

Richard Kelley

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SCIENTIFIC INTERESTS

Automated Vehicles, Unmanned Aircraft, Human-Robot Interaction, Motion Planning, Artificial Intelligence, Language Models, Machine Learning, Neural Networks.

EDUCATION

Doctor of Philosophy, Computer Science and Engineering August 2009 – May 2013
University of Nevada, Reno, NV
DISSERTATION - Models of Intention for Human-Robot Interaction
Advisor: Monica Nicolescu, Ph.D.

Master of Science, Computer Science August 2006 – May 2009
University of Nevada, Reno, NV
THESIS - Mind Reading for Social Robots: Stochastic Models of Intent Recognition
Advisor: Monica Nicolescu, Ph.D.

Bachelor of Science, Mathematics September 2002 – June 2006
Minor: Philosophy
University of Washington, Seattle, WA

PROFESSIONAL EXPERIENCE

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

- **Nevada Autonomous** (FAA UAS Test Site / City of Reno FAA Beyond Program)
 - Created algorithms and software for unmanned aircraft systems, including navigation and control software.
 - Provided range safety and visual observer services for client companies (ranging in size from startups to >\$1 trillion market cap) testing at our FAA UAS test site.
 - Drafted and submitted grant proposals for research on unmanned aircraft systems.
 - Represented Nevada FAA UAS test site at industry events (AUVSI).
 - Authored dozens of research papers for peer-reviewed journals, international conferences, and government agencies (See Publications below).
 - Evaluated submissions for technical conferences, including Conference on Language Modeling (COLM), European Conference on AI (ECAI), Neural Information Processing Systems (Neurips).
- **Intelligent Mobility** (Research initiative funded by Nevada Governor's Office of Economic Development)
 - Designed and built software and algorithms for autonomous ground vehicles, including sensor calibration and mapping systems.
 - Developed software for connected infrastructure systems in partnership with municipal government agencies.
 - Testified at Nevada Legislature on state of the art for intelligent transportation systems and provided one-on-one explanations of technology for state legislators and their staff.

- Drafted and submitted grant proposals for research on intelligent transportation systems and ground robotics.
- Presented and explained robotics research to members of Nevada federal congressional delegation.
- Published research papers on artificial intelligence topics, including generative AI, language models, and stochastic optimization (See Publications below).
- Managed research projects for university students and junior professional software engineers.

Nevada Advanced Autonomous Systems Innovation Center
Engineer

June 2015 – June 2017

- Created new technology to improve the safety and capabilities of unmanned aircraft systems.
- Worked with partner companies (from startups to >\$1 trillion market cap) to develop, test, and commercialize UAS technology.
- Developed software and algorithms for autonomous ground vehicles.
- Wrote software for connected infrastructure systems.

Eigenmancy, LLC
Cofounder

June 2014 – June 2018

- Founded a data science/machine learning consulting firm specializing in custom AI system development and deployment for private corporate clients.
- Assisted companies with exploratory data analysis and statistical model development.
- Administered AWS infrastructure for client companies, designing system architecture and ensuring system security.

Robotics Research Lab and Cyberinfrastructure Lab, University of Nevada
Research Assistant Professor and Data Portal Manager

May 2013 – June 2015

- Led robotics and artificial intelligence research team focused on human-robot interaction and machine learning approaches to robot cognition.
- Coordinated the development and operation of a web-based portal for geospatial data.

Cyberinfrastructure Lab, University of Nevada
Graduate Research Assistant

January 2013 – May 2013

- Contributed to the creation and operation of websites for geospatial data management research.

Robotics Research Lab, University of Nevada
Graduate Research Assistant

August 2006 – May 2013

- Designed and implemented novel algorithms to enable robots to engage in social interaction with humans.
- Authored and published papers describing research in social robotics and artificial intelligence.

Department of Mathematics, University of Washington
Undergraduate Research Assistant

Summer 2005

- Studied computational complexity of combinatorial optimization problems.

Disabled Student Services, University of Washington
Technical editor

January 2004 – June 2006

- Prepare technical books (advanced Math & Computer Science) for conversion to Braille and other accessible formats using L^AT_EX.

OPEN SOURCE SOFTWARE DEVELOPMENT

Dendron

<https://github.com/RichardKelley/dendron>

Lead Developer & Maintainer

- Python library for building large language model agents using behavior trees.

HFLM

<https://github.com/RichardKelley/hflm>

Co-Lead Developer & Maintainer

- Python library for efficient and ergonomic deployment of large language models.

Andron

<https://github.com/RichardKelley/andron>

Lead Developer & Maintainer

- TypeScript Electron application for typesetting interlinear translations in L^AT_EX, with a focus on Ancient Greek translation.

SELECTED TECHNICAL SKILLS

Programming Languages

- *Current significant use:* Modern C++, Python, TypeScript, CUDA, Lean 4.
- *Previous significant use:* Common Lisp, JavaScript, C, Rust.

