**AI Research @ KMD**

**Learning algorithms**
- Supervised and semi-supervised model learning on streams: adaptation to data drift, dealing with evolving feature spaces
- