

Denis Osipychhev

Contact Information

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Professional Area

Autonomous systems, artificial intelligence, planning and decision-making.
Automated reasoning, control policy optimization, deep reinforcement learning.
Behavior modeling, human-in-the-loop, cooperative multi-agent systems.
Machine learning, generative modeling, data analytics for cyber-physical systems.

Professional Experience

Boeing Research & Technology, Huntsville, Alabama USA

2018 – present

AI Advanced Technologist at Center for Applied Simulation and Analytics (CASA)

Research in general autonomy, intelligent systems, and decision-making with a focus on hierarchical architecture, reasoning and risk assessment for autonomous agents. Architecting, prototyping, and consulting a broad range of AI projects at Boeing and government research agencies.

- Developed a surrogate domain, end-to-end deep-learning agent, training procedures, and evaluation metrics for learning-based planning and control for a fighter-jet dogfight (DARPA ADT program). Placed the third in the final trial and captured DARPA ACE.
- Authored a scalable multi-agent planning framework for mission planning tasks, including air combat, collision avoidance, mission operation. Abstracted the dimensionality of the MARL and solved the dimensionality reduction issue.
- Designed and produced a series of autonomous capabilities for unmanned landing, take-off, on-ground taxiing, in-air collision avoidance, traffic deconfliction. Created evaluation metrics for regression, classification, policy models to provide assurances for mission-critical components of learning-based systems (DARPA AA).
- Guided the Boeing-CMU collaboration on adaptive and robust AI agents via Genetic Curriculum training. Demonstrated the training methodology for agents robust to changes in scenario and dynamics.
- Developed and integrated dynamic trajectory planner for local path-planning, dynamic collision avoidance, and navigation for airport taxiing of a full-scale airplane.
- Guided the cybersecurity work for robust AI/ML agents to provide defensive capabilities against deception and adversarial attacks on cyber-physical systems.
- Designed an active learning framework, synthetic data generation pipeline, training procedures to improve performance of visual perception system on a limited dataset.

University of Illinois at Urbana-Champaign, Urbana, Illinois USA

2016 – 2018

Research Assistant at Coordinated Science Laboratory (CSL)

Decision-making algorithms for modern agriculture. Reinforcement learning for multi-agent optimization. Precision agriculture and phenotyping through computer vision.

- Integrated policy optimization for agricultural robot swarm to coordinate the weeding.
- Authored distributed cooperative policy planning for mission control/sensing (AFRL).

Oklahoma State University, Stillwater, Oklahoma USA

2014 – 2016

Graduate Research Assistant at Advanced Technology Research Center (ATRC)

Decision-making for autonomous driving vehicles and human-in-the-loop systems. Human-

activity recognition, behavior modeling and classification.

- Developed model-based collision avoidance for autonomous vehicles.
- Led integration of navigation, path-planning, and control to autonomous vehicle prototype.

Education

University of Illinois at Urbana-Champaign, Urbana, Illinois USA

PhD candidate, Ag and Bio Engineering & Computational Science Engineering

Advisors: Drs. G. Chowdhary, H. Tran, M. West, A. Davis

Oklahoma State University, Stillwater, Oklahoma USA

MS in Electrical and Computer Engineering, Control Systems, 2015

“Collision avoidance for autonomous cars based on human intention”

Moscow Power Engineering Institute, Moscow, Russia

MS in Electronic Equipment, February, 2006

BE in Electronics, May, 2004

Publications

- Osipychiev D., Margineantu D., Reinforcement Learning-Based Air Traffic Deconfliction. Under reviews 2021 IROS.
- P. Kouvaros, T. Kyono, F. Leofante, A. Lomuscio, D. Margineantu, D. Osipychiev, Y. Zheng. Formal Analysis of Neural Network-based Systems in the Aircraft Domain. 2021 FM21.
- Fremont D., Chiu J., Margineantu D., Osipychiev D., Seshia S., Formal Analysis and Redesign of a Neural Network-Based Aircraft Taxiing System with VeriAI. 2020 CAV.
- Osipychiev D., Chowdhary G., Distributed Deep Policy Sharing for Competitive Adversarial Environment. 2018 NIPS Workshop “Deep Reinforcement Learning”.
- McAllister W., Osipychiev D., Davis A., Agbots: Weeding a field with a team of autonomous robots. 2019 Elsevier.
- Osipychiev D., McAllister W., Chowdhary G., Davis A., Multi-Agent Planning for Coordinated Robotic Weed Killing. 2018 IROS conference.
- Osipychiev D., Tran D., Sheng W., Chowdhary G., Human intention-based collision avoidance for autonomous cars. 2017 American Control Conference (ACC).
- Tran D., Du J., Sheng W., Tadesse E., Osipychiev D., Sun Y., Bai H., A Human-Vehicle Collaborative Driving Framework for Driver Assistance. 2018 IEEE Intelligent Transportation Systems Transactions.
- Tran D., Tadesse E., Osipychiev D., et al., A collaborative control framework for driver assistance systems. 2017 ICRA conference.
- Osipychiev D., Tran D., Sheng W., Chowdhary G., Proactive MDP-based Collision Avoidance Algorithm for Autonomous Car. 2015 IEEE CYBER Conference, 2014 NIPS Workshop “From Bad Models to Good Policies”.

Skills

Experience in agile software development and integration of complex cyber-physical systems, simulations of physical and control processes, data analysis and visualization, GUI

Integration of algorithms and methods:

- Policy optimization (deep RL-agents on Pytorch and TF), task-optimization (Q-learning, genetic algorithms, graph search, RRT), and utility optimization (SGD, elastic bands, particle swarm),
- Regression, classification, and GAN models on Pytorch libraries,
- Dynamic simulations and surrogates for multi-agent systems, vehicle dynamics, robotics, computer games.

Integration platforms:

- ROS-based robotics, full-scale autonomous cars/airplanes, software/hardware in-the-loop simulations, Gazebo.

Languages: Python, C++, JavaScript

Interests

Robotics, AI, gamedev, model rocketry, hiking, karting, welding, Futurama.