Application of advanced mathematical models and machine learning methods to analyze psychiatric disorders

CHALLENGES: Advanced models for analysing psychiatric patient data
PRODUCTIVE SECTOR: Psychiatry and data-driven Pharmaceutics

PROBLEM DESCRIPTION

- Investigate, for example, disease comorbidities, patient stratification, drug interactions and clinical outcome of psychiatric patients.
- Apply methods from data mining, machine learning (ML) and text mining on high quality patient data collected in a patient registry database.

CHALLENGES AND GOALS

The goal of this project is twofold:

1. Detailed investigation of the applicability of ML methods and their modified version on psychiatric patient data.
2. Summarize what the best practice solutions are for analyzing psychiatric patient data, highlight the main differences between them.

MATHEMATICAL AND COMPUTATIONAL METHODS

The proposed program focuses on the deep mathematical analysis of a wide-range good quality medical data of psychiatric patients.

Data collected

- PANSS (medical scale used to measure symptom severity of schizophrenic patients)
- CGI (measures illness severity (CGIS), global improvement or change (CGIC) and therapeutic response)
- Medication (Previous drug history and medication during hospitalization)
- Demographic data

Methods

- **Classification**
  decision tree, random forest, stochastic gradient
- **Regression**
  linear and logistic regression
- **Longitudinal data analylsis**
  graph-based analytics of significant time dependent diagnostic pairs

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Results and Benefits

Findings

- Accurate drug utilization data and its detailed statistical analysis
- PANSS positive symptoms mean is significantly smaller than negative mean
- Schizophrenic patient clusters (based on CGI and demographic data) correlates with drug medication
- Changes in negative symptoms over time correlated with drug medication

Benefits, future

- A novel, easy-to-use registry database and high-quality data collected
- Machine learning and network approaches are promising (however hard to collect enough reliable data)
- Functional data analysis and topological data analysis potentials

Potential of significant cost and time reduction in clinical trials. More accurate drug utilization data. Pilot study with the application of machine learning methods.
Detailed drug utilization analysis, patient classification using different methods.

UNIVERSITY OF SZEGED
INSTITUTE OF INFORMATICS

Szegedi Tudományegyetem
Pszichiátriai Klinika 1921
UNIVERSITY OF SZEGED
FACULTY OF MEDICINE
DEPARTMENT OF PSYCHIATRY

HU-MATHS-IN
Hungarian Service Network for Mathematics in Industry and Innovations

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