S D Joshi et al., J Biom Biostat 2014, 5:4
http://dx.doi.org/10.4172/2155-6180.S1.021

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference & Exhibition on
Biometrics & Biostatistics
October 20-21, 2014 DoubleTree by Hilton Baltimore - BWI Airport, USA

Some studies on signal representation and decomposition

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Appropriate signal representation is one of the most fundamental issues of concern in any signal processing application. Different applications impose different requirements on signal representation. For example if the requirement is to transmit or store some information, which belongs to a particular class, then author would like that every member of the class requires minimum number of samples/bits for its representation. In the context of, say, EEG signal analysis, on the other hand, the representation needs to highlight only those features which distinguish one kind of disease from other rather than reproduce the signals with least distortion. In this talk author will present a brief overview of the work carried out by him, along with my research students, for the past three decades or so in the context of signal representation with little more emphasis on the recent work on signal matched filter bank. The central theme can be stated as follows: Given a stochastic or deterministic signal, find an appropriate model for its generation and compute the model parameters. The talk would delve on how exploration of conventional time series models such as ARMA, Gaussian as well as non-Gaussian, lead to a concept of sub-band coder. Since this model had certain limitations, how further investigations resulted in our work on Signal matched wavelet. Observing the restrictions imposed by wavelet based models we were lead to the concept of signal matched filter-bank. In this talk author will provide a definition of Signal Matched Filter-bank, proposed in the PhD thesis of my student, and explore it further. At this juncture author and his students made a very interesting observation. In a number of applications one is required to decompose a given signal into some constituents which have some physical significance in the given practical scenario. For example, in source separation problem these could be different source signals. A number of techniques exist for the purpose such as Principal component analysis, Independent component analysis, Empirical mode decomposition etc. The concept of Signal Matched Filter-bank, mentioned above, also naturally leads to decomposition scheme which is specific to the given signal. Since it is conceptually different way of signal decomposition and has potential to give rise to family of decompositions based on the principle used here, it would be interesting to explore its applicability in variety of contexts, including among others, biomedical signal processing.

Biography

S D Joshi received the BE (Hons.) degree in Electrical and Electronics Engineering from Birla Institute of Technology, Pilani, India, in 1981 and MTech degree in Communications and Radar Engineering and PhD degree, both from Indian Institute of Technology, Delhi, in 1983 and 1988 respectively. He worked as a Lecturer at the Delhi Institute of Technology, Delhi, from 1988 to 1989 and joined Indian Institute of Technology, Delhi, as a Faculty member in May, 1989, where he is currently a Professor in Electrical Engineering Department. His research interests include development of fast algorithms for stochastic signal processing, speech processing, group theoretical approach to signal processing and image processing. He is a recipient of the AES award from the IEEE Aerospace and Electronic Systems/IEEE Communication Society (AES/COM), Indian Chapter, for the year 1986.

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