Computational and Data Enabled Science Seminar

TMulti-Objective Optimization for Best Early Prediction of Extreme Weather Events

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Abstract: In this project, we aim to solve a multi-objective optimization problem regarding the placement, cost, and quality of the meteorological sensing instruments for best early predictions of extreme weather events. This is described by the so-called significance function. Depending on the form of the given data, we proposed two different approaches: a shape-packing strategy and Nonomura's singular value decomposition strategy. The first one leads us to place the sensors in areas with a high significance value in the domain. The Pareto optimality is then applied to judge the best configuration of types and locations for sensors. The second approach approximates the significance fields over the entire domain of study based on historical data. We further proposed the concept of essential dimension, which is the "as linearly independent as possible" information seen by a high grade sensor. Essential dimension will answer the cost-quality trade off problem. The users with a significance function at hand can apply shape-packing strategy while those with historical significance data can implement the second approach to best place the sensors in the domain.

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