OpenMultiMed Training School:

Gearing up for machine learning in Systems Medicine

Ljubljana, Slovenia, September 26th-28th, 2017

PROGRAM OUTLINE

Day 1: ***Tuesday, September 26th***

12.00h Registration and setting up of posters

12.30h Welcome by local organiser

13.00h **Session1: Who does the experiments?** / Blaž Stres, Harald Schmidt

General introduction, human body, triple genomes (nuclear, mitochondrial and microbial), a system of subsystems that interact over vascular system. Levels of study (genome, transcriptome, proteome, metabolome, glycome, lipidome, metadata/environment) using three systemic matrices: vascular system (blood/serum/plasma), urine and feces (e.g. NGS, LS/GC-MS/MS, lsNMR; "suboptimal database syndrome"). Multifactorial disease gradients.

14.45h-15.15h Coffee break1

Microbiome focus. Introduction of the common biolinux platform, SOP hands on analysis of human microbiome data, scripts, translation to metagenomic, enzymatic and pathway data in relation to host metadata. Many studies are published with conflicting results hence an approach of meta-analysis is needed until medical records are made available for in-depth analyses. Signal and noise in microbiome. The transdomain concept of research.

16.45h-17.00h Coffee break2

17.00-17.35h **Invited lecture:** *Diseasome-based common mechanism identification for drug repurposing*. Harald Schmidt. Maastricht University, Chair of the CA15120 OpenMultiMed Action

17.45h Closure

19.00h Get-together at Downtown Ljubljana

Day 2: *Wednesday, September 27th*

09.00h **Session2: Why is current public data fragmentary?** / Tatjana Lončar Turukalo, Sanja Brdar
Learning from data - machine learning fundamentals
Medical data conventions, data integration, transformation and the basic needs of data structure to run different machine learning approaches are not matched. Introduction to basic concepts of machine learning, using real world examples: features (extraction, analysis), dimensionality, learning algorithms, and overfitting versus generalization. Design cycle: data collection, feature selection, model selection, learning and evaluation. Supervised, unsupervised and semi-supervised learning. The statistical clustering: overview of similarity (distance) measures. Clustering algorithms: k-means, hierarchical clustering, DBSCAN (Density-Based Spatial Clustering) and spectral clustering. Ensemble clustering approaches: consensus clustering and non-negative matrix factorization. Working examples: OTUSs as features, distance and similarity among samples, application of clustering algorithms with analysis of the results. The algorithms will be theoretically introduced and exercised through examples using Jupyter Notebook, using human microbiome data.
10.45h-11.15h Coffee break

13.00h-14.00h Lunch

14.00h **Session3: Where are the large datasets?** / Ivan Chorbev, Vice Chair of the CA15120
Scalable and Distributed Analysis and Learning from Big Data
Current limitations to access of large scale data in medicine (patient data, meta data, ethics, statistical approaches,…), »how to« on large scale data analyses, example with algorithms, statistical power and false discovery rate corrections.
Introduction to data processing. Ethics in data processing. Introduction to Big Data. Cloud Computing and its use in Big Data processing.
Trending Machine learning methods, Deep learning, concept and application
Comprehensive knowledge extraction
Data analysis used in Precision medicine
15.45h-16.15h Coffee break
18.00h Closure
19.30h Farewell at Downtown Ljubljana

Day 3: *Thursday, September 28th*

08.00h **Session4: Give us the tools and we will finish the job /** Egils Stalidzans

Dynamic modeling and optimisation of metabolism using freely available software COPASI

Mechanistic models of dynamic processes are usually called »kinetic« because they request kinetic parameters of the processes included in models. In return they can simulate how changes in any of parameters can influence the whole system via »mechanisms« encoded in the model.

The process consists of two parts:

1) buliding of a model where existing knowledge is put in the model and missing information is estimated trying to fit model behavior with experimental data,
2) application of the model for simulations of different scenarios (therapies, best yields aso).

We will build and simulate a model using COPASI software and toy example. We will see also application of artificial intelligence during optmisation tasks.

10.45h-11.15h Coffee break

Discussion and future prospects session

The importance of viewing human body as a system, examples of the current meta-analyses in pharmacology, systemic effect, medicine, microbiology.

Invited talks from prominent researchers in Europe, online skype/webinars:

11.15h-11.40h **Invited lecture:** *Predicting drug synergies through topological analyses.* Massimiliano Zanin, WG3

11.40h-12.05h **Invited lecture:** *Consensus Clustering for Cancer Gene Expression Data***.**Tatjana Lončar Turukalo, WG3

12.05h-12.30h **Invited lecture:** *Modelling liver metabolism - how far from the clinics?* Damjana Rozman, WG1

12.30h-12.55h **Invited lecture:** *Search of minimal adjustable parameter set in kinetic models using Total Optimization Potential (TOP) approach*. Egils Stalidzans, WG3

Voice of the audience, open discussion and interaction, sharing of ideas, networking, guidelines for the two training schools within OpenMultiMed projected to take place in 2018, online questionnaire, joint & endpoint poster discussion, how the presented works of trainees fit into the OpenMultiMed frame.

13.00h-15.00h Lunch, closure, poster wrap-up and farewell

VENUE
University of Ljubljana
Faculty of Civil and Geodetic Engineering
Hajdrihova 28
1000 Ljubljana
First floor, room H28

Googlemaps:

https://www.google.si/maps/place/Hajdrihova+ulica+28,+1000+Ljubljana/@46.0422598,14.4930726,15z/data=!4m5!3m4!1s0x47652d69e0f97667:0x9ba047278965879d!8m2!3d46.0419366!4d14.4927077

GPS: **Latitude:** 46.041937 | **Longitude:** 14.492708

Poster
Every participant is encouraged to actively present their past / current / future work in a form of a poster that is going to be available for discussion throughout the training school.
Poster sessions - Every coffee break and lunch break
Posters: A0 (H90xV120 cm) or A1(H60xV90cm)

Accommodation
September is still a very busy month in Ljubljana and hence it is not possible to book one accommodation considering the various arrival / departure details.
Instead, Booking.com is suggested as the best venue to find accommodation according to your preferences in the close proximity of “Hajdrihova 28”.