Robust Multi-Task Learning Algorithms for Predictive Modeling of Spatial and Temporal Data

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The significant growth of spatial and temporal data has been witnessed in recent years in many disciplines, including geophysical science, neuroscience, and epidemiology. However, due to their non-i.i.d nature, conventional single-task learning approaches may not be as effective for building predictive models on such data especially when there are limited training examples available. The goal of this thesis is to develop novel multi-task learning approaches for modeling spatial and temporal data. Specifically, three problems on spatial and temporal data are investigated, including multi-modal time series classification, multi-location time series regression, and multi-step-ahead ensemble forecasting. And multi-task learning frameworks are developed to address the corresponding challenges, such as spatial autocorrelation, temporal dependency, block-missing value problem, and data distribution preserving. Experiments on real world spatial and temporal data furthermore show the performances of the proposed approaches.