THE UNIVERSITY OF CHICAGO

Computational and Applied Mathematics & Statistics Student Seminar

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Localized Conformal Prediction with Random Weights: Randomization Enables Robustness

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ABSTRACT

Conformal prediction (CP) is an increasingly popular framework for building prediction intervals with distribution-free guarantees, but these guarantees only ensure marginal coverage: the probability of coverage is averaged over a random draw of both the training and test data, meaning that there might be substantial under-coverage within certain subpopulations. Instead, in this talk, I will consider the problem of building distribution-free prediction intervals with finite-sample conditional coverage guarantees as ideally, one would want to have. While the impossibility of achieving pointwise local coverage is well established in the literature, many variants of conformal prediction algorithm show favorable local coverage properties empirically. Relaxing the notion of local coverage can allow for a theoretical understanding of this empirical phenomenon. In this talk, I will focus on bridging this gap between theoretical validation and empirical performance by showing achievable and interpretable guarantees for a relaxed notion of local coverage. Building on the localized CP method of Guan (2023) and the weighted CP framework of Tibshirani et al. (2019), I would introduce our new proposal, randomly-localized conformal prediction (RLCP), which returns prediction intervals that are not only marginally valid, but also achieves a relaxed local coverage guarantee and guarantees under 'nice' covariate shift.