Analysis of Economic Data With Multiscale Spatio-temporal Models

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We develop a new class of multiscale spatio-temporal models for Gaussian areal data. Our framework decomposes the spatio-temporal observations and underlying process into several scales of resolution. Under this decomposition the model evolves the multiscale coefficients through time with structural state-space equations. The multiscale decomposition considered here, which includes wavelet decompositions as particular case, is able to accommodate irregular grids and heteroscedastic errors. The multiscale spatio-temporal framework we develop has several salient attributes. First, the multiscale decomposition leads to an extremely efficient divide-and-conquer estimation algorithm. Second, the multiscale coefficients have an interpretation of their own; thus, the multiscale spatio-temporal framework may offer new insight on understudied multiscale aspects of spatio-temporal observations. Finally, deterministic relationships between different resolution levels are automatically respected for both the observations, the latent process, and the estimated latent process. We illustrate the use of our multiscale framework with two examples. First, we analyze a simulated dataset of functional data with temporally evolving functions. Finally, we analyze a spatio-temporal dataset on agriculture production in the state of Espirito Santo, Brazil.

References

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