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Some applications of Fourier/wavelets transform in statistical sciences

The Fourier analysis, named after the French mathematician Joseph Fourier, is based upon the infinite sum of trigonometric functions such as sine and cosine. Its variant based approaches have wide applicability in almost every branch of sciences, ranging from the study astrophysics to biological sciences. In this work, an attempt has been made to discuss briefly the underlying theories pertaining to the Fourier analysis and its vast applicability in statistical sciences will be highlighted, specifically the utilization of the wavelet theory. A wavelet is a waveform of effectively limited duration and has an average of value zero; it is like a short wave which oscillates and has amplitude: It starts at zero, increases/decreases and comes back again to zero; it circumvents the frequency/time issues which occurs in Fourier transform. Fourier transform is a special case of the continuous wavelet transform with the choice of a mother wavelet: $e^{-2\pi i t}$, where $i = \sqrt{-1}$. Wavelets examine a signal or an image in a flexible way while a Fourier transform describes an overall picture of the dataset's spectrum. Wavelets can easily handle non-stationary objects while the Fourier based approach fails to comprehend such problems. Application of wavelet's theory in time series analysis, signal processing, dimension reduction, nonparametric regression (shrinkage), density estimation, inverse problem, and compression of noisy signals and images will be outlined along with illustrative examples with real data.

Biography

Altat H Khan has completed three Master's degrees in Biostatistics (2004), Applied Mathematics (1999) and Mechanical Engineering (2003) from the University of Utah. Currently, he is working as a Senior Biostatistician at King Abdullah International Medical Research (National Guard Health Affairs), Riyadh (Saudi Arabia) and prior to that he worked at the University of Utah Hospital and Prince Sultan Cardiac Center. He has many publications in international journals and proceedings.

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