

PROCESSING OF MEDICAL RECORDS AND IMAGES

Basic Information

This is a course, which contributes to MSc award in Biology

Course period	From September 1 st till February 1 st , 1 semester
Study credits	5 ECTS credits
Duration	180 hours
Language of instruction	English
Academic requirements	<ul style="list-style-type: none">- BSc degree in Biology, Chemistry, Physics or Environmental Sciences or equivalent (transcript of records),- Good command of English (certificate or other official document)

Course Description

«Processing of medical records and images» is a third-semester course of choice. It includes the information from all previous courses and integrates them in one big task of analysis of the given medical image or the electronic record.

The course includes all aspects of medical data processing: dealing with information in the raw dataset (structure, format, integrality and privacy), machine processing of the given data (the step, which will require the knowledge from all of the previous courses) and interpretation of the analysis result.

The major part of the course is dedicated to the fine features of the machine-learning algorithms, which are special for the medical datasets.

The final stage of the course is designed to give the students the ability to estimate their own results critically and to choose the best solution from the set of existing ones.

The course is designed to cover a wide range of possible prediction techniques and algorithms, which are special for a given type of the medical dataset.

Course Aims

- To help students to study a new discipline or to ameliorate the existing knowledge in the general medical dataset analysis.
- To assist students to estimate their own results of medical data prediction algorithms.
- To give students the understanding of how to estimate the errors of the analysis.
- To introduce the advanced principles of interpretation of the machine learning data.

Course Objectives

The course has been designed to:

- ensure that students are familiar with the formats of the medical dataset.
- ensure that students know the processing techniques for the medical annotations and reports.
- give students the strategy of using the quantitative measures for the machine learning algorithms for the medical data analysis.
- give students an appreciation of the medical data security and privacy protection.
- give students an appreciation of the open problems in the medical data analysis.

Learning Outcomes of the Course

By the end of the course, the students will be able to:

- pre-process the medical data from the dataset of any format,
- perform the machine-learning analysis of the medical dataset of any format,
- interpret the analysis result.

Course (module) Structure

Learning Activities	Hours
Lectures	18
Practice sessions / Seminars,	36
Self-study Assignments	90
Final Exam (including preparation)	36
Total study hours	180

Course Outline

Week	The title of the course subsection	Practice session / Assignments	Hours
• Semester 2			
1-6	The information in the Medical Records	<ul style="list-style-type: none"> • The formats of the medical records • Classification of medical databases • DICOM standard and hospital information systems • Home assignment No 1 	(6/12/30)
7-12	The Machine Learning Processing of Images and Medical Records	<ul style="list-style-type: none"> • Machine learning for text • Machine learning for medical images • Machine quantitative measurements • Image processing tasks • Home assignment No 2 	(6/12/30)
13-18	Verification of the Processed Medical Data Results	<ul style="list-style-type: none"> • Evaluation of patient record systems • Interpretation of the processed results • Medical data security and privacy • Open problems of the medical data processing • Home assignment No 3 	(6/12/30)
	Final Exam		36

Course Instructors and Tutors, Contact Information

Instructor	Contact Information
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Assessment

The final exam is an individual problem in the form of a simulated experimental dataset. The student must demonstrate the abilities in:

- operating the databases in different formats (20 points maximum),
- construct the machine-learning algorithm for purpose, given by the professor (40 points maximum),
- estimate the final result and interpret it (40 point maximum).

Grade policy:

A (excellent work)	91-100 %
B (above average work)	81-90 %
C (average work)	71-80 %
D (below average work)	50-70 %
F (failed work)	<50 %

Core reading

1. Collen, M.F., Slack, W.V. and Bleich, L.H. (2015) Chapter: *Medical Databases and Patient Record Systems*. Book: *The History of Medical Informatics in the United States*. Springer, London.
2. Menasalvas, E. and Gonzalo-Martin, C. (2016) Chapter: *Challenges of Medical Text and Image Processing: Machine Learning Approaches*. Book: *Machine Learning for Health Informatics*. Springer, Cham.
3. Stanescu, L., Burdescu, D. and Brezovan, M. (2009) Chapter: *Multimedia Medical Databases*. Book: *Biomedical Data and Applications*. Springer, Berlin, Heidelberg.
4. Deserno, T.M. (2011) Chapter: *Fundamentals of Medical Image Processing*. Book: *Springer Handbook of Medical Technology*. Springer, Berlin, Heidelberg.

5. Legrand, L. (2014) Chapter: *The Processing of Medical Images: Principles, Main Applications and Perspectives*. Book: Medical Informatics, e-Health. Springer, Paris.
6. Kountchev, R. and Iantovics, B. (2013) Chapter: *Architecture for Medical Image Processing*. Book: Advances in Intelligent Analysis of Medical Data and Decision Support Systems. Springer, Heidelberg.
7. Ogiela, M.R. and Tadeusiewicz, R. (2008) Chapter: *Algorithms and methods for the goal-oriented processing of medical images*. Book: Modern Computational Intelligence Methods for the Interpretation of Medical Images. Springer, Berlin, Heidelberg.