Richard Kelley

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RESEARCH INTERESTS

Human-Robot Interaction, Motion Planning, Machine Learning, Automated Vehicles, Unmanned Aircraft.

EDUCATION

Doctor of Philosophy, Computer Science and Engineering — May 2013
University of Nevada, Reno, NV
DISSERTATION - Models of Intention for Human-Robot Interaction
Advisor: Monica Nicolescu

Master of Science, Computer Science — May 2009
University of Nevada, Reno, NV
THESIS - Mind Reading for Social Robots: Stochastic Models of Intent Recognition
Advisor: Monica Nicolescu

Bachelor of Science, Mathematics — June 2006
Minor: Philosophy
University of Washington, Seattle, WA

PROFESSIONAL EXPERIENCE

Nevada Center for Applied Research, University of Nevada — June 2017 – Present
Senior Engineer

- Draft and submit grant proposals for research on intelligent transportation and robotics.
- Develop software and algorithms for autonomous ground vehicles.
- Develop software for connected infrastructure systems.
- Provide technical support to State of Nevada Unmanned Aircraft System FAA Test Site.

Nevada Advanced Autonomous Systems Innovation Center, University of Nevada — June 2015 – June 2017
Senior Engineer

- Research and develop unmanned aircraft systems technology.
- Work with partner companies to develop and commercialize UAV technology.
- Develop software and algorithms for autonomous ground vehicles.
- Develop software for connected infrastructure systems.

Robotics Research Lab and Cyberinfrastructure Lab, University of Nevada — May 2013 – June 2015
Research Assistant (Robotics Lab) and Data Portal Manager (Cyberinfrastructure Lab)

- Conduct robotics and artificial intelligence research.
- Assist in the development and operation of the Nevada Climate Change Portal.

Cyberinfrastructure Lab, University of Nevada — January 2013 – May 2013
Graduate Research Assistant

- Assist in the development and operation of the Nevada Climate Change Portal.

Robotics Research Lab, University of Nevada 2006 – May 2013
Graduate Research Assistant

- Design and implement novel algorithms to enable robots to engage in social interaction with humans.
- Author papers describing my research in social robotics and artificial intelligence.

Department of Mathematics, University of Washington Summer 2005
Student researcher

- Research computational complexity in the context of combinatorial optimization problems.

Disabled Student Services, University of Washington 2004 – 2006
Technical editor

- Prepare technical books for conversion to Braille and other accessible formats using LaTeX.

TECHNICAL SKILLS

The Basics

- Regular Linux user (Ubuntu, Slackware, Arch).
- Comfortable in a Windows development environment.

Programming Languages

- *Current significant use:* Modern C++, Python.
- *Previous significant use:* Common Lisp, JavaScript, C, CUDA (C/C++).

Systems

- ROS (12 Years)
- PyTorch/LibTorch (5 years/3 years)
- GTSAM (3 years)

MAJOR GRANTS & CONTRACTS

The Digital Twin Paradigm for Real-Time Transit Infrastructure Maintenance 2021-2022
Sponsor: Washoe County Regional Transportation Commission / Federal Transit Administration
Amount: $130,500.55
Role: PI

Unmanned Aircraft Systems Test Sites IDIQ Task Order 1 2016
Sponsor: Nevada Institute for Autonomous Systems
Amount: $136,828
Role: PI

UAS Traffic Management Support 2015-2020
Sponsor: NASA Ames Research Center
Amount: $249,970
Role: PI

