

System Compression: A New Computational Phenomenon

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Abstract

In this talk, I will introduce the logical mechanism, methodology and applications of system compression. System compression theory describes a new computational phenomenon. New discoveries may change traditional understandings in linear algebra, including solvability of linear equations and equivalence relationship between matrices. It may further apply to graph theory, PDE and beyond. And, it may revolutionarily improve technical performance in many engineering applications, such as signal and image acquisition, remote sensing, medical imaging and so on. It may improve efficiency of signal acquisition by 4 times or higher without loss of signal quality.

System compression theory discloses that a linear system may be compressed to a lower dimension and may be completely reconstructed. The principle of system compression is akin to that of data compression. In a large data set, data elements may have different importance. The task of data compression is to identify and eliminate unessential data elements. Likewise, in a large linear system, equations may have different importance. System compression is purported to identify and eliminate unessential equations, in an effort to reduce dimension of linear systems. Solution of a linear system can be found only from its partial equations, whence the entire system can be reconstructed. As one application, a signal may be reconstructed from its partial samples. New mathematical transforms and visual thresholding methods are specifically designed for system compression. Moreover, a variety of practical system compression methods are designed for industrial applications. Experiment results may well demonstrate the significance of new discoveries. More results may be seen at website <http://qualvisual.net>.