



MACHINE LEARNING FOR EARTH SYSTEM SCIENCES

PROF. ADWAY MITRA

Centre of Excellence in Artificial Intelligence
IIT Kharagpur

PRE-REQUISITES : Machine Learning (mandatory), Deep Learning (optional), a working idea of one or two domains in earth system sciences

INTENDED AUDIENCE : Final year undergraduate, Postgraduate and research students

COURSE OUTLINE :

This course will start with a gentle recapitulation of relevant concepts of spatio-temporal statistics and data mining, following which it will take up the topics of earth system observations, earth system data analytics and earth system modeling in various domains, such as hydrology, climate and soil.

ABOUT INSTRUCTOR :

Prof. Adway Mitra is an assistant professor at the Centre of Excellence in AI. He works in the domain of Machine Learning and its applications in climate, remote sensing and modeling of physical processes. He designed and launched the course “Machine Learning for Earth System Sciences” in IIT Kharagpur, that is offered in every Spring Semester since 2020.

COURSE PLAN :

Week 1: Recap of probability, spatio-temporal statistics (autoregression, geostatistical equation, Gaussian Processes, Extreme value statistics)

Week 2: Recap of relevant Machine Learning and Deep Learning techniques (Bayesian Networks, CNN, RNN/LSTM, VaE, Interpretability, Causality)

Week 3: Earth System Process Understanding: case studies (predictors of monsoon, extreme weather forecasting, climate change visualization)

Week 4: Earth System Process Understanding: case studies(Extreme event analysis, networks and teleconnections, causal analysis)

Week 5: Earth System Process Understanding: case studies(Extreme event analysis, networks and teleconnections, causal analysis)

Week 6: Earth System Process Understanding: case studies(Extreme event analysis, networks and teleconnections, causal analysis)

Week 7: Earth System Modeling: relevant concepts (Model structures, modeling challenges, model validation, data assimilation)

Week 8: Earth System Modeling: applications in different domains (ML-based surrogate models, deep and shallow generators, long-term forecasting)