Joe Dinius, PhD

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Summary Statement

I am an experienced robotics engineer seeking technical leadership opportunities in autonomous systems development. I am a fast learner, a motivating force, and have led technical efforts in sensing and estimation, path planning, localization, and computer vision. On the technical side, I enjoy solving hard problems with creativity; employing solutions that others might not consider. On the leadership side, I focus on regular interpersonal communication, making expectations plainly known, and on identifying and providing any support necessary for optimizing team output. In everything I do, I strive to communicate clearly, candidly, and respectfully.

Professional Experience

AeroVironment, Inc. Simi Valley, CA

Manager – Autonomy & Robotics March 2020 – Present

- Transitioned to functional leadership role shortly after joining: (*14 direct reports*)
    * Developing learning initiatives to grow in-house expertise in new technology foci for the company: *computer vision, machine learning, sensing & perception, and visual navigation*
    * Technical lead (upwards of 7 team members) on single vehicle autonomy R & D team. Responsibilities include program management, application infrastructure development for fixed-wing and multirotor craft, and visual navigation algorithm development and testing
    * Initiator and champion of several internal process improvement efforts: *Legacy CM/CI to Gitlab, containers for application development and deployment, and embracing open-source projects*

Senior Staff Engineer – Autonomy & Robotics December 2019 – March 2020

- Developed robust visual navigation capability for autonomous aerial vehicles with multiple monochrome imagers (with different quantum efficiencies) for indoor and outdoor environments

UBTECH Robotics North American R&D Center Los Angeles, CA

Senior Research Engineer – Navigation & Control April 2019 – December 2019

- Was the first team hire for, and a key member in building, the software team
    * Developed interview process for software candidates, including coding challenge component and skill set questions for computer vision, navigation, and general software candidate interviews
    * Worked with external recruiters to identify screening criteria for candidates
    * Conducted ∼90% of interviews initially, including technical panel interviews for hardware team candidates, but was able to delegate much of this responsibility as the team grew.
    * Grew the team from 1 to 12+ in 8 months. Total team, including hardware and industrial design, grew to 35+
- Led software development for initial vehicle prototype
    * Developed SLAM algorithms for operation in dynamic indoor environments using RGB-D cameras and 2d lidar
    * Worked closely with hardware design team to do sensor coverage analyses and hardware downselect in early design stages
    * Led team of 3-5 individuals working on autonomously navigating mobile platform. Starting from concept-only (no drawings), demonstrated a fully-functional minimum viable product (MVP) in ∼6 months
    * Created decentralized application infrastructure using Docker and ROS to streamline parallel development efforts within team
    * Encouraged short feedback cycles between team and project leadership via daily standups, clear and complete documentation of work, and frequent mini-demonstrations

inVia Robotics Westlake Village, CA

Staff Research Scientist – Perception & Controls December 2017 – April 2019

- Responsible for development of control, navigation, and localization algorithms for wheeled mobile robots deployed in a warehouse automation application
    * Increased coarse navigation speed 2.5x in 2 months with a novel method
    * Increased navigation accuracy on precision maneuvers by 5x while simultaneously increasing speed by 2x; *reduced inventory drops due to navigation failures >5x*

- Introduced processes that greatly increased system robustness
  * Integrated obstacle avoidance, both static and dynamic, into robot control algorithm
  * Built automated test procedure, including physical setup, for evaluating navigation performance (both control and localization accuracy) on precision approaches
  * Statistical experimental design for controller tuning based on Latin Hypercube sampling (coarse resolution) and Full-Factorial design (fine resolution)
  * Refactored trajectory planner, which resulted in >20x *reduction in network traffic and memory consumption*, and added a scalable automated test suite
  * Safe and automatic recovery of robots after throwing and logging exceptions
  * Automatic wheel calibration procedure during final robot manufacturing checkout led to *significant reduction in path-related errors observed at customer deployments*
- Worked with Operations team to monitor and correct issues while running the system live at customer deployments
- Organized ongoing efforts for personal and professional growth of team members: book club, game nights, and technical journal club

Walt Disney Imagineering R & D   Glendale, CA
Senior R & D Imagineer – Contract Position   July 2017 – October 2017

- Responsible for developing scene segmentation and state estimation algorithms for multiple object tracking using 2D laser rangefinders
- Created a simple multi-vehicle collision-free path planner using the Hybrid A* algorithm

Ford Motor Company   Dearborn, MI
Senior Research Engineer   December 2015 – June 2017

- Responsible for conceptualizing and interpreting advanced algorithms for multiple object tracking for the Next Generation Vehicle (NGV), including state estimation, data fusion, and data association

