Arinan Dourado

Resume

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Professional Narrative

AI assurance and trustworthy AI researcher whose career has progressed from uncertainty, robustness, and reliability analysis of mechanical systems to the development and evaluation of learning-enabled systems in engineering, healthcare, and education. Two PhD degrees established complementary foundations in mechanical-system reliability and probabilistic machine learning. Industrially sponsored research then translated those foundations into physics- and domain-informed neural networks, Bayesian calibration, and prognostic methods for sparse-data and missing-physics problems. As an Assistant Professor, I now lead a multidisciplinary research group that asks a broader question: what evidence is required to determine whether an AI system is worthy of reliance in its intended operating environment? My work develops assurance evidence that extends beyond predictive accuracy. I'm the lead proponent of an engineering-trustworthiness framework that emphasizes AI-enabled decisions' robustness to perturbations, consistency with physical or domain knowledge, familiarity and stability under current operating conditions, and reproducibility of predictions and explanations. This engineering-trustworthiness perspective connects model development with validation strategy, risk identification, documented limitations, and responsible deployment. It has been applied across prognostics and health management, autonomous and intelligent systems, neuro-oncology, orthopedics, and engineering education. I combine this technical trajectory with program and quality-system leadership. I have built collaborations across engineering, medicine, and international institutions, and led a six-year ABET accreditation review completed with no deficiencies, weaknesses, or concerns. These experiences position me to contribute to AI assurance, model governance, validation, and R&D organizations that must translate technical evidence into defensible decisions for high-consequence applications.

AI Assurance and Research Expertise

Assurance	AI use-case and risk framing; validation strategy; acceptance criteria; robustness and sensitivity analysis; uncertainty and calibration; distribution shift; reproducibility; lifecycle evidence and limitations.
Trustworthy AI	Engineering trustworthiness; explainability and explanation stability; physics- and domain-consistency assessment; traceability; responsible deployment; monitoring and continuous-improvement concepts.
R&D	Study design; comparative modeling; cross-validation; external-validation planning; experimental analysis; technical roadmaps; interdisciplinary proposal development; peer-reviewed dissemination.
Technical	Python; MATLAB; SHAP; LIME; machine learning methods; optimization, dynamics, control, and uncertainty quantification.

Selected Projects

Trustworthy AI — **Engineering Trustworthiness and TRUST research initiative.** Develops integrated assurance evidence for predictive robustness, domain consistency, operational familiarity and stability, and reproducibility of predictions and explanations. Current studies examine whether these dimensions identify distinct failure modes and provide more decision-relevant evidence than existing strategies.

Clinical AI — **Trustworthy neuro-oncology decision support.** Integrates clinical, laboratory, demographic, and radiographic variables for meningioma characterization and postoperative outcome prediction. The project emphasizes patient-level explanations, external validation, and role-appropriate communication rather than automated diagnosis.

Clinical AI — **Explainable AI for personalized orthopedic care.** Combines demographic, preoperative, radiographic, intraoperative, and outcome data to study procedure selection and high patient-reported outcomes following total knee arthroplasty, with interpretable evidence supporting clinician judgment and shared decisions.

Education — **Explainable ML for engineering persistence.** Co-leads an NSF-funded research project with the objective of responsible decision support for mentoring engineering students.

Industrial AI — **Domain-informed prognostics and intelligent systems.** Applies physics-informed neural networks, Bayesian inference, surrogate models, vibration analytics, and robust control to rotating machinery, wind-energy systems, and fleet health management.

Professional Experience and Trajectory

2021--Present — **Assistant Professor of Mechanical Engineering | Trustworthy AI Research Lead**, *University of Louisville*, Louisville, KY

- Leading a growing research portfolio at the intersection of AI assurance, engineering systems, and human-centered decision support. The program began with interpretable and domain-informed ML for engineering applications and expanded through collaborations with neurosurgeons, orthopedic surgeons, and engineering education researchers. Current work focuses on developing a multidimensional engineering-trustworthiness construct encompassing predictive performance and robustness, physics/domain consistency, operational familiarity and stability, and prediction/explanation reproducibility.
- Translate domain questions into assurance-oriented R&D plans by defining intended use, evidence requirements, validation protocols, limitations, and decision criteria.
- This position also includes a component of organization-level assurance and quality leadership through my role as the Chair of the Mechanical Engineering ABET assessment process, coordinating evidence, performance measures, corrective actions, faculty review, and audit-ready documentation. The resulting six-year accreditation review reported no deficiencies, weaknesses, or concerns.
- Advise approximately five concurrent AI/ML projects with GE Appliances, guiding problem definition, responsible data use, validation, limitations, sponsor communication, and delivery.