PUBLICATIONS

- E. Duong, J. Poston, R. Kelley, "Predicting Agents' Trajectories by Estimating Their Motion Planners," *RSS 2020 Workshop on Interaction and Decision-Making in Autonomous Driving*. 2020.
- J. Blankenburg, R. Kelley, D. Feil-Seifer, R. Wu, L. Barford, F. Harris, "Towards GPU-Accelerated PRM for Autonomous Navigation," *International Conference on Information Technology: New Generations.* 2020.
- H. Lucas, R. Kelley, "Generating Control Policies for Autonomous Vehicles Using Neural ODEs," *Workshop on Integration of Deep Neural Models and Differential Equations, International Conference on Learning Representations*. 2020.
- K. Wagner, R. Harding, R. Kelley, B. Labus, S. Verdugo, E. Copulsky, J. Bowles, M. Mittal, P. Davidson, "Post-overdose interventions triggered by calling 911: Centering the perspectives of people who use drugs (PWUDs)," *PLOS One*. 2019.
- B. Miller, R. Kelley, "Inverse Reinforcement Learning for Model Predictive Control of a Self-Driving Car," *Women in Machine Learning Workshop at Neural Information Processing Systems*. 2018.
- V. Le, C. Carthen, R. Kelley, T. Kozubowski, F. Harris, "Rewind: An Automatic Music Transcription Web Application," *International Journal of Computers and Their Applications*. 2017.
- C. Carthen, R. Kelley, C. Ruggieri, S. Dascalu, J. Colby, F. Harris, "MUSE: A Music Conducting Recognition System," *Information Technology - New Generations. Advances in Intelligent Systems and Computing*. 2017.
- B. Rekabdar, M. N. Nicolescu, M. Nicolescu, M. Saffar, R. Kelley, "A Scale and Translation Invariant Approach for Early Classification of Spatio-Temporal Patterns Using Spiking Neural Networks," *Neural Processing Letters*. 2016.
- R. Kelley, "Sequence Modeling with Recurrent Tensor Networks," *openreview.net*. 2016.
- B. Rekabdar, M. N. Nicolescu, R. Kelley, M. Nicolescu. "An Unsupervised Approach to Learning and Early Detection of Spatio-Temporal Patterns Using Spiking Neural Networks," *Journal of Intelligent and Robotic Systems*. 2015.
- V. Le, M. Neff, R. Stewart, R. Kelley, E. Fritzinger, S. Dascalu, F. Harris Jr., "Microservice-based architecture for the NRDC," *International Conference on Industrial Informatics*. 2015.
- B. Rekabdar, M. N. Nicolescu, M. Nicolescu, R. Kelley, "Scale and translation invariant learning of spatio-temporal patterns using longest common subsequences and spiking neural networks," *International Joint Conference on Neural Networks*. 2015.
- B. Rekabdar, M. N. Nicolescu, M. Nicolescu, R. Kelley, "A biologically inspired approach to learning spatio-temporal patterns," *International Conference on Developmental Learning and on Epigenetic Robotics*. 2015.
- B. Rekabdar, M. N. Nicolescu, R. Kelley, M. Nicolescu. "Unsupervised Learning of Spatio-temporal Patterns Using Spike Timing Dependent Plasticity," *International Conference on Artificial General Intelligence*. 2014.
- R. Kelley, A. Tavakkoli, C. King, A. Ambardekar, L. Wigand, M. Nicolescu and M. Nicolescu, "Intent Recognition for Human-Robot Interaction," *Plan, Activity, and Intent Recognition*, 2013.
- R. Kelley, A. Tavakkoli, C. King, A. Ambardekar, M. Nicolescu, M. Nicolescu, "Context-Based Bayesian Intent Recognition," *IEEE T. Autonomous Mental Development* 4(3): 215-225 (2012).
- D. Ennis, A. Medaille, T. Lambert, R. Kelley, F. Harris, "A Comparison of Academic Libraries: An Analysis Using a Self-Organizing Map," *Library Science*, 2012.
- R. Kelley, L. Wigand, B. Hamilton, K. Browne, M. Nicolescu, M. Nicolescu, "Deep networks for predicting human intent with respect to objects," *HRI 2012*. 171-172.
- T. Kollar, A. Weiss, J. Monast, A. Austermann, D. Lu, M. Patel, E. Gribovskaya, C. Datta, R. Kelley, H. Osawa, L. Lin, *HRI pioneers workshop 2011*. HRI 2011: 9-10.

