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Title: **Aspects of Advanced Signal Processing Methods in Pattern Recognition**

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A general approach for change detection in vibration signals with application in machine health monitoring.

2). D. Aiordachioaie and Th.D. Popescu
Aspects of features selection and extraction from time-frequency images of vibration signals

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A general approach for change detection in vibration signals with application in machine health monitoring

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Abstract:

The paper presents a unified approach for change detection in vibration signals with application in machine health monitoring using advanced signal processing techniques. These techniques include, mainly detection/segmentation (CDS) algorithms, and independent component analysis (ICA), time-frequency analysis (TFA), energy distribution (ED) evaluation, as auxiliary tools for feature extraction and analysis of the multivariate vibration signals in a reduced dimension space, for scalar signals, or to highlight and enhance the changes in signal dynamics. The outline of this paper is as follows. In Section 2, we present the problem of change detection and diagnosis (CDD) in vibration analysis, from the point of view of challenges and solutions. Section 3 offers a general view on the main signal processing techniques used in vibration monitoring in our approach: change detection and segmentation, independent component analysis, time-frequency analysis and energy distribution evaluation, and how they are combined to assure more robust detection of changes in vibrating signals, as well as proactive actions in vibration monitoring. Finally, Section 4 presents some experimental results obtained in fault detection of rolling element (REB) operating and monitoring of a rotating machine, an industrial pump.

Keywords:

Unified approach; change detection; independent component analysis; time-frequency analysis; energy distribution; vibration signal processing; machine health monitoring; case study.

Aspects of Features Selection and Extraction from Time-Frequency Images of Vibration Signals

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***Abstract*—**The research domain of the paper is the time-frequency image processing. Firstly, a comparation among the features selection and extraction methods from time-frequecny images of vibration signals in bearings with faults is made. Both time and frequency methods are considered and discussesd, from classification performances point of view. A method of image registration based on intensity and translation is introduced, discussed and implemented. Non-stationarity is considered and a detection and selection of non-stationary images is considered and used. Such criterion will remove the images with high dissimilarity comparing with the images from the same class. Computer based experiments are conducted with real data from a benchmark data base with signals of vibrations from bearings with various size and type of faults. The results are encouraging and shows the fezability of the method.

Keywords*—signal processing, time-frequency transforms, vibration, change detection, diagnosis, fault, bearings.*

On thermal image pre-processing for fusion and classification purposes

Dorel Aiordachioaie, Anisia Culea-Florescu and Sorin Marius Pavel

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Abstract:

The paper introduces a toolbox for change detection on human faces based on thermal image processing. The main task is to find right representations and descriptors/features for change detection. The structure of the toolbox has specialized functions for: image conversion form color to gray levels, image conversion from low to high resolution, image segmentation, objects detection and localization, face contours, image compression and analysis.

Various data transform for image processing are considered, accompanied by information-based transform, e.g. Renyi transforms.

Classification is also considered based on machine learning paradigm.

A data base with thermal images is created with people in various states which reveals happiness, normal and sadness.

The results are at the level of other works published in prestigious journal and conferences.

ECG Signal Filtering in FPGA

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Abstract: In this paper we use an ECG signal taken from a previously purchased file using a 12-bit acquisition system and a 1kHz sampling rate. The signal is processed in a Spartan 3E FPGA circuit using two different filters: a mediation filter using a 16-sample window and a filter generated by the FDAtools utility in the Matlab environment. Both filtering algorithms are implemented in the FPGA circuit using the Verilog HDL language. The results are compared with each other, then with those obtained in the Matlab environment. The paper also analyses the hardware resources in the FPGA required for the two implementations. Finally, we will present a simple way to view the filtered signals on a VGA monitor.

Change detection in EEG signals

Rustem Popa, Laurentiu Frangu

Abstract:

The purpose of this work is to provide a method for change detection in subjects' status, based on analysis of electroencephalographic (EEG) signals. These algorithms prove to be useful in diagnose and in brain-computer inerfaces. The status of the subject may refer to: emotions, sensorial activity and intentions of muscular activity.

The analysis methods used throughout the paper include: separation of the frequency bands of the EEG signals, classical non-parametric pattern recognition algorithms and neural networks. Experimental results concerning the proposed method, applied to real data EEG signals, are presented in the paper.