Abstract

Complex dynamics of chaotic maps under an infinite-precision mathematical framework have been well known. The case in a finite-precision computer remains to be further explored. Previous work treated a digital chaotic map as a black box and gave different explanations according to the test results of the output. Using the Logistic map as a typical example, we disclose some dynamical properties of chaotic maps in fixed-point arithmetic by studying its corresponding state network, where every possible value is considered as a node and every possible mapping relation between a pair of nodes works as a directed edge. The scale-free property of the state network will be quantitatively proven. The obtained results can be extended to the scenario of floating-point arithmetic and to other chaotic maps. Understanding the real network structure of the state space of a chaotic map in the digital domain will help evaluate and improve the randomness of pseudo-random number sequences generated by chaotic maps. This talk will also try to clarify the relationship between chaos/fractals and complex networks.

About the Speaker

Chengqing Li received his M.Sc. degree in Applied Mathematics from Zhejiang University, China in 2005 and his Ph.D. degree in Electronic Engineering from City University of Hong Kong in 2008. Thereafter, he had been working as a Postdoctoral Fellow at The Hong Kong Polytechnic University till September 2010. Then, he joined the College of Information Engineering, Xiangtan University, China as an Associate Professor, where he received his Bachelor degree in Mathematics before. From April 2013 to July 2014, he worked at University of Konstanz, Germany, under the support of the Alexander von Humboldt Foundation.

Dr Li focuses on security analysis of image and chaos-based encryption schemes. He has published forty papers on the subject in the past ten years.

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