

f-Separable Distortion Measures: Towards Better Models for Data Compression

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ABSTRACT: Rate-Distortion Theory is a branch of Information Theory which provides theoretical foundation for lossy data compression. In this setting, the decompressed data need not match original data exactly; however, it must be reconstructed with a prescribed fidelity which is modeled by a distortion measure. An endemic assumption in information theory is that such distortion measures are separable: that is, the distortion function can be written as an arithmetic average of per-letter distortions. Such set up gives nice theoretical results at the expense of a very restrictive model; real-world distortion functions rarely have such nice structure.

Motivated by works of Kolmogorov and Nagumo on generalized notions of mean we introduce f-separable distortion measures. This generalization allows for the analysis of a much wider class of distortion measures than those which have received the bulk of attention in literature. We derive the rate-distortion function for discrete memoryless sources and f-separable distortion measures, as well as present some illuminating examples of different types of f-separable distortion measures.

BIO: Yana Shkel is a postdoctoral researcher in the department of Electrical Engineering at Princeton University. She received a PhD and MS degrees in Electrical and Computer Engineering from University of Wisconsin - Madison in August 2014 and December 2010, respectively. She received a BS in Mathematics and a BS in Computer Science from University of Wisconsin - Madison in May 2005. Yana has spent time as a visiting graduate student at University of Toronto and as an intern with the Computational Intelligence group at 3M Corporate Research (St. Paul, MN). Prior to starting graduate school she worked as a database developer at Morningstar Inc. (Chicago, IL).