Conference Pathwise Stochastic Analysis and Applications
CIRM (Marseille, France) — March 8-12, 2021
Organized by GdR TRAG (INSMI-CNRS)

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# Sig-Wasserstein Generative models to generate realistic synthetic time series

Wasserstein Generative adversarial networks (WGANs) have been very successful in generating samples, from seemingly high dimensional probability measures. However, these methods struggle to capture the temporal dependence of joint probability distributions induced by time-series data. Furthermore, training WGANs is computational expensive due to the min-max formulation of the loss function. To overcome these challenges, we integrate Wasserstein GANs with mathematically principled and efficient path feature extraction called the signature of a path. The signature of a path is a graded sequence of statistics that provides a universal description for a stream of data, and its expected value characterises the law of the time-series model. In particular, we a develop new metric, (conditional) Sig-W1, that captures the (conditional) joint law of time series models, and use it as a discriminator. The signature feature space enables the explicit representation of the proposed discriminators which alleviates the need for expensive training. We validate our method on both synthetic and empirical dataset and observe that our method consistently and significantly outperforms state-of-the-art benchmarks with respect to measures of similarity and predictive ability.

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