Master M2 Data Science 2020/2021

UE SMSCU14C Signal, big data and compressed sensing

Summary

The aim of this lecture is to provide the basics on signals and signal processing in the context of big data. The Nyquist-Shannon sampling theorem, a fundamental theorem in digital signal processing, will be recalled. Some basics of the Fourier transform will be likewise recalled including sampling and aliasing. Then an extension to multivariate signal and images will be discussed. Wavelet transforms and the efficient representation of big data using nonlinear approximation will be presented. Finally an introduction to compressed sensing (also known as compressive sensing, or sparse sampling) will be given. The underlying idea is efficiently acquiring and reconstructing signals by finding solutions to underdetermined linear systems requiring sparsity of the representation. This will be illustrated by numerous examples in different fields of application.

Contents

References:

Mallat, S., 1999. *A wavelet tour of signal processing*. Elsevier.

Eldar, Y.C. and Kutyniok, G. eds., 2012. *Compressed sensing: theory and applications*. Cambridge University Press.

Kolomenskiy, D., Onishi, R. and Uehara, H., 2018. WaveRange: Wavelet-based data compression for three-dimensional numerical simulations on regular grids. *arXiv preprint arXiv:1810.04822*.

Partly available on google books.