A Location-Mixture Autoregressive Model for online forecasting of lung tumor motion

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Lung tumor tracking for radiotherapy requires real-time, multiple-step ahead forecasting of a quasi-periodic time series recording instantaneous tumor locations. We introduce a location-mixture autoregressive (LMAR) process that admits multimodal conditional distributions, fast approximate inference using the Expectation-Maximization algorithm and accurate multiple-step ahead predictive distributions. LMAR outperforms several commonly used methods in terms of out-of-sample prediction accuracy using clinical data from lung tumor patients. With its superior predictive performance and real-time computation, the LMAR model could be effectively implemented for use in current tumor tracking systems.

Keywords: radiotherapy; nonlinear; motifs; prediction