

Bioinformatics and Computational Biology

The aim is to **educate experts with interdisciplinary domain knowledge of natural and medical sciences and informatics with an emphasis on practical experience and skills necessary for bioinformatics analysis** of different types of large and complex datasets, extraction of knowledge from data and database systems.

- **new** doctoral degree program
- supported by **two universities**
- **interdisciplinary field** – IT, Medicine
- **full-time or combined** study
- study in **Czech or English**
- partnership with **foreign universities**
- **scholarship**, grant funding

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Looking for New Talents

Bioinformatics and Computational Biology

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 VSB TECHNICAL
UNIVERSITY
OF OSTRAVA

FACULTY OF ELECTRICAL
ENGINEERING AND COMPUTER
SCIENCE



Faculty of Medicine
and Dentistry

Palacký University
Olomouc

Motivation

- Real demand in the field of bio-medical data analysis
 - new topics related to Precision Medicine and Precision Health
 - new opportunities, grant projects, private financing
 - new science challenges
- New doctoral study program
 - IT (VSB-TUO) + medicine (UP OL)
 - already accepted topics of dissertation theses (but can be also extended and/or changed during time)
 - financial motivation (scholarships, grants, ...)
- We have also projects that can be attractive to motivate people
- Be a part of an existing team (people, science, fun, money)

Bioinformatics and Computational Biology

“Bioinformatics and Computational Biology is an interdisciplinary study program in three fields, namely informatics, biology and general medicine and dentistry. The aim of the program is to educate experts with interdisciplinary domain knowledge with an emphasis on practical experience and skills.”

“A new doctoral degree program on both universities: **VSB-TUO** and **UP OL**”

The ideas behind the program:

- connect IT, medicine, clinics
- use existing human resources (university staff)
- share resources of both universities (hardware, laboratories, etc.)
- share domain knowledge
- better chance to get new projects, grants, publications
- solve real problems targeting the precision medicine/health

Topics of dissertation theses I

Many of them are freely defined to meet student expectations and ideas

[doc. Ing. Petr Gajdoš, Ph.D.] – **big data analysis, parallel computing, data visualization, bio-inspired methods, statistics**

- Algorithms and Data Structures for Parallel Processing of Genetic Data
- Analysis of Image Data in the Area of Gene Mapping
- Processing of Data Obtained by Next-Generation Sequencing and Optical Mapping
- Algorithms and Data Structures for Optical Mapping

[doc. Ing. Pavel Krömer, Ph.D.] – **big data analysis, evolutionary algorithms, optimizations**

- Evolutionary feature selection in bioinformatics
- Deep neural networks and transfer learning for computational biology
- Efficient algorithms for edge and fog computing in bioinformatics
- Evolutionary Optimization of Machine-learned Models in Computational biology

[doc. Mgr. Miloš Kudělka, Ph.D.] – **big data analysis, complex networks, bio-inspired methods, statistics**

- Applications and analysis of molecular networks in biomedicine
- Analysis of protein-protein interaction networks
- Analysis of disease-drug association networks
- Analysis of feature-rich biomedical networks
- Analysis of associations between scientific biomedical texts and co-authorship communities

Topics of dissertation theses II

[doc. Ing. Jan Platoš, Ph.D.] – **big data analysis, evolutionary algorithms, data compression**

- Searching for Patterns in Sequenced Data
- Classification of small collections of records while maximizing generalization

[doc. Dr. Eva Kriegová] – **biomedical data analysis, biomarkers**

- Analysis and Evaluations of Structural Variants in B-cell Malignancies at Single-molecule Level Using Optical Mapping
- Analysis and Evaluations of Methylation Profiles using Optical Mapping and Next-Generation Sequencing
- Functional Genomics and Proteomics and Bioinformatics Processing of Data

[prof. MUDr. Jiří Gallo, Ph.D.] - **biomedical data analysis**

Contribution of Omics and Standard Clinical Methods for Determination of Risk of Aseptic Loosening and Infections in Total Knee and Hip Arthroplasty

[prof. MUDr. Tomáš Papajík, CSc.] - **biomedical data analysis**

New approaches of computational cytometry for the analysis of complex immune cell profiles in hemato-oncology

... but we are opened to new topics, ideas, trends ...

Join the existing research group

CLINICAL TRANSLATION RESEARCH
PRECISION MEDICINE
NEXT GENERATION SEQUENCING
OPTICAL MAPPING
BIOMEDICAL DATA ANALYSIS
HIGH PERFORMANCE COMPUTING
DOCTORAL DEGREE PROGRAM

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Current research topics

Utility of cellular profiles and proteomics of synovial fluid and periprosthetic tissues for clinical decision making in knee osteoarthritis [MZ CR, 2020-2024]

- The project focuses on using immunological/imaging/biochemical methods for better description of the knee joint state in patients with knee osteoarthritis (KOA).

