Camilo Andres Duarte

candresdu@gmail.com +1 301 674-4987 https://www.linkedin.com/in/camilo-06bb03ab/

SUMMARY

I am seeking a role as a Robotics Engineer within the space of perception and motion planning for autonomous systems. I have over 4 years of industry experience in deploying algorithms for robotic arms and UAVs. My master's degree was focused on deep learning for motion planning of systems with highly nonlinear dynamics and non-convex cost functions.

EDUCATION

GEORGIA INSTITUTE OF TECHNOLOGY

- **M.S. in Aerospace Engineering** **GPA:** 3.83/4.00 **Aug 2019 - Jun 2021**
  - **Focus:** Robotics and Autonomous Systems
- **B.S. in Aerospace Engineering** **GPA:** 3.87/4.00 **Jan 2015 - Jun 2019**

PROFESSIONAL EXPERIENCE

LOCKHEED MARTIN (AI/Robotics Research Engineer) | Palo Alto, CA | September 2021 – Present

- **Robotic Assisted Agility**
  - Realized an estimated $0.4M per year savings by successfully leading the deployment of autonomy modules for wire harness assembly using robotic arms, reducing labor costs.
  - Developed, tested and maintained packages to enable hardware control and telemetry using ROS Humble.
  - Designed a set of motion constraint functions for an UR10e robotic arm to simplify motion planning, enhancing safety and repeatability in dynamic manufacturing environments.
  - Innovated automated calibration procedures for eye-in-hand camera systems and implemented a robust object pose estimation framework with fiducial markers and a Kalman Filter-based sensor fusion solution in C++ enabling millimeter-level accuracy for object picking actions.
  - Integrated NVIDIA cuRobo packages (nvBlox and cuMotion) improving motion planning success rate and enabling obstacle avoidance capabilities.
  - Integrated off-the-shelf pre-trained models enabling language-driven robotic grasping for bin picking operations.
  - Optimized various Machine Learning models in the autonomy stack using TensorRT, improving inference runtime by 10x and enabling their use for real-time processing.
- **Firefighting Intelligence as a Service**
  - Led a research team in implementing and evaluating various neural network architectures in Pytorch for wildfire behavior prediction, applying insights to real-world fire data in California and Colorado.
  - Collaborated closely with data engineering teams to curate and process Geo-spatial data (using GDAL and GeoPandas) for model training.
  - Supported the development of data pre-processing pipelines using Kubeflow and model training pipelines using Determined AI.
  - Implemented custom servers and clients for trained model deployment using KServe
  - Developed key performance metrics and visualization tools for model evaluation.
  - Designed unit and performance test functions to ensure functionality and stability of code generated by the fire front prediction team.

GEORGIA TECH RESEARCH INSTITUTE (Graduate Research Assistant) | Atlanta, GA | January 2020 – June 2021

- **AlphaDogfight DARPA Challenge**
  - Member of 1 of 8 teams selected to compete in a virtual competition designed to demonstrate advanced AI algorithms that can perform simulated within-visual-range air combat maneuvering.
  - Implemented a trajectory tracking controller for JSBSim's F-16 aircraft model.
  - Carried out system identification experiments to estimate aerodynamic force and moment coefficients at different flight conditions.

- **Combined Proportional Navigation for Object Tracking with Partial State Observation**
  - Engineered and tested various vision-based Proportional Navigation Guidance algorithms for UAV target tracking and pursuit missions.
  - Performed Lyapunov Stability Analysis to validate controller stability.
  - Deployed algorithm on a small UAV, demonstrating effective target pursuit maneuvers with partial target state information.

NASA LANGLEY RESEARCH CENTER (Engineering Intern) | Hampton, VA | January 2018 – May 2018

- **Augmenting Adaptive Control for the Space Launch System** [Paper]
  - Contributed to the development a quadcopter testbed to replicate fuel sloshing dynamics in launch vehicles.
  - Performed system identification studies to determine physical parameters of the vehicle and supported the development of a nonlinear dynamical model in MATLAB/Simulink.
  - Contributed to the design and implementation of an Augmented Adaptive Controller for attitude control and a Linear Quadratic Regulator (LQR) for waypoint tracking.

RESEARCH EXPERIENCE

GEORGIA INSTITUTE OF TECHNOLOGY (Graduate Researcher) | Atlanta, GA | May 2019 – May 2021

- **Deep L1 Stochastic Optimal Control Policies for Planetary Soft-landing** [Paper]
  - Advanced the research in non-convex optimal control for minimum-fuel powered descent guidance and demonstrated the proposed framework in a simulated environment.
  - Contributed to the theory and implementation of a deep learning-based non-convex stochastic optimization algorithm using Pytorch.
  - Presented results in a Journal publication. Accepted for publication in the Journal of Guidance, Control, and Dynamics.
- **Risk-Sensitive Gradient-Based Adaptive Stochastic Search** [Paper]
  - Contributed to the development of a Motion Planning algorithm that minimizes Conditional Value-at-Risk of cost functions for systems subject to nonlinear stochastic dynamics.
  - Demonstrated algorithm's efficacy in simulated environments for different systems including an inverted pendulum, a cartpole, and a quadcopter.
- **Alphapilot AI Drone Innovation Challenge**
  - Contributed to the software development of a Stochastic Optimal Controller (Model Predictive Path Integral Controller) for Autonomous Drone Racing in the AlphaPilot Innovation Challenge.
  - Responsibilities included controller testing in simulation, cost map generation in C++/CUDA, cost function design, and integration of an Extended Kalman Filter for state estimation.

PUBLICATIONS AND MANUSCRIPTS

1. M. Pereira, **C. Duarte**, I. Exarchos, and E. Theodorou. "Deep L1 Stochastic Optimal Control Policies for Planetary Soft-Landing" *Journal of Guidance, Control, and Dynamics*. https://arc.aiaa.org/doi/10.2514/1.G007132
2. Z. Wang, K. Lee, O. So, **C. Duarte**, and E. Theodorou. "Adaptive CvaR Optimization for Dynamical Systems with Path Space Stochastic Search," 2020. https://arxiv.org/pdf/2009.01090
3. J. Pei, A. Puetz, **C. Duarte**, and L. Miller. "Suppression of Nonlinear Rotary Slosh Dynamics using the SLS Adaptive Augmenting Control System Demonstration on a Quadcopter Testbed," *AIAA SciTech*, 2019. https://doi.org/10.2514/6.2019-0114

SKILLS & ABILITIES

Coding Languages and Development Platforms

- Python, MATLAB, C++, Linux (Ubuntu, Red Hat), Docker, Kubeflow.

Simulators and Relevant Libraries

- JSBSIM, FlightGoggles, SCRIMMAGE, ROS Noetic/Humble, Gazebo, Pytorch, Tensorflow, OpenCV.

Relevant Knowledge

- Advanced Dynamics, Linear and Nonlinear Control, Stochastic Optimal Control, Kalman/Particle Filtering, Computer Vision, Regression Analysis, Mathematical Principals of Motion Planning and Autonomy, Udacity Sensor Fusion Nanodegree, Udacity C++ Nanodegree.