Systems

- ROS (Since 2010)
- PyTorch/LibTorch (Since 2017/Since 2020)
- GTSAM (Since 2020)

SELECTED GRANTS & CONTRACTS

Subcanopy UAS development for watershed-scale surface and ladder fuel quantification 2024 – 2027

Sponsor: NASA

Amount: \$2,999,999

Role: Co-Principal Investigator

Synopsis: Designing lidar-based control and navigation systems to enable unmanned aircraft to navigate beneath the canopy of a forest. Designing simultaneous localization and mapping (SLAM) system to build lidar, optical, and multispectral maps of the subcanopy region of a forest. Designing machine learning systems with partners at NASA to automatically estimate fuel loading in Sierra Nevada forests for fire prevention efforts.

The Digital Twin Paradigm for Real-Time Transit Infrastructure Maintenance 2021 – 2024

Sponsor: Federal Transit Administration – Washoe County Regional Transportation Commission

Amount: \$130,501

Role: Principal Investigator

Synopsis: Designed and built a hardware and software system to enable municipal buses to automatically detect maintenance needs (such as glass repair and graffiti removal) using lidars, cameras, and generative artificial intelligence in the form of transformer-based vision-language models. Deployed system on municipal bus in Reno and provided reports to U.S. Federal Transit Administration.

Unmanned Aircraft Systems Test Sites IDIQ Task Order 1 2016

Sponsor: Nevada Institute for Autonomous Systems

Amount: \$136,828

Role: Principal Investigator

Synopsis: Partnered with external corporate partner to manage design and construction of a secured aerospace research lab at the Reno Stead Airport. Oversaw process of securely networking lab computer systems with computer systems at the NASA Jet Propulsion Laboratory. Validated secure connection.

- UAS Traffic Management Support* 2015 – 2020
 Sponsor: NASA Ames Research Center
 Amount: \$249,970
 Role: Principal Investigator
 Synopsis: Collaborated with researchers from NASA Ames research center to test prototype UAS traffic management (UTM) systems. Developed onboard-UAS software and ground control station (GCS) software to enable unmanned aircraft to connect to UTM prototypes. Designed and executed test plans for software validation at the Nevada FAA test site's ranges. Participated in airworthiness and flight safety reviews on behalf of partner companies.
- UAV-Based Camera Vibration Reduction for Detect and Avoid Tasks* 2014 – 2015
 Sponsor: NASA EPSCoR
 Amount: \$36,512
 Role: Co-Principal Investigator
 Synopsis: Managed student research on mechanical designs to reduce camera vibration on multirotor unmanned aircraft.
- Asymmetrical Quad/Hex-Rotor Failsafe Algorithm* 2014 – 2015
 Sponsor: Flirtey, Inc.
 Amount: \$15,000
 Role: Co-Principal Investigator
 Synopsis: Conducted feasibility study for operation of an unmanned quadrotor delivery drone with one or more propulsion failures.
- Fast Detection of Partially Occluded Humans from Mobile Platforms* 2014 – 2015
 Sponsor: Nevada Space Grant Consortium (NVSGC)
 Amount: \$30,000
 Role: Co-Principal Investigator
 Synopsis: Managed graduate student researching use of convolutional neural networks to detect humans from video streams under conditions of visual occlusion at real-time frame rates.

SELECTED INVITED TALKS

- A Byte-Sized Intro to AI & Ethics* October 2024
 Sponsor: Christian Legal Society
 Location: CLS National Conference, Washington, D.C.
 Synopsis: Continuing legal education talk on responsible use of generative AI technology for lawyers.
- Navigating the Virtual Road to Autonomous Driving:
 Using Simulations to Test, Train, and Validate Autonomous Vehicles* October 2020
 Sponsor: American Bar Association
 Location: Online continuing legal education course
 Synopsis: Continuing legal education discussion on legal issues related to testing autonomous vehicles.
- Maximizing the Societal Benefit of Robots and Autonomous Cars during a Pandemic* May 2020
 Sponsor: Istanbul Bar Association
 Location: Online talk
 Synopsis: Lecture on ways that robots could be used to improve public health and safety in a pandemic.
- Science Distilled: Robot Revolution?* April 2019
 Sponsor: The Discovery Museum
 Location: Reno, Nevada
 Synopsis: Popular science presentation about human-robot interaction research.

Apollo-Driven Intelligent Mobility in Nevada

August 2018

Sponsor: Baidu, Inc.

Location: The Computer History Museum, Mountain View, California

Synopsis: Keynote address about open-source software for autonomous vehicle research.

Intelligent Mobility in Nevada

September 2017

Sponsor: Ford Motor Company

Location: Ford Research and Innovation Center, Palo Alto, California

Synopsis: Technical talk covering my research on robot motion planning.

PUBLICATIONS

G. Evangelista, H. Xu, D. Wilson, R. Kelley, “Calibration of a Municipal-Scale Lidar Network Using An Autonomous Car.” 2025 (expected).

G. Evangelista, Z. Wang, H. Xu, R. Kelley, “Real-time Traffic Infrastructure Monitoring using Digital Twins Constructed via Lidar-Inertial Odometry.” 2025 (expected).

R. Kelley, “Behavior Trees Enable Structured Programming of Language Model Agents,” arXiv preprint arXiv:2404.07439. 2024.

