Diego Mandelli

Title: R&D Scientist at Idaho National Laboratory
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Professional Interest: Develop and apply methods and algorithms to analyze, model, and manage complex systems

CORE COMPETENCIES

Stochastic Modeling	Optimization Methods	Machine Learning
Methods Development	System Modeling	Data Mining

SOFTWARE SKILLS

Computer Languages	Python, Latex
Front end	HTML, XML, JSON
Data analysis	Numpy/Scipy/Matplotlib, scikit-learn, Pandas, Tensorflow, Spacy, nltk, Pyomo, OpenBUGS
System engineering	OPM, SysML (entry level)
Applications	Eclipse, Knime, Matlab/Simulink
Platforms	MacOS, Ubuntu, Windows
Version control	GitLab/GitHub

PROFESSIONAL EXPERIENCE

Idaho National Laboratory: R&D Scientist August 2011 - Present

Project **Tasks**

RISA Leader of the "Cost and Risk Categorization Applications" work package. Developed an enterprise risk-analysis framework which integrates economic and reliability in a single analysis platform. R&D directions:
· Data analytics methods for equipment reliability data that integrate numeric and textual data
· Development of economic risk models for nuclear power plants
· Innovative methods to solve reliability models using metric spaces rather than set theory based operations for system reliability/health analysis
· Development of reliability models and methods released in the open source library SR2ML (https://github.com/idaholab/SR2ML)
· Discrete optimization methods for job scheduling and project prioritization in several forms: deterministic, stochastic and distributionally robust
· Development of optimization models released in the open source library LOGOS (https://github.com/idaholab/LOGOS)

RISMC Leader of the "Methods Development" work package. Performed classical and dynamic Probabilistic Risk Assessment (PRA) of nuclear systems. R&D directions:
· Data mining methods for analysis of large amounts of accident scenarios
· Adaptive sampling methods based on machine-learning algorithms
· Several dynamic PRA analyses performed including multi-unit modeling (first of its kind)
· Stochastic human reliability models for simulation-based PRA

RAVEN Project manager (starting 2021) and developer of the RAVEN open source code (github.com/idaholab/raven). R&D directions:
· Data mining methods for analysis of large amounts of accident scenarios
· Risk importance measures for dynamic PRA
· Model-based optimization methods through genetic algorithms
· Multi-objective optimization methods based on Pareto frontier and evolutionary methods

NEUP Integration of sensor and simulation data to predict core power generation using machine learning methods
OFBGT such as optimization and inverse Bayesian inference methods.

NEUP Integration of dynamic and classical PRA. R&D directions:
DPRA · Linking classical PRA models to system simulators
· Integration of simulation based data into event trees and fault trees
· Automatic generation of event trees and fault trees from simulation data
INL PI for the R&D project: *Exploratory Nuclear Reactor Safety Analysis and Visualization via Integrated*
LDRD *Topological and Geometric Techniques*. Developed software for visualization and analysis multi-dimensional data using topological decomposition methods (based on Morse-Smale regression) in collaboration with Scientific Computing and Imaging Institute (University of Utah).

U.S. Nuclear Regulatory Commission (NRC): Instructor 2018 - Present

· Instructor for the "P-102 Bayesian Inference in Risk Assessment" and "P-502 Bayesian Inference in Risk Assessment - Advanced Topics" courses. Topics covered: probability theory, computational Bayesian inference, uncertainty propagation on reliability models

Idaho State University: Adjunct Professor 2016

· Instructor for the "Reliability and Risk Assessment" class. Topics covered: computational statistical analysis, numeric reliability modeling, integration of machine learning methods with reliability models

The Ohio State University: Graduate Research Assistant 2005 - 2011

· Develop data mining methods (e.g., clustering) for analysis of nuclear accident sequences (i.e., multi-variate time series data), and data reduction using manifold analysis based algorithms

· Develop codes that implement several dynamic PRA methods (e.g., Markov-CCMT and Dynamic Event Trees) applied to the analysis of digital control and communication systems

EDUCATION

Ph.D Nuclear Engineering, The Ohio State University *June 2011*
M.S. Nuclear Engineering, The Ohio State University *March 2008*
Laurea Nuclear Engineering, Politecnico di Milano *October 2004*

SELECTED HONORS AND AWARDS

· INL Award: In recognition of top-notch technical research, presentation of research, quality of products and contribution to project management on the RISMC pathway methods development

· PSA 2013 Award "First runner-up for best student paper"; co-author of the paper "Adaptive Sampling Algorithms for Probabilistic Risk Assessment of Nuclear Simulations"

· ANS NISD *Honorable Mention Award* for the paper "Adaptive sampling using support vector machines"

· OSU Nuclear Engineering Achievement Award for Distinguished Research Support

· OSU Nuclear Engineering Achievement Award for Instant Impact

SELECTED PUBLICATIONS

D. Mandelli, C. Wang, M. Abdo, A. Alfonsi, P. Talbot, J. Cogliati, C. Smith, D. Morton, I. Popova, and S. Hess, "Development and application of a risk analysis toolkit for plant resources optimization," Tech. Rep. INL/EXT-20-59942, Idaho National Laboratory (INL), 2020

D. Mandelli, C. Wang, M. Abdo, K. Vedros, J. Cogliati, J. Farber, A. A. Rashdan, S. Lawrence, D. Morton, I. Popova, S. Hess, C. Pope, J. Miller, and S. Ercanbrack, "Industry use cases for risk-informed system health and asset management," Tech. Rep. INL/EXT-21-64377, Idaho National Laboratory (INL), 2021

D. Maljovec, S. Liu, B. Wang, D. Mandelli, P. T. Bremer, V. Pascucci, and C. Smith, "Analyzing simulation-based PRA data through traditional and topological clustering: A BWR station blackout case study," *Reliability Engineering & System Safety*, vol. 145, no. 1, pp. 262–276, 2015

D. Mandelli, A. Yilmaz, T. Aldemir, K. Metzroth, and R. Denning, "Scenario clustering and dynamic probabilistic risk assessment," *Reliability Engineering & System Safety*, vol. 115, pp. 146–160, 2013

T. Aldemir, S. Guarro, J. Kirschenbaum, D. Mandelli, L. Mangan, P. Bucci, M. Yau, B. Johnson, C. Elks, M. Stovsky, D. Miller, X. Sun, S. Arndt, Q. Nguyen, and J. Dion, *NUREG/CR-6985: A Benchmark Implementation of Two Dynamic methodologies for the reliability modeling of Digital Instrumentation and Control Systems*. Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC, 2009