Speaker: Jonathan Koh (ETH Zurich)

Date: 11/12/2025 at 15:15 in 4 West 1.2

Title: Extreme-value modelling of migratory bird arrival dates: insights from citizen science data

Abstract:
Citizen science mobilizes many observers and gathers huge datasets but often without strict sampling protocols, resulting in observation biases due to heterogeneous sampling effort, which can lead to biased predictions. We develop a spatio-temporal Bayesian hierarchical model for bias-corrected estimation of arrival dates of the first migratory bird individuals at their breeding sites. Higher sampling effort could be correlated with earlier observed dates. We implement data fusion of two citizen-science datasets with fundamentally different protocols (Breeding Bird Survey, eBird) and obtain posterior distributions of the latent process, which contains four spatial components endowed with Gaussian process priors: species niche; sampling effort; position and scale parameters of annual first arrival date. The data layer consists of four response variables: counts of observed eBird locations (Poisson); presence–absence at observed eBird locations (Binomial); BBS occurrence counts (Poisson); first arrival dates (generalized extreme-value). We devise a Markov chain Monte Carlo scheme and check by simulation that the latent process components are identifiable. We apply our model to several migratory bird species in the northeastern US for 2001–2021 and find that the sampling effort significantly modulates the observed first arrival dates. We exploit this relationship to effectively bias-correct predictions of the true first arrivals.