Internal Student Grant Project [SGS at VSB-TUO, continuing project with an annual evaluation]

- The project focuses on support of young researchers during their doctoral studies

Bioinformatics and Computational Biology [ESF, 2017-2022]

- The aim of the project is to strengthen human resources in research in the field of bioinformatics and computational biology, which will provide the labor market with experts from both areas

Bioinformatics and Computational Biology [ERDF, 2017-2022]

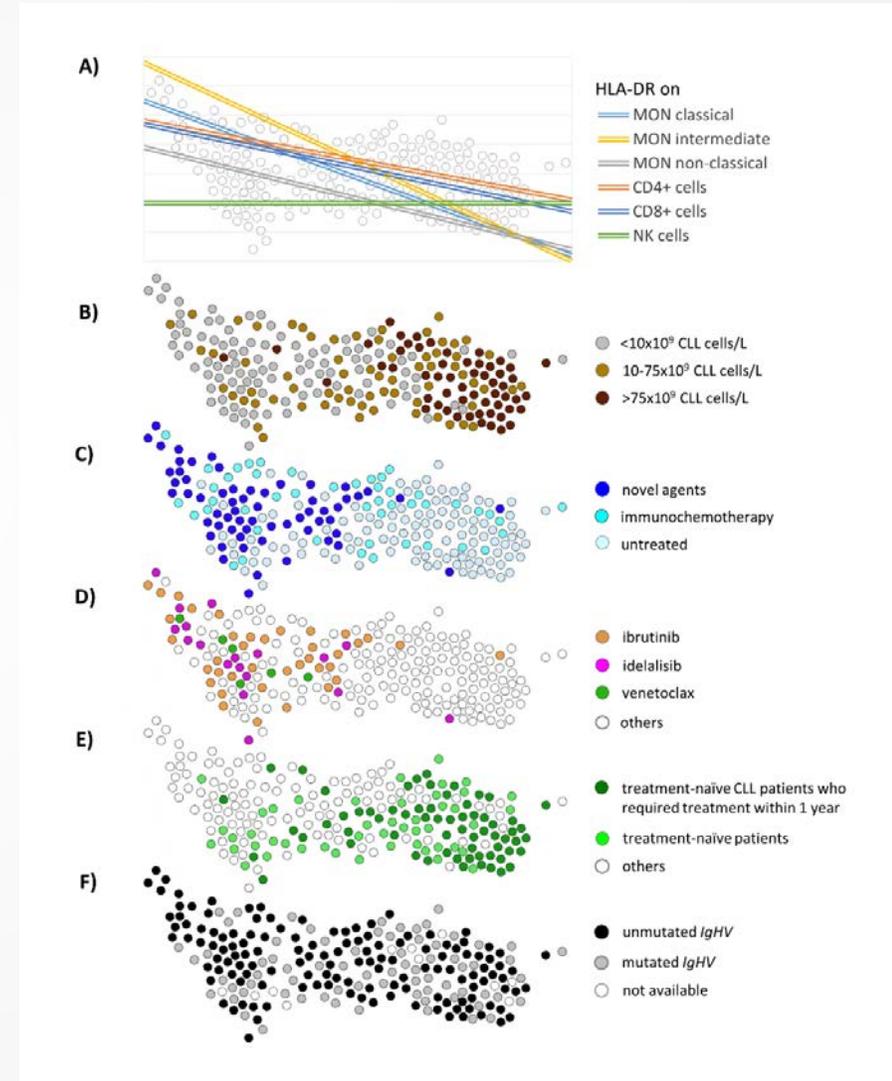
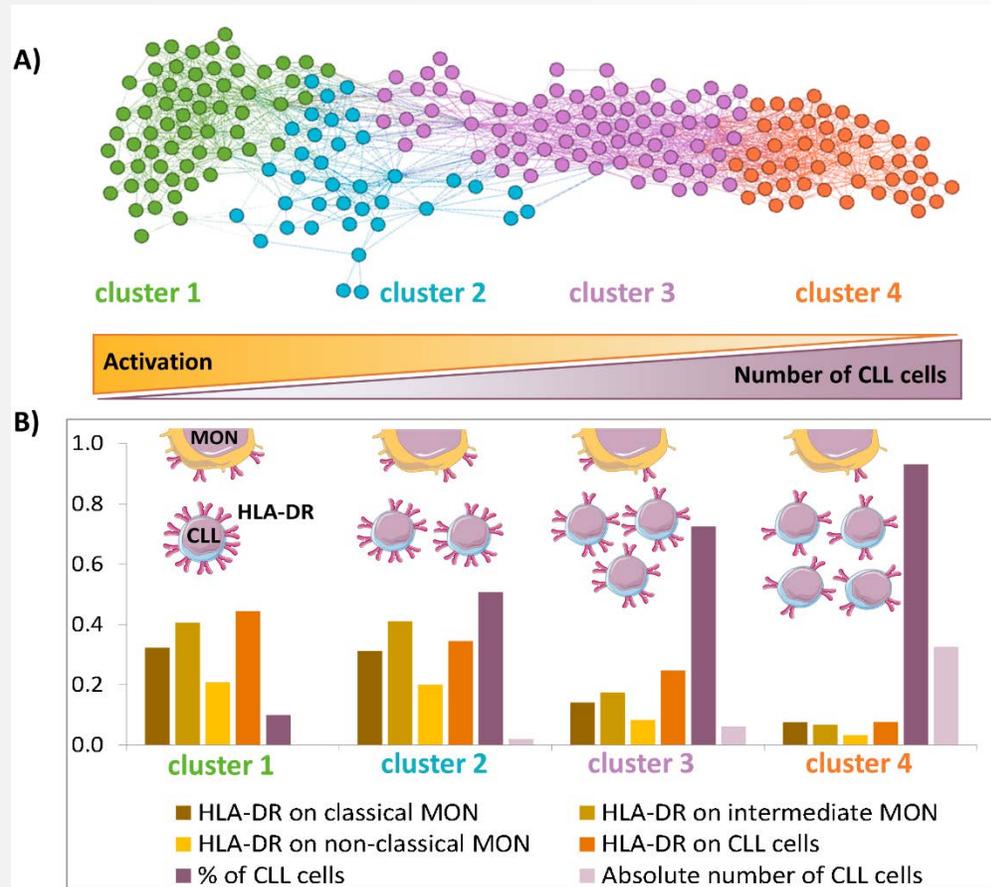
- The aim of the project is to improve the infrastructure (modernization) for research and educational purposes

