# Probabilistic Takens embedding theorem

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*Takens-type embedding theorems* deal with the problem of reconstructing a dynamical system from a sequence of measurements performed via a one-dimensional observable. Classical results of that type state that for a typical observable $h : X \to \mathbb{R}$, every initial state $x$ of an aperiodic system $(X, T)$ is uniquely determined by a sequence of $k$ measurements (i.e. the map $x \mapsto (h(x), h(Tx), \ldots, h(T^{k-1}x))$ is injective) as long as $k > 2\dim(X)$. We prove ([1]) that in a probabilistic context, the number of measurements can be reduced by a factor of two: if $k > \dim_H(\mu)$, then $\mu$-*almost every* initial point can be uniquely reconstructed, where $\mu$ is any finite Borel measure on $X$. The possibility of reducing twice the number of measurements for natural measures of smooth diffeomorphisms was conjectured by Schroer, Sauer, Ott and Yorke [2]. We prove a modified version of this conjecture and construct examples showing the necessity of these modifications. We also obtain a non-dynamical embedding theorem in terms of almost sure injectivity of typical linear maps. The talk is based on joint works with Krzysztof Barański and Yonatan Gutman.

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## References

[1] Krzysztof Barański, Yonatan Gutman, Adam Śpiewak *A probabilistic Takens theorem* Nonlinearity **33** (2020) 4940

[2] Christian G. Schroer, Tim Sauer, Edward Ott, and James A. Yorke. *Predicting chaos most of the time from embeddings with self-intersections.* Phys. Rev. Lett., **80** (1998) 1410–1413.