Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Using chaos to model random symbols for improved unsupervised information processing[1] SUMONA MUKHOPADHYAY[2], HENRY LEUNG[3], Department of Electrical and Computer Engineering, University of Calgary — We present theoretical analyses that may allow strengthening the connection between chaotic dynamical system and information processing. The analytical and empirical studies prove that computing with chaos and nonlinear characterization of information improves unsupervised information processing. Traditional supervised techniques for information retrieval from noisy environment achieve optimal performance. However, the need for training symbols is an inefficient strategy. We prove that with a chaotic generator as an information source, unsupervised performance is close to that of supervised with a white Gaussian stochastic process. Analytical results show that unsupervised technique using chaotic symbolic dynamics is equivalent to that of supervised when using random symbolic information. We conclude from the concepts of measure theory and ergodic theory, that random symbolic information can be modeled by a chaotic dynamical system via symbolic dynamics. We observe that the performance of unsupervised information retrieval is equivalent to that of supervised, when random symbolic information and a dynamical representation of it are used in conjunction. This fact enables to apply nonlinear dynamics to design improved communication systems.

[1]This research is supported by Alberta Innovates Technology Futures doctoral scholarship
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Date submitted: 05 Nov 2015 Electronic form version 1.4