2018--2021 — **Researcher and Teaching Associate | Machine Learning for Prognostics**, *University of Central Florida*, Orlando, FL

- Conducted applied R&D on a GE Aviation-funded program addressing system health management under sparse data and model-form uncertainty.
- Developed a hybrid neural-network architecture for bias correction and missing-physics estimation in cumulative degradation models; investigated Bayesian calibration of failure models with limited observations; and contributed to reusable Python software for neural-network formulation and training.
- This role established the bridge between an earlier foundation in mechanical reliability and a later focus on evidence-based assurance of learning-enabled systems.

2015--2018 **Lecturer | Dynamic Systems and Engineering Analysis**, *UNA Uberlandia*, Uberlandia, Brazil

- Taught dynamics, vibration, thermofluids, and design while advising more than 100 capstone students and helping implement a project-based capstone curriculum.
- Developed the ability to translate complex mathematical and engineering evidence into structured decisions for audiences with varied technical backgrounds, a capability central to multidisciplinary AI assurance and governance.

Education and Technical Foundation

2021 **PhD, Mechanical Engineering**, *University of Central Florida*, Orlando, FL
Probabilistic mechanics and machine learning; physics-informed neural networks for model-form and data uncertainty in fleet management.

2018 **PhD, Mechanical Engineering**, *Federal University of Uberlandia*, Brazil
Uncertainty quantification, robustness, reliability, fuzzy methods, and vibration of mechanical systems.

2013 **MSc, Chemical Engineering**, *Federal University of Uberlandia*, Brazil
Petrochemical process simulation and optimization.

2011 **BSc, Chemical Engineering**, *Federal University of Uberlandia*, Brazil

Research Leadership, Funding, and Professional Contribution

Funding Co-PI, NSF IUSE: EDU, $600K grant. Lead developer for interdisciplinary NSF proposals in human-centered clinical AI and trust-aware autonomy; developing NIH-aligned clinical decision-support research.

Leadership Chair, Mechanical Engineering ABET Program Assessment Committee; PhD advisor and co-advisor across U.S. and international institutions; research mentor to multidisciplinary engineering and clinical collaborators.

Peer review NSF proposal reviewer, 2022--2025, and reviewer for engineering and applied-AI journals. Experienced in assessing intellectual merit, rigor, feasibility, validation, broader impacts, and the alignment between claims and evidence.

Impact 732 citations; h-index 12; i10-index 13 (Google Scholar, August 2026). Faculty Favorites Award, University of Louisville, 2022--2023.

Representative Publications

1. **A. Dourado** and F. A. C. Viana, ''Physics-informed neural networks for missing physics estimation in cumulative damage models: a case study in corrosion fatigue,'' ASME Journal of Computing and Information Science in Engineering, Vol. 20 (6), 10 pages, 2020, DOI: 10.1115/1.4047173.
2. Y. A. Yucesan, **A. Dourado** and F. A. C. Viana, ''A survey of modeling for prognosis and health management of industrial equipment,'' Advanced Engineering Informatics, Vol. 50, 2021, DOI: 10.1016/j.aei.2021.101404.
3. P. Ostrov, R. Jani, M. Mullick, N. Rama, A. Avula, A. Chopra, **A. Dourado**, I. Abecassis, A. Mistry, and B. Williams, ''Predicting Who Grade in Meningioma Surgery: Development of an Unbiased Variable Selection and Validation Approach Using Preoperative Clinical and Radiographic Data,'' Journal of Neurological Surgery Part B: Skull Base, 2025, DOI: 10.1055/s-0045-1803224.
4. A. Duncan, A. Malkani, M. Stoltz, N. Ahmed, M. Mullick, J. Whitaker, A. Swiergosz, L. Smith, and **A. Dourado**, ''Machine Learning Model for Selection of Cementless Total Knee Arthroplasty Candidates Utilizing Patient and Radiographic Parameters,'' Journal of Orthopaedic Research, 2025, DOI: 10.1002/jor.70059.
5. M. De Oliveira, L. Sicchieri, **A. Dourado**, A. Cavalini, ''Kriging-Based Surrogate Controller for Robust Control of a Flexible Rotor Supported by Active Magnetic Bearings,'' Journal of Engineering for Gas Turbines and Power, Vol. 145 (7), 2023, DOI: 10.1115/1.4062104.