

Title: Non-Turing machines: Stochastic and probabilistic learning circuits

Speaker: Prof. Sandip Tiwari is a distinguished alumnus of IIT Kanpur

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Venue: LHC L-14

Abstract:

The world is probabilistic, whether classical arising in the incompleteness of the classical unknowns or of the natural randomness as in quantum-mechanical fluctuations or their spontaneous classical manifestations. The Turing machine is a computational device that explores the extent and the limit of what can be computed. A simple view would be that it sets limits for implementation of deterministic logic implementation in a computing engine. Boolean, von Neumann, for example. Probabilities, which have within them the objective versus subjective conundrum, not unlike the natural world we inhabit, provide a non-Turing means to computation as one learns. The Bayesian reconstitution of the probability with new information is the subjective tool for this learning. This makes stochastic and probabilistic learning circuits, compact and specific, possible that can operate rapidly and at low power in real time on real-world problems. This talk discusses the underpinning of the computational approach and develops and gives examples of implementation in circuits, where the probabilities are derived using the low-power randomness from superparamagnetism.

Bio:

Prof. Sandip Tiwari is a distinguished alumnus of IIT Kanpur. He is currently the Charles N. Mellowes Emeritus Professor of Engineering at Cornell University. He was earlier the Director of National Nanotechnology Users Network, Director of the National Nanotechnology Infrastructure Network, and a research scientist at IBM T. J. Watson Research Center. At IBM he carried out pioneering research work on compound semiconductor transistors - codeveloping SiGe transistor and nanocrystal memory. At Cornell University, his research focused on adaptive approaches for low power design, three-dimensional integration, inexact computing, and Bayesian implementations.