- R. Kelley, A. Ambardekar, L. Wigand, M. Nicolescu, M. Nicolescu, "Point Clouds and Range Images for Intent Recognition and Human-Robot Interaction," *RGB-D Workshop: Advanced Reasoning with Depth Cameras*, 2011.
- L. Barford, I. Gibbs, R. Kelley, "Toward Real-Time Kernel Density Estimate Display for Instrumentation," *IEEE Instrumentation and Measurement Technology Conference*, 2011.
- R. Kelley, E. Schaerer, M. Gomez, M. Nicolescu, "Liability in Robotics: An International Perspective on Robots as Animals," *Advanced Robotics, Special Issue on Legal and Safety Constraints for Service Robots Deployment*, 2010.
- R. Kelley, C. King, A. Ambardekar, M. Nicolescu, M. Nicolescu, A. Tavakkoli, "Integrating Context into Intent Recognition Systems," *Proceedings of the International Conference on Informatics in Control, Automation and Robotics*, 2010.
- R. Kelley, A. Tavakkoli, C. King, M. Nicolescu, M. Nicolescu, "Understanding Activities and Intentions for Human-Robot Interaction," *Advances in Human-Robot Interaction*, 2009.
- R. Kelley, M. Nicolescu, M. Nicolescu, S. Louis, "An Evolutionary Approach to Maximum Likelihood Estimation for Generative Stochastic Models," *Proceedings of the 40th International Symposium on Robotics*, 2009.
- R. Kelley, M. Nicolescu, M. Nicolescu, "Grammar-Based Robot Control," *Proceedings of the 8th International Conference on Autonomous Agents and Multiagent Systems*, 2009.
- E. Schaerer, R. Kelley, M. Nicolescu, "Robots as Animals: A Framework for Liability and Responsibility in Human-Robot Interactions," *Proceedings of the 18th IEEE Symposium on Robot and Human Interactive Communication*, 2009.
- R. Kelley, C. King, A. Tavakkoli, M. Nicolescu, M. Nicolescu, G. Bebis, "An Architecture for Understanding Intent Using a Novel Hidden Markov Formulation," *International Journal of Humanoid Robotics, Special Issue on Cognitive Humanoid Robots*, 2008.
- R. Kelley, A. Tavakkoli, C. King, M. Nicolescu, M. Nicolescu, G. Bebis, "Understanding Human Intentions via Hidden Markov Models in Autonomous Mobile Robots," *Proceedings of the 3rd International Conference on Human-Robot Interaction*, 2008.
- A. Tavakkoli, R. Kelley, C. King, M. Nicolescu, M. Nicolescu, G. Bebis, "A Visual Tracking Framework for Intent Recognition in Videos," *Proceedings of the International Symposium on Visual Computing*, 2008.
- A. Tavakkoli, R. Kelley, C. King, M. Nicolescu, M. Nicolescu, G. Bebis, "A Vision- Based Architecture for Intent Recognition," *Proceedings of the International Symposium on Visual Computing*, Vol. II, pp 173-182, 2007.

TEACHING

CSE 493/693 - Directed Study: Unsupervised Learning Spring 2017
Lead Instructor

- Introduced core algorithms for neural networks.
- Introduced concepts, mathematics, and implementation of generative adversarial networks.
- Introduced concept of variational inference.
- Introduced concept and implementation of variational autoencoders.

CSE 793 - Independent Study: Deep Natural Language Processing Spring 2017
Lead Instructor

- Introduced core algorithms for neural networks.
- Introduced unsupervised algorithms for word modeling.
- Covered recurrent neural networks for sentence processing.

CSE 491/691 - Foundations of Autonomous Systems: Math, Minds, and Machines Fall 2016
Lead Instructor

- Provided overview of formal systems, discrete math, and theoretical computer science with application to Artificial Intelligence.
- Gave introduction to programming with the lambda calculus.

CSE 491/691Q - Deep Learning Spring 2015
Lead Instructor

- Introduced seniors and beginning graduate students to the field of Deep learning.
- Designed lab sections to reinforce core course material.
- Course contents: Math review, machine learning overview, probability and statistics for regression and classification, gradient-based training, deep architectures, autoencoders, convolutional neural networks, neural language models, applications in speech, vision, and language processing.

CSE 482/682 - Introduction to Artificial Intelligence Fall 2014, Fall 2015
Lead Instructor

- Taught seniors and beginning graduate students the basics of classical and modern artificial intelligence.
- Course contents: History of AI, agent-based systems, search algorithms, basic optimization, dynamic programming, reasoning under uncertainty, machine learning, neural networks.

CSE 491H/691H - Data Science & Big Data Spring 2014
Lead Instructor

- Taught seniors and beginning graduate students how to work with large data sets and do machine learning in practical settings.
- Designed lab sections to reinforce core course material.
- Course contents: Data science workflow, data visualization, basic exploratory statistics, introduction to Python, numerical computing in Python, regression, classification, Kaggle competitions, group data projects.

