Dynamic Bayesian Prediction and Calibration using Multivariate Sensor Data Streams

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Abstract: There is a critical need to understand the temporal dynamics of depression using real-time, objective measures. We introduce a flexible multivariate time series model to analyze multiple sensor data streams collected at distinct time scales (minutely, daily, and quarterly) with occasional missingness (due to failure to wear wristbands or carry smartphones). Our model predicts interns' mood and estimates the profile of lagged effects for each predictor time series by sharing information both across time, to account for smooth time-varying associations, as well as across similar subjects. We illustrate our methods using data from the 2017-18 Intern Health Study cohort recruited at University of Michigan. Lastly, we discuss computational issues and the practical implications of our results in the analysis of emerging intensive longitudinal data in mobile health.