HemaSeq Dx – diagnostic set for hemato-oncology [MZ CR, 2017-2020]

- The multidisciplinary project is aimed at developing diagnostic kit(s) and panel HemaSeq Dx for the detection of clinically relevant mutations in chronic lymphocytic leukemia and multiple myeloma, including the development of analytical software for the clinical evaluation of sequence variants. The project uses next-generation sequencing in combination with optical mapping.

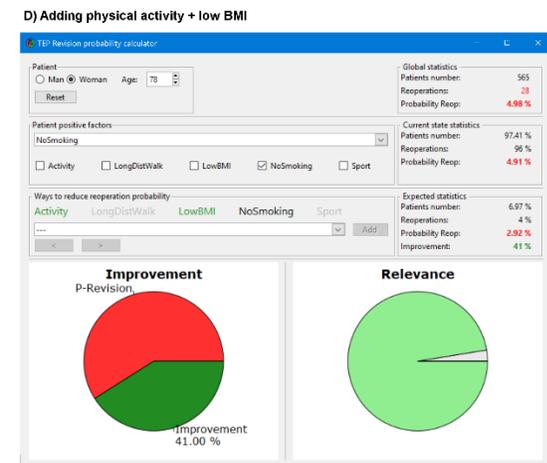
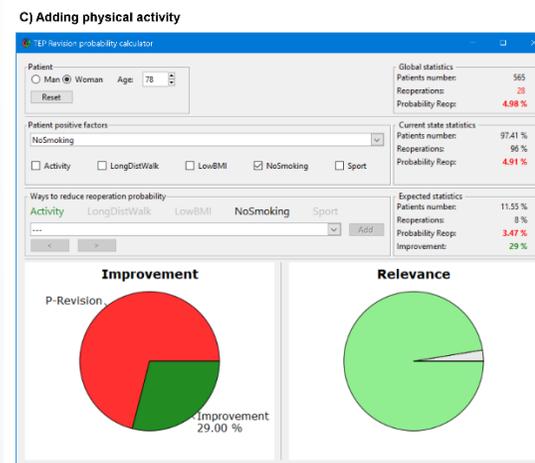
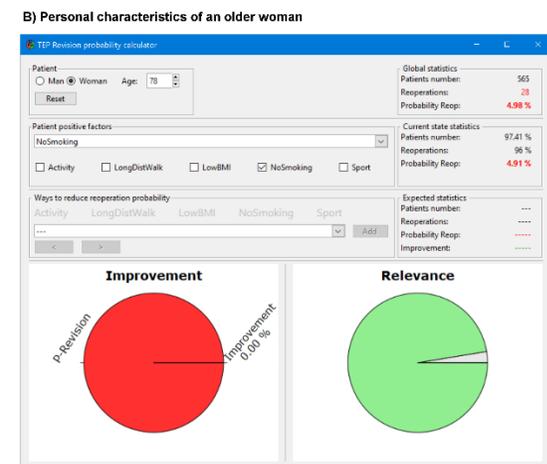
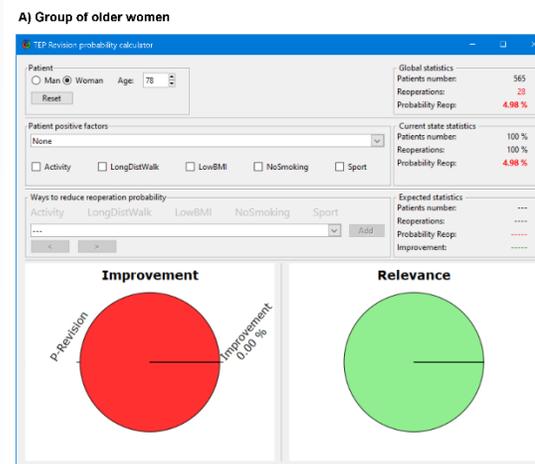
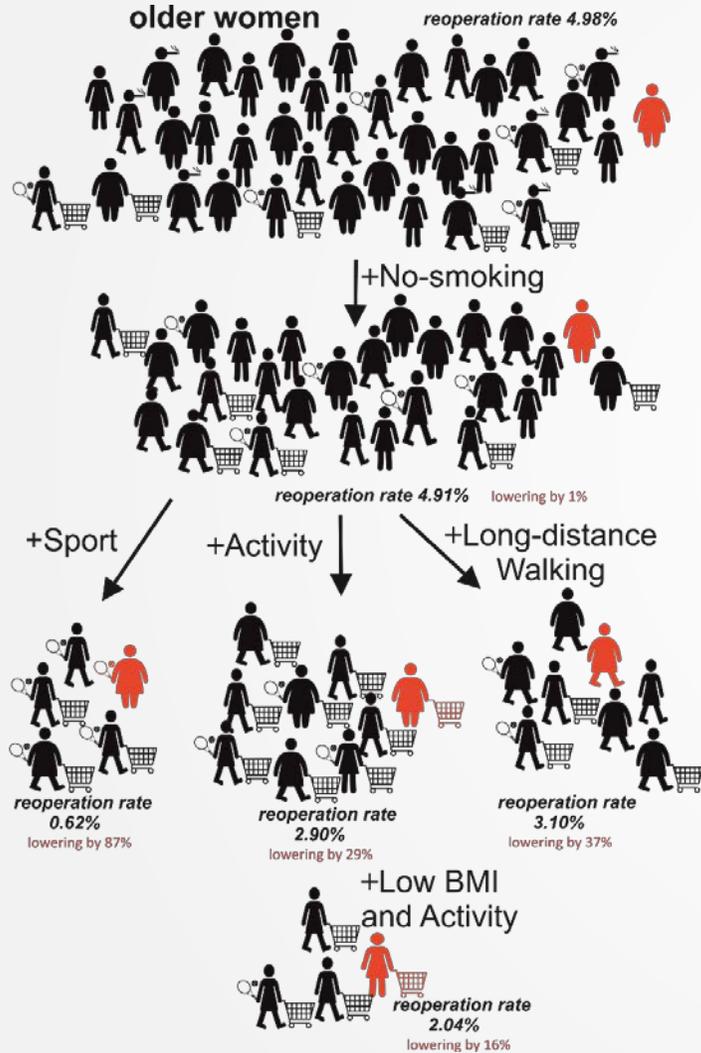
Current research topics – examples

Multivariate analysis of laboratory and clinical data to detect patients with poor prognosis



Current research topics – examples

Prediction modeling on patient registry data – to identify risk patients for reoperations



Contact our study departments

Study at VSB-TUO

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<https://www.fei.vsb.cz/en/study/admission-procedure/admission-requirements/>



Study at UP OL

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<https://www.lf.upol.cz/en/students/doctoral-studyprogrammes/>



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