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Data Modeling and Applied Harmonic Analysis

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Abstract

The goal of this article is to relate a version of data modelling to Applied Harmonic Analysis. Our personal philosophy is that every modeler should have a basic understanding of data modelling. They do not need to be experts at data modelling, but they should be prepared to be involved in the creation of such a model, be able to read an existing data model, understand when and when not to create a data model, and appreciate fundamental data design techniques. The purpose of this article is to serve as an introduction into the modelling the behavior of data by using tools which are nowadays available in Applied Harmonic Analysis.
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1 Introduction

Today we are living in a data-drenched world, in which we are challenged to not only provide the methodology to process various different types of data, but - especially as mathematicians - to also analyze the accuracy of such methods and to provide a deeper understanding of the underlying structures. There is a pressing need for those tasks coming from various fields as diverse as air traffic control, digital communications, seismology, medical imaging, and cosmology. As diverse as those fields are the characteristics of the data themselves, where data are usually modeled as functions $f : X \longrightarrow Y$ or just collections of points in X. Here X can, for instance, be Z^n or R^n for arbitrarily large n, a compact subset Ω of R^n, or a general Riemannian manifold, and Y can be similarly diverse concerning its mathematical structure. Let us take a quick look at some intriguing examples of such modern data.

- High-dimensional data can be found in various applications where the most prominent one might be the internet.

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