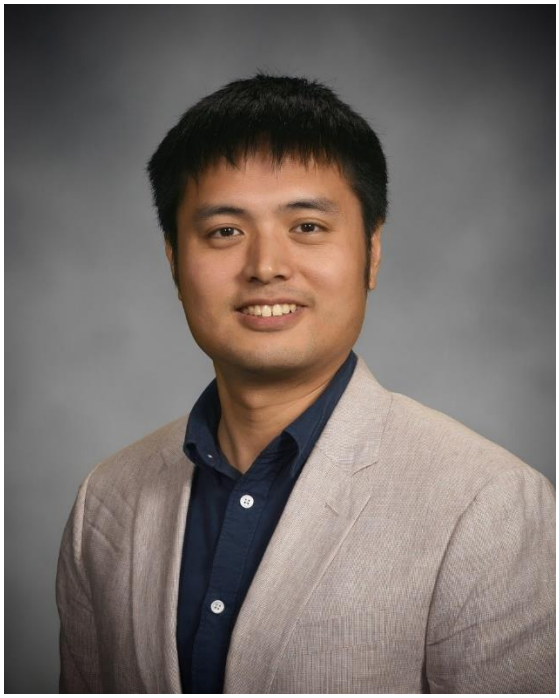
Structural Engineering Seminar Series

CEE 595 S



Embedding Physical Constraints in Learning Models

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Abstract:

Gaussian process (GP) regression is a widely used method in machine learning for classification, supervised learning, etc. The standard GP regression is a data driven method that uses observations (e.g., measurements) of a state of interest to construct a GP that describe the state. In many scientific and engineering problems, existing knowledge are available in the form of physical laws, governing equations, etc., that reflect (partial) understanding of the system. I will introduce two frameworks that incorporate these knowledge in a GP model. The first one uses state-of-the-art simulation tools in specific domain to construct a GP that satisfies constraints in the form of equations, e.g., Dirichlet boundary condition, divergence-free flow field, conservation law. The other one is a data-driven method that imposes constraints in the form of inequalities, e.g., positivity, monotonicity, with high probability.

Bio:

Xiu Yang is an assistant professor at Department of Industrial and System Engineering, Lehigh University. Before joining Lehigh, he was a staff scientist at Pacific Northwest National Laboratory (PNNL) since 2016. His research is focused on modern scientific computing including uncertainty quantification, multi-scale modeling, physics-informed machine learning, and data-driven scientific discovering. He received the Outstanding Performance Award from PNNL in 2015 and 2016. Xiu served on the DOE applied mathematics visioning committee (guided by Computational Research Leadership Council) in 2018. Xiu obtained his Ph.D. in the Division of Applied Mathematics at Brown University. He received his B.S. and M.S. in Computational Mathematics at Peking University, China.

Monday, December 14th, 2020 4:00 – 5:00 p.m. (CDT)

RSVP: https://go.cee.illinois.edu/RSVP-Seminar-by-Xiu-Yang