Raytheon Missile Systems   Tucson, AZ
Senior Systems Engineer II   June 2006 – December 2015

- Led small teams, composed of 2-5 individuals, in simulation, control, and signal/image processing disciplines
  * Worked with team members to define performance targets for yearly reviews and contributed to performance reports
  * Worked with team members' and their functional management to define performance improvement plans (PIP) when performance was unsatisfactory; worked with team members to increase likelihood of successfully executing the PIP
- Directed analyses of flight test failures, operational safety, requirements development, and system performance
- Designed and developed simulation architectures for new product development efforts (DARPA/MDA/IR&D)
- Developed guidance, navigation, and control (GNC) algorithms in simulation, Computer-in-the-Loop (CiL) and Hardware-in-the-Loop (HiL) environments

Sample Projects

Traffic Sign Recognition using fastai   July 2019

- Built an end-to-end pipeline for performing classification on the German Traffic Sign Recognition Benchmark dataset
- Used modern techniques – including use of a residual network (ResNet34) as the back-bone architecture and learning rate annealing
- Achieved SOTA accuracy on a holdout set – 99.95% vs. competition winning 99.46% of a few years ago
- Project Writeup, Github. Technologies Used: Python, PyTorch, fastai, docker

Pose Error Compensation Using Imprecise Visual Landmarks   March 2019

- Created and integrated a simple SLAM-inspired algorithm to increase precision navigation terminal accuracy 5x. *The net effect was a >5x decrease in inventory drops.*
- Visual landmarks imprecisely placed on stationary warehouse objects were used to create stable, robot-centric map markers for estimating accumulated robot localization error.
- Technologies Used: Python, OpenCV / AprilTags, Redis

Extended Object Tracking   April 2018

- Developed a performant representation of a cutting-edge algorithm for extended object tracking using elliptical primitive shapes
- Built a simulation and multi-threaded infrastructure layer for testing the algorithm in a representative environment
- Project Writeup, Github. Technologies Used: C++, JUCE

Technical Skills

OS   : Windows, OS X, Ubuntu
Languages: Modern C++ (11/14/17 standards), Python, Fortran (77 & 90/95)
Software : Eigen, Armadillo, Scikit-image, Scikit-learn, Tensorflow, Keras, OpenCV, Matlab/Simulink, git,
     gdb(pdb), cmake, numpy, scipy, pandas, LaTeX, Boost, IPOPT, ROS, fastai, PyTorch, docker,
     Jira, Confluence, Xilinx Vivado, Petalinux, CircleCI, Coveralls
Other : Kalman filtering, particle filtering, SLAM, computer vision, signal processing, optimization,
     machine learning (including deep learning), state-space control design, optimal control,
     design-of-experiments (DoE), data exploration & visualization

Selected Publications & Patents

- Sakai, A., D. Ingram, **J. Dinius**, K. Chawla, A. Raffin, A. Paques. PythonRobotics: a Python code collection of robotics algorithms. *arXiv e-print: submitted 31 Aug, 2018*. Available: `https://arxiv.org/abs/1808.10703`

- **Dinius, J.W.**, B.K. Pennington. Spatiotemporal Controller for Controlling Robot Operation. *U.S. Nonprovisional Pat. Ser. No. 16/044,344*, filed 24 July, 2018

- **Dinius, J.**, R. Furfaro, F. Topputo, and S. Selnick. Near Optimal Feedback Guidance Design and the Planar Restricted Three-Body Problem. In: *Proceedings of the AAS 24th Spaceflight Mechanics Meeting*, January 26–30, 2014.

- **Dinius, J.**, Adv. J. Lega. Dynamical Properties of a Generalized Collision Rule for Multi-Particle Systems. *Doctoral Dissertation*. Available: `http://arizona.openrepository.com/arizona/handle/10150/315858`.

Education

University of Arizona, MS/PhD Applied Mathematics

 – Raytheon Advanced Scholar's Fellowship

Northern Arizona University, BS Mathematics and Physics

 – University Honors Program
 – Dean's List

Related Activities

Open-Source Software Projects

Contributor   2017 – Present

I regularly contribute to open-source projects, some of which include

 – Non-Minimal Sampling Consensus (NMSAC) - *main contributor*
 – Open Source Self Driving Car Initiative (OSSDC)
 – PythonRobotics

Check out my GitHub for more details.

Student Engineering Projects

Mentor   2014 – Present

After finishing my doctorate, I regularly serve as mentor on different student-led engineering projects, including

 – Udacity Self-Driving Car Nanodegree Session Mentor – 2019
 – Community Helpers in Mathematics, Engineering, and Science (CHiMES) – (2014-2015)