2017 RIMS Joint Research

Advanced Innovation powered by Mathematics Platform

Signal analysis and time-frequency analysis

Organizer: Ryuichi Ashino
(Mathematics and Information Sciences, Osaka Kyoiku University)

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Location: Research Institute for Mathematical Sciences, Room 110
Kyoto University, Kyoto 606-8502, Japan

Program

October 23, Monday

13:00 – 14:00 **Hongmei Zhu** Department of Mathematics & Statistics, York University, Toronto

From the Fourier transform to the S-transform, and beyond

The S-transform is an effective time-frequency analysis technique that can provide a time-frequency representation of a nonstationary signal. In addition, its multi-scale analysis allows more accurate detection of subtle signal changes while interpretation in a time-frequency domain is easy to understand. It has been used successfully in various fields including ocean analysis, medical and industrial application. In this talk, we will overview the theory of the ST and introduce the various forms of the S-transforms.

14:15 – 15:15 **Kensuke Fujinoki** Department of Mathematical Sciences, Tokai University

Multi-lapped directional wavelet transforms and their applications to image analysis

Various types of framelets have been developed and their redundant transforms proven to be a useful tool for applications such as image and video processing. While high redundancy rate provides significant flexibility in wavelet design, computational cost increases exponentially as the dimension increases. In this talk, we introduce a two-dimensional redundant wavelet transform that offers a good tradeoff between redundancy and computational cost. We show how our redundancy makes the directional selectivity of the wavelet transform improve and how it leads to better performance in image processing tasks.

15:45 – 16:45 **Hisashi Yoshida** Department of Computational Systems Biology, Kindai University

Application of time-frequency analysis in biomedical signals and the challenges

Biomedical signals, such as EEG, ECG and EMG usually have time-varying characteristic. Time-frequency representation is effective way to track the change but it is often too much information for automatic diagnosis. In this talk, we introduce information theoretic instantaneous bandwidths which is defined on positive time-frequency distribution and show some results of biomedical signal applications.

October 24, Tuesday

9:30 – 10:30 **Hongmei Zhu** Department of Mathematics & Statistics, York University, Toronto

Looking inside of biomedical signals using the S-transform

Biomedical signals are typically finite duration, dynamic and non-stationary processes whose frequency characteristics vary over time or space. This often requires algorithms capable of locally analyzing and processing signals. The S-transform (ST) combines the time-frequency representation of the windowed Fourier transform with the multi-scale analysis of the wavelet transforms. It is easy interpretation and multi-scale analysis make it popular in various applications. In this talk, we illustrate its effectiveness of the S-transform in biomedical applications.

10:45 – 11:45 **Kazuaki Nakane** Graduate School of Medicine, Osaka University

A tissue image analysis method via the homology concept

With the development of imaging devices in recent years, many tissue images have been taken as data. For clearly shaped images, analysis is being carried out by using deep learning and other techniques. Effective methods have not yet been developed, however, for very complex images like medical tissue images. For this reason, many tissue image data have been hoarded without being utilized. These can also be called "image data type big data". Developing a method to analyze such images is important issue. In this talk, we introduce the imaging method via the homology concept and several applied examples. This method has been applied to analyze the colon cancer tissue images and got significant results.

13:15 – 14:15 **Kohei Arai** Saga University

Phytoplankton and zooplankton identification with microscopic images using shape feature extracted by wavelet descriptor

Method for phytoplankton and zooplankton identification with microscopic images using shape feature extracted by wavelet descriptor is proposed. Planktons have a plenty of shape features. Therefore, shape features are effective for plankton identification rather than tone and color features as well as textural features. The effectiveness of these features is compared for plankton image identifications.

14:30 – 15:30 **Kiyoshi Mizohata** Department of Mathematical Sciences, Doshisha University

The analysis of big data and applications of wavelets

The amount of social media data is now growing exponentially. Such data is now called 'Big Data'. In this talk, we shall show several interesting results on comments of niconico-douga (famous social media in Japan) obtained by using Hadoop system and wavelets.

For more information, visit our website at

▷ `http://www.osaka-kyoiku.ac.jp/~ashino/rims2017/`

Contact: Ryuichi Ashino Tel: 072-978-3685 `ashino@cc.osaka-kyoiku.ac.jp`