



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title: **MULTILEAD ECG DATA ANALYSIS USING SVD AND HIGHER-ORDER SVD**

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SHORT ABSTRACT

The electrocardiogram (ECG) measures the electrical activity of the heart over period of time. Simultaneous recording of the electrocardiogram (ECG) from different body locations provides the spatial perception of cardiac events. Cardiologists use multilead ECG (MECG) comprising of the standard 12-leads to diagnose the cardiac diseases. This standard MECG system helps study the spatio-temporal orientation of heart's electrical vector. This data has three types of correlations: intra-beat, inter-beat and inter-lead. These correlations need to be exploited for different MECG applications. Several methods have been proposed for this purpose, either in time-domain or in transform-domain. In this thesis, few MECG data processing applications using SVD and HOSVD in multiscale domain are proposed. These methods are designed for three separate but interconnected tasks such as data dimensionality reduction, feature extraction from reduced MECG volume for MI classification (both detection and localization), and a study on progression of MI in different leads over a period of time using TWA analysis, all by exploiting spatio-temporal correlations of MECG data.

The major contributions of the work reported in this thesis include,

1. Exploitation of both intra-beat and inter-lead correlations using multiscale SVD.
2. Thresholding technique that accounts variation of relative energy across subbands.
3. Novel representation of MECG data in a 3-dimensional tensor structure.
4. Exploiting all three types of correlations using multiscale HOSVD.
5. A set of discriminant features (MSVs and NMWE) is extracted for detection and localization of MI.
6. Validating TWA analysis using MAS-HOSVD with semi-synthetic and real ECG signals.
7. TWA analysis for study of progression of acute MI over period of time.