

Verification, Validation, and Testing of Learning Systems

Saturday December 18, 2004

Dragos Margineantu, *Boeing, Mathematics & Computing Technology*

Johann Schumann, *RIACS, NASA Ames Research Center*

Pramod Gupta, *QSS Inc., NASA Ames Research Center*

Michael Drumheller, *Boeing, Mathematics & Computing Technology*

Roman Fresnedo, *Boeing, Mathematics & Computing Technology*

<http://www.dmargineantu.net/nips2004/>

Compared to the attention given to the development of new learning methods, our community has devoted only very little effort to developing principled approaches for (1) assessing the goodness of complex systems that contain learning components, (2) estimating the quality of the outputs of learned models in the context of the actual problem that needs to be addressed, (3) assessing online learning methods, (4) evaluating learning methods employed in safety-critical tasks, and for (5) understanding the tradeoffs between robustness and risk in making complex decisions.

Learning has the potential to provide several key advantages to adaptive, autonomous, and control systems: adaptability to changing environments, capability of processing different types of sensor data, and addressing multiple objectives in parallel - to name just a few. In the meantime, most of these systems require a reliable deployment and operation. In other words, for most applications, in order to be deployed, learning components need to be proven as trustable to the users (engineers, designers, quality control specialists). Failures of these systems can occur and will occur, regardless of whether they contain learned or learning components. Therefore, questions such as "what are the tradeoffs for improving the quality of the outputs of a learning system in a certain region of the space?", or "what can be inferred (regarding future decisions) from observing the operation of a learning system?" have deep ramifications and, and if answered can result in learning technology having a deeper impact on newly developed systems.

The workshop aims to explore the requirements of practical applications that make use of, or could benefit from learning methods, tasks in areas such as complex decision making, adaptive flight control, autonomous navigation, robotics, security, biology, and ecology.

We see this as an opportunity for bringing together researchers and users of learning and adaptive systems and to create a forum for discussing recent advances in verification, validation, and testing of learning systems, to understand better the practical requirements for developing and deploying learning systems, and to inspire research on new methods and techniques for verification, validation, and testing.

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Organizers: Dragos Margineantu, Johann Schumann, Pramod Gupta,
Michael Drumheller, Roman Fresnedo

Saturday morning session: 7:30am–10:30am

- 7:30am Opening Remarks
- 7:50am **Stable Adaptive Control with Online Learning.**, *Andrew Ng - Stanford University*
- 8:30am **Competence Maps: A Phase Transition Inspired Approach**,
Michèle Sebag - Université Paris-Sud
- 9:00am *Coffee break*
- 9:20am **Evaluation of Spatially Dependent Aggregations of Classifications**,
Bill Langford - NCEAS, University of California, Santa Barbara
- 9:40am **Robustness and Risk Trade-offs in Management Decisions for Endangered Species**,
Helen Regan - San Diego State University
- 10:00am **A Theoretical and Experimental Framework for the Validation and Testing of Learning Systems**,
Michael Drumheller, Roman Fresnedo - Boeing

Saturday afternoon session: 4:00pm–7:00pm

- 4:00pm **Confidence Tool for the Verification and Validation of Neural Network Based Controllers**,
Johann Schumann, Pramod Gupta - NASA Ames Research Center
- 4:20pm **Co-Validation: Using Model Disagreement to Validate Classification**,
Omid Madani, David Pennock, David Flake - Yahoo! Research Labs
- 4:40pm **Intelligent Flight Control: A Boeing Perspective**, *Jim Urnes Sr., Tim Smith - Boeing*
- 5:00pm **Weaving it All Together - A Methodology for the Verification and Validation of Adaptive Neural Networks**,
Brian J. Taylor, Marjorie Darrah, Spiro Skias - Institute for Scientific Research
- 5:20pm *Coffee break*
- 5:40pm **Levels of Verification for Adaptive Systems**, *KrishnaKumar Kalmanje - NASA Ames*
- 6:00pm **A Stability Monitoring System for Validating Online Learning**,
Sampath Yerramalla, Edgar Fuller, Bojan Cukic, Srikanth Gururajan, Yan Liu - W. Virginia U.
- 6:20pm **Characterizing Software Quality Assurance Methods: Impact on the Verification of Learning Systems**,
Frederick Sheldon - ORNL, Ali Mili - NJIT
- 6:40pm Wrap-up