DEPARTMENT OF COMPUTER SCIENCE

TEXAS TECH
Whitacre College of Engineering

Algorithmic Precision: Harnessing Machine Learning, Computational Biology, and QSAR Modeling to Advance Personalized Medicine

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Tuesday, September 30, 2025
3:30 p.m.
TFPETR 110

Abstract: In this talk, I will present an overview of algorithmic frameworks developed in my laboratory to address key challenges in personalized medicine. The discussion will focus on three primary directions: (a) the REFINED CNN framework, which leverages Bayesian multidimensional scaling to transform high-dimensional vectors into compact image representations, thereby enabling convolutional neural network–based feature extraction and improved predictive accuracy; (b) the design of a similarity-driven Topological Regression framework, providing a statistically rigorous method for predicting drug responses that achieves performance comparable to state-of-the-art deep learning approaches, while offering substantially lower computational cost and enhanced interpretability; and (c) recent progress in model evaluation and reusability assessment, aimed at ensuring robustness and reproducibility in personalized medicine applications.

Bio: Ranadip Pal received the BTech degree in electronics and electrical communication engineering from the Indian Institute of Technology, Kharagpur, India, in 2002, and the MS and PhD degrees in electrical engineering from Texas A & M University, College Station, in 2004 and 2007, respectively. From 2007, he has been with Texas Tech University where he is currently a professor in the Electrical and Computer Engineering Department. His research areas are genomic signal processing, computational systems biology, machine learning and stochastic modeling and control. He is the author of more than 100 peer-reviewed articles including publications in high impact journals such as Nature Medicine, Nature Communications and Cancer Cell and author of a book entitled “Predictive Modeling of Drug Sensitivity”. He has contributed extensively to robustness analysis of genetic regulatory networks and predictive modeling of drug sensitivity. His research has been supported through NSF, NIH, DOE and USDA grants including NSF Career and NIH R01s. Pal received the Whitacre Faculty fellow in 2018, Chancellor’s council distinguished research award in 2016, Whitacre Research Award, 2014; President’s excellence in Teaching Award, 2012; and NSF CAREER Award, 2010.