Shuijing Liu

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Research Interests

Learning-based Robotics, Human-Robot Interaction, Multiagent Systems, Machine Learning

Education

University of Illinois at Urbana Champaign   2018 – Exp. May 2023
Doctor of Philosophy in Electrical Engineering (CGPA: 3.91/4.0)
Advisor: Prof. Katherine Driggs-Campbell

University of Illinois at Urbana Champaign   2014 – 2018
Bachelor of Science in Computer Engineering, minor in Art and Design (CGPA: 3.86/4.0)

Publications

Under Review

- **Learning to Navigate Intersections with Unsupervised Driver Trait Inference**
  S. Liu, P. Chang, H. Chen, N. Chakraborty, and K. Driggs-Campbell.
  submitted to IEEE International Conference on Robotics and Automation (ICRA), 2022. [arXiv] [Website] [Video]
- **Robot Sound Interpretation: Learning Visual-Audio Representations for Voice-Controlled Robots**
  P. Chang, **S. Liu**, and K. Driggs-Campbell.
  submitted to IEEE Robotics and Automation Letters (RA-L). [arXiv]
- **Off Environment Evaluation using Convex Risk Minimization**
  P. Katdare, **S. Liu**, and K. Driggs-Campbell.
  submitted to IEEE International Conference on Robotics and Automation (ICRA), 2022. [Code]

Conference Publications

- **Decentralized Structural-RNN for Robot Crowd Navigation with Deep Reinforcement Learning**
  S. Liu*, P. Chang*, W. Liang, N. Chakraborty, and K. Driggs-Campbell.
  In IEEE International Conference on Robotics and Automation (ICRA), 2021. [Paper] [Website] [Code] [Video]
- **Robot Sound Interpretation: Combining Sight and Sound in Learning-Based Control**
  P. Chang, **S. Liu,** H. Chen, and K. Driggs-Campbell.
  In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2020. [Paper] [Website] [Video]
- **Robust Deep Reinforcement Learning with Adversarial Attacks**
  A. Pattanaik, **S. Liu*,** Z. Tang*, G. Bommannan, and G. Chowdhary.
  In International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2018 (abstract). [Paper]

Undergraduate Thesis

- **Prostate Cancer Diagnosis by Deep Learning**
  S. Liu, A. Parameswaran, and J. Peng.
  In Illinois Digital Environment for Access to Learning and Scholarship (IDEALS), 2018. [Thesis] [Slides]

Research Projects

Driver Trait Inference for Autonomous Vehicle Navigation   2021
- Proposed an unsupervised approach to learn a representation of driving styles from vehicle trajectories.
- Proposed a variational autoencoder + RNN network for representation learning.
- Used the driving style representation to improve the autonomous navigation through an uncontrolled T-intersection. The success rate increased over 10% compared with previous works.

Wayfinding Assistance Robot for People with Visual Impairments   2020 – Present
- Design a robot that guides blind people to navigate in indoor places.

Robot Crowd Navigation   2019 – 2020
- Proposed a neural network model for robot navigation in crowded environment with humans.
- The proposed network enables the robot to perform spatial and temporal reasoning in navigation.
- Used model-free reinforcement learning to train the network, the success rate increased by ~20%.

Voice-Controlled Robots with Sound Interpretation   2021
- Helped propose a novel pipeline for voice-controlled robots.
- Built a visual-audio representation that associates images and sound commands.
- Used the visual-audio representation to generate reward function to train the robot.
- Designed and conducted simulation and real world experiments, the success rate increased by 1%-5% compared to our previous work.

Robust Deep Reinforcement Learning with Adversarial Attacks   2017 – 2018
- Implemented novel adversarial attacks that improve the robustness of deep RL algorithms.

Cancer Diagnosis with Deep Learning   2017 – 2018
- Proposed ResNet with ensemble methods to classify cancer biopsy images.
- achieved near 100% testing accuracy in US Biomax prostate cancer dataset.

Skills

Programming: Python, C++/C, ROS, HTML, MySQL, PHP.
Packages: PyTorch, Keras, Tensorflow, NumPy, SciPy, OpenCV.
Software: Matlab, Latex, Git.
Soft skills: Self-motivation, leadership in research, verbal & written communication, teamwork, time management, critical thinking, curiosity.

Selected Courses

Robotics: Rigid body motion, kinematics, dynamics, filtering, mapping, localization, grasp & manipulation planning, perception, pose estimation, human-robot interaction

Reinforcement Learning: MDP, dynamic programming, value function, Q-learning, policy gradient, actor-critic, inverse RL, model-based & model-free RL, exploration, transfer learning, meta-learning, hierarchical RL

Computer Vision: low-level vision, grouping and fitting, geometric vision, CNN

AI & ML: search, Bayes nets, SVM, ensemble methods, probabilistic graph models, regression, classification, clustering, VAE, GAN, transformers, GNN, self-supervised learning, imitation learning

NLP: POS tagging, parsing, machine translation, semantics

Theory: Optimization, linear control theory, random processes, RL theory

Miscellaneous: Data structure, algorithms, database, data mining, numerical analysis, compliers, bioinformatics

Honors and Awards

- **Lauren Kelley Memorial Scholarship**   2017 – 2018
- **Professor N. Narayana Rao Scholarship** awarded to the top 10% of the junior class for scholastic excellence and distinguished meaningful service to the department and campus community, 2016.
- **Oakley Scholarship** awarded to outstanding sophomores for being active in outside activities, 2015.
- **Dean's List** honored full-time students whose GPA ranks in the top 20% of their college, 2014 – 2016.

Teaching Experience

- ECE 598: Human Centered Robotics
  Designed machine problems, led discussion sections, presented lecture materials.
- ECE 470: Introduction to Robotics
  Led laboratory sections, designed online exam questions, held office hours, graded lab reports and exams.
- ECE120: Introduction to Computing **(Head TA)**
  Led discussion sections, held office hours.

References

Prof. Katherine Driggs-Campbell, Electrical and Computer Engineering, UIUC. Email: krdc@illinois.edu.