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New techniques for empirical processes of dependent data

Let $(X_i)_{i\geqslant 1}$ be a stationary ergodic process with marginal distribution function $F(x) := P(X \leqslant x)$. We define the empirical distribution function $F_n : \mathbb{R} \to [0,1]$ and the empirical process $(U_n(x))_{x\in\mathbb{R}}$ by

$$\begin{aligned} F_n(x) &= \frac{1}{n}\sum_{i=1}^{n} 1_{\{X_i\leqslant x\}} \\ U_n(x) &= \sqrt{n}(F_n(x) - F(x)). \end{aligned}$$

In our talk we present a recent technique that allows to establish empirical process invariance principles when the underlying process $(X_i)_{i\geqslant 1}$ is weakly dependent. The technique is particularly suitable for Markov processes and dynamical systems where the CLT for partial sums can be established via spectral gap techniques. Our main theorem requires two conditions, namely the CLT for $\sum_{i=1}^n \phi(X_i)$ and some bound on $E(\sum_{i=1}^n \phi(X_i))^4$, for all Lipschitz functions $\phi : \mathbb{R} \to \mathbb{R}$ satisfying $E(\phi(X_1)) = 0$. We also present some recent extensions to the multivariate case; here we require a multiple mixing condition that is e.g. satisfied in the example of non-hyperbolic torus automorphisms.

Joint work with Olivier Durieu (Tours) and Dalibor Volny (Rouen)

Bibliografia

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