

George Karniadakis, BINNS: Biophysics-Informed Neural Networks

April 7 @ 11:00 am - 12:00 pm KST

ZOOM ID: 997 8258 4700 (Biomedical Mathematics Online Colloquium), (pw: 1234) + Google Map https://www.ibs.re.kr/bimag/event/binns-biophysics-informed-neural-networks/



SPEAKER

George Karniadakis Brown University

Abstract: We will present a new approach to develop a data-driven, learning-based framework for predicting outcomes of biophysical systems and for discovering hidden mechanisms and pathways from noisy data. We will introduce a deep learning approach based on neural networks (NNs) and on generative adversarial networks (GANs). Unlike other approaches that rely on big data, here we "learn" from small data by exploiting the information provided by the mathematical physics, e.g.., conservation laws, reaction kinetics, etc., which are used to obtain informative priors or regularize the neural networks. We will demonstrate how we can train BINNs from multifidelity/multimodality data, and we will present several examples of inverse problems, e.g., in systems biology for diabetes and in biomechanics for non-invasive inference of thrombus material properties. We will also discuss how operator regression in the form of DeepOnet can be used to accelerate inference based on historical data and only a few new data, as well its generalization and transfer learning capacity.

IBS (기초과학연구원)