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. 2012.
- 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. 2011.
- 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 135 - Computer Science I

Spring 2017

Lead Instructor

- Lectured on core concepts of computer science to approximately 200 students.
- Managed a team of approximately 20 teaching assistants and graders.
- Course contents: Basic computer architecture, basic programming abstractions, syntax and semantics of the C programming language, basic algorithms for searching and sorting, introduction to debugging C code with gdb, introduction to algorithm analysis.

CSE 493/693 - Directed Study: Unsupervised Learning

Spring 2017

Course Designer & Lead Instructor

- Taught core algorithms for neural networks to beginning graduate students.
- Course contents: Machine learning review, generative adversarial network training, basic concepts of variational inference from a statistical perspective, implementation of variational autoencoders.

CSE 793 - Independent Study: Deep Natural Language Processing

Spring 2017

Course Designer & Lead Instructor

- Introduced advanced graduate students to special topics at the intersection of deep learning and natural language processing.
- Course contents: Basic linguistics, core algorithms for neural network training and inference, word modeling using unsupervised algorithms, recursive neural networks for modeling tree structures, recurrent neural networks for sequence modeling, Python implementation of natural language processing algorithms.

CSE 491/691 - Foundations of Autonomous Systems: Math, Minds, and Machines

Fall 2016

Lead Instructor

- Oversaw student designing course material.
- Lectured on select topics including the lambda calculus and the Lisp programming language.
- Course contents: Overview of formal systems, discrete math, theoretical computer science, lambda calculus, philosophy of AI, ethical issues related to the use of technology, Lisp programming.

CSE 491/691Q - Deep Learning

Spring 2015

Course Designer & 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

Course Designer & 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

Course Designer & 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

Course Designer & 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

Course Designer & 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 young students (aged 14 to 17) to build and animate 3D models using open-source tools such as Blender.

ACADEMIC ADVISING

Gaetano Evangelista Ph.D. in Computer Science and Engineering, University of Nevada	Spring 2025 (expected)
Jennifer Clayton B.S. in Mechanical Engineering, University of Nevada	Spring 2023
Jamie Poston M.S. in Computer Science and Engineering, University of Nevada Thesis: <i>Predicting Agent Behavior By Estimating Motion Planners</i>	Spring 2020
Houston Lucas M.S. in Computer Science and Engineering, University of Nevada Thesis: <i>Differentiable Boundary Value Problem Solver</i>	Spring 2020
Niki Silveria M.S. in Computer Science and Engineering, University of Nevada Thesis: <i>Optimal Strategy Imitation Learning from Differential Games</i>	Winter 2017

MEDIA COVERAGE

<i>Waymo Testing Self-Driving Cars on Las Vegas Strip</i> http://tiny.cc/no6b001	31 January 2025
<i>Faces of the Pack: Jennifer Clayton discovers fascination for autonomous robotics</i> https://bit.ly/3ewjWdY	30 August 2022
<i>Is The Robotic Revolution Upon Us?</i> https://bit.ly/3qn3TBU KUNR Public Radio	14 August 2019
<i>Dell Luminaries Podcast: Artificial Intelligence ... Driving In the Streets</i> https://bit.ly/2PhXxTd	23 October 2018
<i>Apollo 3.0 Launch Event - Developer Highlight: Richard Kelley</i> https://bit.ly/2VaJ0aU	9 August 2018
<i>Can artificial intelligence help predict and prevent traffic accidents?</i> https://bit.ly/2VzM31D BBC Click	22 January 2018
<i>Proterra to test self-driving bus in downtown Reno</i> https://bit.ly/2LzOWKW SFGate	2 May 2017
<i>Don't Look Now, But Even Buses Are Going Autonomous</i> https://bit.ly/2pV69mD Wired Magazine	2 May 2017
<i>Drone Traffic Control</i> https://bit.ly/2Yn2gnI Breakground Magazine	11 April 2017

<i>UNR to test autonomous technology on Reno buses</i> http://tiny.cc/xo6b001 Reno Gazette Journal	18 January 2017
<i>Multiple drones flying beyond line of sight perform in first-ever tests by NASA</i> http://tiny.cc/po6b001	29 November 2016
<i>New lab with NASA enables research of air traffic platform concepts for unmanned aircraft</i> http://tiny.cc/vo6b001	20 April 2016
<i>Nevada researchers helping develop air traffic control for drones</i> https://bit.ly/30cK6qo Las Vegas Sun	7 August 2015
<i>Drone delivery start-up Flirtey taking on Google, Amazon</i> https://ab.co/2Hdb0vC ABC News	16 May 2015
<i>More drones, more jobs for Northern Nevada</i> http://tiny.cc/so6b001 Reno Gazette Journal	13 September 2014

ACADEMIC HONORS

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

COMMUNITY INVOLVEMENT

Community work and personal interests include Ancient Greek translation, guitar, serving as a volunteer Catechist teaching high school confirmation students, an OCIA Sponsor, and a regular content creator and weekly Cathedral bulletin producer for St. Thomas Aquinas Cathedral. Previous volunteer roles include instructor for the Northern Nevada Math Club, Head Coach for McQueen High School Speech and Debate, and Secretary for the Northern Nevada Forensic League.