GPA 4.0/4.0

**DEEP REINFORCEMENT LEARNING NANODEGREE** | UDACITY  
Completed: November 2018

**DEEP LEARNING NANODEGREE** | UDACITY  
Completed: December 2017

**PH.D MECHANICAL ENGINEERING** | UNIVERSITY OF KANSAS  
Graduated: August 2014 | GPA 3.8/4.0

**Dissertation Title:** "Ultracapacitor Development and Implementation Management System"

**M.S. MECHANICAL ENGINEERING** | UNIVERSITY OF KANSAS  
Graduated: December 2011 | GPA 3.79/4.0

**Thesis Title:** "Parallelized Distributed Embedded Control System implemented on 2D robotic walking machine"

**B.S. MECHANICAL ENGINEERING** | UNIVERSITY OF KANSAS  
Graduated: December 2010 | GPA 3.3/4.0

## EXPERIENCE

**LEAD RESEARCH ENGINEER** | SCIENTIFIC SYSTEMS CO INC. (SSCI)  
June 2019 – Current | Woburn, MA

- **Proposal Writing:** Lead for grant proposals winning >\$4M
- **Principal Investigator:** PI for 3 programs for DARPA, Office of Naval Research, and Navy, leading technical teams from 2-5 researchers.
- **Optimal Transport Multi-sensor Multi-spectral Image Fusion:** Developed Optimal Transport-based image fusion algorithm that explicitly optimizes image metrics across spectral bands to fuse multi-sensor and multi-spectral images. Developed offline parameter optimizer that tunes the image fusion to improve downstream algorithm (e.g. object detector) performance without retraining.
- **Model-Based Reinforcement Learning Cognitive Autonomy:** Developed Multi-agent Model-based RL method for using a team of less maneuverable homogeneous agents to track an intelligent adversary operating a more maneuverable vehicle.
- **Uncertainty Quantification in Deep Neural Networks:** Developed post-hoc approach for quantifying aleatoric, epistemic and prediction uncertainties for pretrained regression networks.
- **USV Tight Formation Control w/ Force Feedback:** Developed nonlinear maritime vessel control strategy to enable underactuated ships to navigate up to sea state 5 in a train by utilizing compression forces between vessels. Won **Engineering Excellence Award**.
- **Density Swarm Control:** Collaborated on CubeSat constellation controller to maintain satellite distribution density while changing orbits.
- **Autonomy Decision Explanation Engine:** Collaborated on an explainable autonomy engine that learns a black box autonomy system decision making process and explains the actions in human readable text using MDP-based model.

## SKILLS

### PROGRAMMING

Python • MATLAB/Simulink • C++ • L<sup>A</sup>T<sub>E</sub>X

### LIBRARIES/Frameworks

ROS/ROS2 • OMPL • IPOPT  
• Pytorch • TorchRL • JAX • CASADI • OpenCV • PCL

### TOOLS/Platforms

Git • Jenkins • Atlassian • Docker • Linux

## RESEARCH INTERESTS

- Reinforcement Learning
- Model Predictive Control
- Optimal Mass Transport
- Intersection of Math/AI

## ADVISORY BOARD MEMBER | ROBOPATH LLC

January 2017 – present | Leewood, KS

- Co-founder and Technical Advisor
- Selected for NSF SBIR Phase I funding
- Granted patent: System and Methods for Archiving and Retrieving Specimens US 2015/0217936A1

## SENIOR ROBOTICS RESEARCH SCIENTIST | SCHLUMBERGER

January 2017 – June 2019 | Boston, MA

- **Autonomous Underwater Vehicle Autonomy:** Developed a novel autonomy system that achieved extremely high reliability by decoupling fault tolerance from business logic intelligence. Operated four open water field tests completing over a month of test days with zero failures.
- **Abstract USV Formation Control:** Simplified operators control of 30 USVs using centralized abstract control law to maneuver based on a time varying elliptical grouping and distribution.
- **Tight Tolerance Peg-In-Hole(PIH) Manipulation:** Designed task level optimizer for 0.001" - 0.008" accuracy PIH sequencing that improved performance time on a UR5/UR10 by 58% utilizing ROS and MOVEIT.
- **Negative Feature Extraction in Point Clouds:** Designed an algorithm to extract open (negative) feature templates in point cloud data to determine location of holes in 3D objects for placing pegs.

## EMBEDDED CONTROLS ENGINEER | SCHLUMBERGER

February 2014 – January 2017 | Houston, TX

- **PMSM Control for Drilling Tool:** Implemented PID permanent magnet synchronous motor controller that supported resolver feedback and sensorless field oriented control
- **Continuous Integration System:** Designed and maintained CIS using Jenkins, GIT, and automated deployment scripts

## RESEARCH ASSISTANT - MATHEMATICS AND COMPUTER SCIENCE | ARGONNE NATIONAL LAB

Summer 2013 | Lemont, IL

- Developed a reconfigurable hardware system that interfaces with the cloud aimed at remote sensing for big data and computationally intensive applications
- Built around TI Sitara ARM A8 processor incorporated IR camera, RGB camera, a large variety of discrete sensors, and network support over Ethernet, WIFI, or GSM connections
- Proposed a hardware to cloud architecture that supports goal oriented and self-aware hardware systems
- OpenSource software and project documentation in Hardware tab <http://press3.mcs.anl.gov/forest/>

## INDUSTRY AND COMMUNITY ENGAGEMENT

**Active Security Clearance (Secret)**

**NSF Proposal Reviewer (Foundational Research in Robotics)**

**Letters to a Pre-Scientist (LPS) Pen Pal:** LPS connects students to STEM professionals through snail mail to broaden students' awareness of STEM professionals look like and do at work and inspire all students to explore a future in STEM.

## PUBLICATIONS AND TALKS

1. G. Strunk **Novel Autonomous System-tactics leveraging Hypergames (NASH)**, Sea, Air, and Space, NavySTP Poster Presentation, 2024.
2. G. Strunk, **"Uncertainty Quantification's Role in Metacognition"**, Workshop on Metacognitive Prediction of AI Behavior, ASU Skysong, Invited talk, 2023.
3. G. Strunk, **"Greedy Clustering-Based Algorithm for Improving Multi-point Robotic Manipulation Sequencing"**, arXiv:2205.02662 [cs.RO], May 2022.
4. A. Jarrot, A. Gelman, G. Choi, A. Speck, G. Strunk et al., **"High-speed underwater acoustic communication for multi-agent supervised autonomy,"** 2021 Fifth Underwater Communications and Networking Conference (UComms), 2021
5. A. Speck, A. Croux, A. Jarrot, G. Strunk et al., **"Supervised Autonomy for Advanced Perception and Hydrocarbon Leak Detection,"** Global Oceans 2020
6. Vincent, Jack, Vannuffelen, Stephane, Ossia, Sepand, Speck, Andrew, Strunk, Gavin, et al. **"Supervised Multi-Agent Autonomy for Cost-Effective Subsea Operations."** Offshore Technology Conference, Houston, Texas, USA, May 2020