JACOBS UNIVERSITY

DE 340113:

Biomedical Signal Processing

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This course is about …

- the origin and characteristics of biomedical signals
- difficulties in the measurement and processing procedures
- basic processing algorithms

The objectives of biomedical signal processing are …

- to reduce the subjectivity of manual measurements
- to develop methods that extract features to better understand and interpret the information contained in a signal
- to reduce the noise and artifacts
- data compression of the digitized signals
- mathematical signal modeling and simulation to attain a better understanding of underlying biological processes

Major clinical applications of biomedical signal processing are …

Diagnosis:

- **the pathological conditions can be identified by processing the signals recorded from organs in combination with clinical symptoms.**
- **for this purpose, the algorithms work in an off-line fashion.**
- **the scope of this algorithms ranges from performing a simple noise filtering to form a more influential step of the clinical decision- making procedure.**

Therapy:

- **in therapeutic context, an algorithm is used to modify the behaviour of a particular physiological process (e.g, pacemaker or implantable heart defibrillator).**
- **for this purpose, on-line analysis is necessary and the algorithms should work in real- time.**
- **these algorithms are not power consuming and computationally expensive.**

Monitoring:

- **during the monitoring, the signal is processed in a sequential fashion and the past samples play a major role in decision making.**
- **this algorithms are mainly designed to detect the variations in cardiac or neurological functions in intensive care units.**

Contents

Chapter 6: ECG- A Brief Introduction

- **6-1 Electrical Activity of the Heart**
- **6-2 Generation and Recording of an ECG**
- **6-3 Heart Rhythms**
- **6-4 Heartbeat**
- **6-5 Noise and Artifacts**
- **6-4 Clinical Applications**

Chapter 7: ECG Signal Processing

- **7-1 Baseline Wander**
- **7-2 Powerline Interference**
- **7-3 Muscle Noise Filtering**
- **7-4 QRS Detection**
- ***7-5 Data Compression**
- ***7-6 Heart rate variability**

References

- Alan, V. Oppenheim, W. Schafer Ronald, and R. B. John. *Discrete-time signal processing*. New Jersey, Printice Hall Inc (1989).
- Cohen, Arnon. *Biomedical Signal Processing: Time and frequency domains analysis*, Volume I. CRC-Press, 1986.
- Proakis, John G., and Dimitris G. Manolakis. *Digital signal processing: principles, algorithms, and applications*. (1996).
- Cohen, Arnon. *Biomedical Signal Processing: Compression and automatic recognition*, Volume II. CRC-Press, 1986.
- Rangayyan, Rangaraj M. *Biomedical signal analysis*. Vol. 33. John Wiley & Sons, 2015.
- Sörnmo, Leif, and Pablo Laguna. *Bioelectrical signal processing in cardiac and neurological applications*. Vol. 8. Academic Press, 2005.
- Van Drongelen, Wim. *Signal processing for neuroscientists: an introduction to the analysis of physiological signals*. Academic press, 2006.
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- Akay, Metin. *Biomedical signal processing*. Academic Press, 2012.
- Devasahayam, Suresh R. *Signals and systems in biomedical engineering: signal processing and physiological systems modeling*. Springer Science & Business Media, 2012.
- Sanei, Saeid, and Jonathon A. Chambers. *EEG signal processing*. John Wiley & Sons, 2013.
- Acharya, Rajendra, et al., eds. *Advances in cardiac signal processing*. Berlin: Springer, 2007.

Grading and Exams

The final course grade will be determined as follows:

- **Class attendance (presence sheets) will count for 10% of the final grade**
- **Three mini-quizzes which each will account to 10% of the final grade**
- **Homework will count for 20% of the final grade**
- **A take home final exam will count for 40% of the final grade**

☑ **How to access class materials and additional resources?**

visit this link:

http://minds.jacobs-university.de/teaching/BSPSpring2018

☑ **How to ask your questions?**

Drop a line to:

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