Tao Wang

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EDUCATION

Doctor of Philosophy in Computer Science January 2024 – Present
University of Idaho, Moscow, Idaho Expected May 2027
Advisor: Dr. Aleksandar Vakanski
Relevant Coursework: Machine Learning, Deep Learning, NLP, Adversarial Machine Learning, Data Science

Bachelor of Science in Computer Science August 2022 – May 2023
University of Idaho, Moscow, Idaho

RESEARCH EXPERIENCE

Graduate Research Assistant January 2024 – Present
Department of Computer Science, University of Idaho, Moscow, Idaho
Develop machine learning and AI methods, including gradient boosting, neural networks, domain adaptation, and large language models, for predicting material properties and analyzing nuclear power plant safety data.

Directed Research (First Author): "A Temperature-Dependent Geometry-Corrected Stress Descriptor for Machine Learning-Based Prediction of Creep Rupture Life"
Collaborator: Idaho National Laboratory; funded by the INL LDRD Program

- Developed a physics-informed, temperature-dependent stress descriptor correcting for specimen geometry.
- Benchmarked six machine learning models, including gradient boosting and neural networks, on 2,433 tests.
- Gradient boosting with the descriptor performed best (R^2 = 0.914), outperforming conventional correlations.
- Manuscript under review at *Journal of Nuclear Materials*.

Directed Research (First Author): "Domain-Adaptation Machine Learning Approach for Correlation of Full-Sized Charpy Properties from Sub-Sized Tests"
Collaborator: Idaho National Laboratory; funded by the INL LDRD Program

- Designed a three-step ML framework to predict full-sized Charpy properties from sparse sub-sized tests.
- Combined uncertainty-aware dual sampling for data augmentation with sub-to-full label projection.
- Built a DS-AdaBN network to account for distribution differences between synthetic and measured data.
- Achieved R^2 of 0.957 for upper-shelf energy and 0.963 for ductile-to-brittle transition temperature.
- Manuscript under review.

Directed Research: "A Knowledge-Informed Large Language Model Framework for U.S. Nuclear Power Plant Shutdown Initiating Event Classification"
Collaborator: Idaho National Laboratory; funded by the U.S. Nuclear Regulatory Commission

- Co-developed a two-stage framework: knowledge-informed prescreening plus a fine-tuned BERT classifier.
- Classified shutdown initiating events for PRA in a highly imbalanced set of 10,928 U.S. nuclear plant reports.
- Used 44 domain-specific text patterns to exclude over 97% of irrelevant events; reached 93.4% accuracy.
- Co-developed a web-based NLP annotation tool deployed to Idaho National Laboratory.
- Published in the *Journal of Risk and Reliability*.

Directed Research: "Compilation of Creep Property Data for Nuclear Structural Materials"
Collaborator: Idaho National Laboratory; funded by the INL LDRD Program

- Supported literature search and data extraction, and performed data organization and cleaning.
- Contributed to a public, ML-ready database of 1,583 creep specimens from 54 peer-reviewed sources.

- Covers stainless steels, reactor pressure vessel steels, Inconel alloys, Zircaloy, and ferritic-martensitic steels.
- Released on the Materials Cloud Archive with open-source Python code; published in *Scientific Data*.
- Later expanded to 2,433 creep test records for the creep rupture life study above.

Undergraduate Capstone Project August 2022 – May 2023
Interdisciplinary Capstone Design Program, University of Idaho, Moscow, Idaho
Project: "Spear of Ares: Tube-Deployed Reentry Vehicle for Mars Weather Station"
Partner: NASA Ames Research Center

- Member of a seven-person interdisciplinary team that designed, built, and flight-tested the prototype.
- Payload combined a spring-deployed drag skirt, custom multilayer PCBs, and an ESP32 flight computer.
- Implemented FreeRTOS flight software with publish–subscribe communication and a ground tracking GUI.
- High-altitude balloon drop reached 6,688 m apogee (12.7 m/s terminal velocity, 0.90 drag coefficient).
- Received the Best Booth Presentation award at the University of Idaho Engineering Design EXPO 2023.

PUBLICATIONS

Manuscripts Under Review

Tao Wang, John W. Merickel, Yalei Tang, Fei Xu, Aleksandar Vakanski, and Rongjie Song. "A Temperature-Dependent Geometry-Corrected Stress Descriptor for Machine Learning-Based Prediction of Creep Rupture Life." Under review at *Journal of Nuclear Materials*.

Tao Wang, John W. Merickel, Yalei Tang, Fei Xu, Aleksandar Vakanski, and Rongjie Song. "Domain-Adaptation Machine Learning Approach for Correlation of Full-Sized Charpy Properties from Sub-Sized Tests." Under review.

Peer-Reviewed Journal Articles

Isshu Lee, John W. Merickel, Boopathy Kombaiah, Yalei Tang, **Tao Wang**, Fei Xu, Rongjie Song, and Aleksandar Vakanski. 2026. "Compilation of Creep Property Data for Nuclear Structural Materials." *Scientific Data* 13: 1262. https://doi.org/10.1038/s41597-026-07563-y

Min Xian, **Tao Wang**, Sai Zhang, Fei Xu, and Zhegang Ma. 2025. "A Knowledge-Informed Large Language Model Framework for U.S. Nuclear Power Plant Shutdown Initiating Event Classification for Probabilistic Risk Assessment." *Proceedings of the Institution of Mechanical Engineers, Part O: Journal of Risk and Reliability* 239 (6): 1257–1264. https://doi.org/10.1177/1748006x251386900

DATASETS AND SOFTWARE

Creep Property Dataset for Nuclear Structural Materials, Materials Cloud, doi:10.24435/materialscloud:99-xr

Web-based NLP annotation tool for shutdown initiating events; deployed to Idaho National Laboratory.

HONORS & AWARDS

Best Booth Presentation, Engineering Design EXPO, University of Idaho May 2023
Dean's List, University of Idaho August 2022 – May 2023
Invitation to Idaho Scholarship, University of Idaho August 2022 – May 2023

SKILLS

Research & Analysis: Machine learning, large language models, natural language processing, domain adaptation, physics-informed machine learning, uncertainty quantification, scientific data curation

Domain Knowledge: Nuclear power plant safety, probabilistic risk assessment (PRA), nuclear structural materials, Charpy impact testing, creep rupture behavior