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*Path Signatures and Topological Time Series Analysis*

Let $\{\gamma_i\}_{i=1}^n$ be a collection of $n$ simultaneous time series $\gamma_i : [0,1] \to \mathbb{R}$. By viewing this collection of time series as a path $\gamma = (\gamma_1, \ldots, \gamma_n) \in P\mathbb{R}^n$, we may consider the 0-cochains in Chen's iterated integral cochain model for $P\mathbb{R}^n$ as a complete, reparametrization-invariant feature set for paths (and thus collections of time series). Standard tools for time series analysis such as Fourier analysis and cross-correlation often depend on the exact parametrization of the input, but measured data is rarely parametrized in the same manner as the underlying value of interest. In addition, many properties of interest, such as the existence of a lead-lag relationship between time series, are also not parametrization dependent. We present algebraic and statistical properties of path signatures, and outline possible applications.