Brett Pennington

Software Engineering Manager – Robotics/AV – Planning/Prediction

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## EXPERIENCE

Manager, Planning and Prediction

*Rivian,* Palo Alto, CA Jan 2021 - Present

* Grew the team of 7 in 6 months; consisting of junior engineers up to senior staff.
* Architected prediction, behavior planning, motion planning, and trajectory optimization for an L3 tech stack.
* Introduced RL for improved behavior planning in complex traffic scenarios.
* Led team responsible for writing a planning stack for next generation features, finishing the prototype one year ahead of schedule.
* Co-lead the safety critical design of the ADAS application logic for L3+ autonomy.
* Designed and wrote a C++, real-time framework for extending application logic to improve development time and reduce bugs.
* Collaborated across 13,000 person organization to reduce duplicate work, define team objectives and identify opportunities for future.

Member, IEEE Working Group on AV Decision Making

*IEEE SA* Oct 2020 - Present

* Reviewed for the 2846 white paper “Literature Review on Kinematic Properties of Road Users for Use on Safety-Related Models for Automated Driving Systems”.
* Contributed to 3321 “Recommended Practice for the Application of Assumptions on Reasonably Foreseeable Behavior of Other Road Users”.

Staff Planning Engineer

*Rivian,* Palo Alto, CA Jul 2020 - Dec 2020

* Wrote an offline, non-convex solver for optimal paths on off-road terrain in python.
* Designed a path toolbox to store the optimal paths and load them in a dense, space-efficient representation in Matlab, Python, and C.
* Introduced TDD and modular software practices.
* Implemented online algorithms in C for fast multi-dimensional KNN lookups.

Planning & Controls Engineer

*Boston Dynamics,* Boston, MA Jul 2018 - Jun 2020

* Applied optimal control techniques for multi-objective and multi-bodied systems.
* Implemented MPC/Planning for linear/non-linear systems.
* Developed proprioceptive sensing algorithms for workspace compliance and improved balancing of floating base robots.
* Introduced TDD and modular software practices for robotic systems.
* Designed planner for de-palletizing with Handle and Stretch.

Tech Lead – Motion Planning, Robotics & Controls

*Automata Tech,* London, UK Apr 2017 - Jul 2018

* Built custom kinematics, controls & motion planning libraries in C and modern C++.
* Designed collision detection systems in embedded MISRA compliant C with low bandwidth constraints.
* Introduced Agile practices: Grew a team from 5 individuals into 3 cross-functional teams with 15 members in 9 months.

Software Engineer

*Cubic Transportation Systems,* London, UK Apr 2016 - Apr 2017

* Maintained code running the London Transit (Oyster Card) environment along other global metropolitan transit systems (SF Clipper, new NYC Metrocard, Sydney Opal).
* Correlated high-speed, time-sensitive data streams in critical systems handling payments for +6 million users daily in less than 0.3 seconds each.
* Delivered client-focused results quickly while adhering to sound development practices and refactoring a large and historic database along the way.

Controls Research Engineer

*University of Alabama,* Tuscaloosa, AL Jan 2011 - Dec 2015

* Designed and synchronized embedded systems to enhance our testing ecosystem
* Programmed and modeled safety-critical high performance systems
* Built adaptive and dependable systems in critical testing environments
* Researched diesel engine controls to advance sustainability and performance

ENGINEERING SKILLS

Software Languages

* *Dream in:*  Modern C++
* *No problem writing:*  C and Python
* *Once upon a time I wrote:* C++98, SQL, MATLAB, SIMULINK, Go
* *Could stack-overflow my way through:* JS, R, Ruby
* *Maybe one day:* Haskell, Rust

Planning

* Classical Behavior Planning (FSMs, STRIPS-based, and hierarchical FSMs)
* Classical Motion Planning Techniques (graphs, trees, and gradients)
* Learned Planners (DQN and model-based RL)
* Trajectory Optimization (shooting and collocation based for online/offline work)

##### EDUCATION

Ph.D. Mechanical Engineering, University of Alabama

Jan 2011 - Dec 2015

*Advanced Controls Systems, Optimal Control, and Computational Analysis*

B.S. Mechanical Engineering, University of Alabama

Aug 2006 - Dec 2010

*Thermodynamics, Physics, and Mechanical Systems*