Understanding climate variability with statistical machine learning and artificial intelligence

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Recent years have seen a boom in the application of statistical machine learning and deep learning methods to tackle problems in meteorology and climate science.

In this talk, I will present three projects ongoing in my group that use machine learning concepts to understand climate variability. I will show how we can use similarity-based networks of climate time series data to reveal new features of intraseasonal variability of extreme rainfall propagation over South Asia in the summer that might potentially be useful for early warning systems of extreme monsoonal rain. I will next present how we can use principal component analysis in combination with Gaussian Mixture Models to categorize extreme phases of the El Niño Southern Oscillation (ENSO) and show how the Eastern Pacific El Niño is better modeled as two separate categories: a weaker 'canonical' form and an extreme El Niño, both of which show distinct idiosyncratic onset and development. Last, I will present how we can leverage deep learning to develop purely data-driven models for subseasonal-to-seasonal forecasting of the ENSO that are at par with state-of-the-art physics based weather prediction models. Finally, we will briefly talk about what these recent developments mean for understanding and modelling climate variability over the Indian subcontinent.

About the Speaker

Bedartha Goswami graduated from IISER Pune in 2011 and completed his PhD at the Potsdam Institute for Climate Impact Research in 2015. He has a background in climate data science, drawing upon ideas from nonlinear dynamics and chaotic dynamical systems, nonlinear time series analysis methods, statistical data analysis, Bayesian inference, and machine learning. Since 2020, he is leading a research group at the University of Tübingen on "Machine Learning in Climate Science." His research is focused on finding principled methods to estimate low dimensional representations of climate variability and using data-driven models to predict weather patterns at the subseasonal-to-seasonal scale.

All are welcome