Ming-Yen Cheng
(National Taiwan University)

Nonparametric modeling of dynamical seasonality and trend with heteroscedastic and dependent errors

Seasonality (or periodicity) and trend are features describing an observed sequence, and extracting these features is an important issue in many scientific fields. However, it is not an easy task for existing methods to analyze simultaneously the trend and dynamics of the seasonality such as time-varying frequency and amplitude, and the adaptivity of the analysis to such dynamics and robustness to heteroscedastic, dependent errors is not guaranteed. These tasks become even more challenging when there exist multiple seasonal components. We propose a nonparametric model to describe the dynamics of multi-component seasonality, and investigate the recently developed Synchrosqueezing transform (SST) in extracting these features in the presence of a trend and heteroscedastic, dependent errors. The identifiability problem of the nonparametric seasonality model is studied, and the adaptivity and robustness properties of the SST are theoretically justified in both discrete- and continuous-time settings. Consequently we have a new technique for de-coupling the trend, seasonality and heteroscedastic, dependent error process in a general nonparametric setup. Results of a series of simulations are provided, and the incidence time series of varicella and herpes zoster in Taiwan and respiratory signals observed from a sleep study are analyzed. This is joint work with Yu-Chun Chen and Hau-Tieng Wu.