CSE 282 - Simulation Physics Fall 2012
Lead Instructor

- Taught sophomores in Computer Science how to build simulations and computer games that use physics to increase realism.
- Designed lab sections to reinforce core course material.
- Supervised a TA for the purposes of grading and lab work.
- Course contents: basic kinematics and linear algebra, numerical solution of ordinary differential equations, implementing Newton's laws on a computer, 3D rotation via matrices and quaternions, rotational dynamics, efficient collision detection and resolution.

CSE 457/657 - Database Management Systems Spring 2012
Lead Instructor

- Provided an overview of modern database and data mining technologies to seniors and beginning graduate students in Computer Science.
- Course contents: relational databases, SQL, database-backed web applications, Ruby on Rails, NoSQL databases, distributed key-value stores, document databases, graph databases, supervised and unsupervised machine learning in Python.

CSE 477/677 - Analysis of Algorithms Fall 2011
Lead Instructor

- Taught design and analysis of algorithms to seniors and beginning graduate students in Computer Science.
- Course contents: basic asymptotic analysis, graph algorithms, greedy algorithms, dynamic programming, NP-completeness, and approximation algorithms.

College of Engineering Computer Science Summer Camp 2010 – 2013
Camp Designer and Instructor

- Created the College of Engineering's Computer Science Camp, focusing on 3D Graphics and Digital Art and Animation.
- Taught campers (aged 14 to 17) how to build and animate 3D models using open-source tools such as Blender.

ACADEMIC ADVISING

Gaetano Evangelista Spring 2024 (expected)
Ph.D. in Computer Science and Engineering

Jamie Poston Spring 2020
M.S. in Computer Science and Engineering
Thesis: *Predicting Agent Behavior By Estimating Motion Planners*

Houston Lucas Spring 2020
M.S. in Computer Science and Engineering
Thesis: *Differentiable Boundary Value Problem Solver*

Niki Silveria Winter 2017
M.S. in Computer Science and Engineering
Thesis: *Optimal Strategy Imitation Learning from Differential Games*

MEDIA COVERAGE

Faces of the Pack: Jennifer Clayton discovers fascination for autonomous robotics 30 August 2022
`https://bit.ly/3ewjWdY`

Is The Robotic Revolution Upon Us? 14 August 2019
`https://bit.ly/3qn3TBU`
KUNR Public Radio

Dell Luminaries Podcast: Artificial Intelligence . . . Driving In the Streets 23 October 2018
`https://bit.ly/2PhXxTd`

Apollo 3.0 Launch Event - Developer Highlight: Richard Kelley 9 August 2018
`https://bit.ly/2VaJ0aU`

Can artificial intelligence help predict and prevent traffic accidents? 22 January 2018
`https://bit.ly/2VzM31D`
BBC Click

Proterra to test self-driving bus in downtown Reno 2 May 2017
`https://bit.ly/2LzOWKW`
SFGate

Don't Look Now, But Even Buses Are Going Autonomous 2 May 2017
`https://bit.ly/2pV69mD`
Wired Magazine

Drone Traffic Control 11 April 2017
`https://bit.ly/2Yn2gnI`
Breakground Magazine

NASA Marks Success for Most Complex Drone Traffic Management Test Yet 21 April 2016
`https://go.nasa.gov/1VHpCRj`

Nevada researchers helping develop air traffic control for drones 7 August 2015
`https://bit.ly/30cK6qo`
Las Vegas Sun

Drone delivery start-up Flirtey taking on Google, Amazon 16 May 2015
`https://ab.co/2HdbOvC`
ABC News

ACADEMIC HONORS

Graduate Regents' Scholar, University of Nevada 2013
Outstanding Graduate Student in Computer Science and Engineering, University of Nevada 2013
Phi Beta Kappa, University of Washington 2004
National Merit Scholar, University of Washington 2002

COMMUNITY WORK

McQueen High School Speech and Debate 2006 – 2008
Assistant Coach

McQueen High School Speech and Debate 2008 – 2010
Head Coach
- 2009 Northern Nevada Coach of the Year

Northern Nevada Forensic League 2009 – 2010
Secretary