

Denis Osipychev

Contact Information

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Professional Area

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

Professional Experience

Boeing Research & Technology, Huntsville, Alabama USA ***2018 – present***

AI Software Engineer 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.

- Produced surrogate domain, end-to-end deep-learning agent, training procedures, and evaluation metrics for learning-based planning and control for fighter-jet dogfight (DARPA ADT program). Placed the third in the final trial and captured DARPA ACE.
- Developed autonomous capabilities for unmanned landing, take-off, on-ground taxiing, in-air collision avoidance. Produced evaluation metrics for regression, classification, policy models to provide assurances for mission critical components of learning-based systems (DARPA AA).
- Prototyped and integrated dynamic trajectory planner for local path-planning, dynamic collision avoidance, and navigation for airport taxiing of a full scale airplane.
- Guided cybersecurity work for robust AI/ML agents to provide defense capabilities against deception and adversarial attacks on cyber-physical systems.
- Prepared active learning framework, synthetic data generation pipeline, training procedures to improve performance of visual perception system on limited dataset.
- Introduced sequence optimization methodology for fiber placement process to reduce number and severity of defects in composite manufacturing process.

University of Illinois at Urbana-Champaign, Urbana, Illinois USA ***2016 – 2018***

Research Assistant at Coordinated Science Laboratory (CSL)

Decision-making algorithms for modern agricultural swarm-robotics. Precision agriculture. Reinforcement learning for multi-agent optimization.

- Integrated policy optimization for agricultural robot swarm to coordinate weeding task.
- 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.
- Directed navigation, path-planning and control of 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

M.S. in Electrical and Computer Engineering, Control Systems, 2015

“Collision avoidance for autonomous cars based on human intention”

Moscow Power Engineering Institute, Moscow, Russia

M.S. in Electronic Equipment, February, 2006

B.E. in Electronics, May, 2004

Publications

Fremont D., Chiu J., Margineantu D., Osipychev D., Seshia S., Formal Analysis and Redesign of a Neural Network-Based Aircraft Taxiing System with VerifAI. Submitted CAV 2020.

Osipychev D., Chowdhary G., Distributed Deep Policy Sharing for Competitive Adversarial Environment. 2018 Archived, NIPS Workshop “Deep Reinforcement Learning”.

McAllister W., Osipychev D., Davis A., Agbots: Weeding a field with a team of autonomous robots. 2019 Elsevier.

McAllister W.*, Osipychev D.*, Chowdhary G., Davis A., Multi-Agent Planning for Coordinated Robotic Weed Killing. 2018 IROS conference.

Osipychev 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., Osipychev D., Sun Y., Bai H., A Human-Vehicle Collaborative Driving Framework for Driver Assistance. 2018 IEEE Intelligent Transportation Systems Transactions.

Tran D., Tadesse E., Osipychev D., et al., A collaborative control framework for driver assistance systems. 2017 ICRA conference.

Osipychev D., Tran D., Sheng W., Chowdhary G., Proactive MDP-based Collision Avoidance Algorithm for Autonomous Car. 2015 IEEE CYBER Conference.

Osipychev D., Tran D., Sheng W., Chowdhary G., Proactive MDP-based Collision Avoidance Algorithm for Autonomous Car. 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), task-optimization (Q-learning, genetic algorithms, graph search), 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, model rocketry, Futurama.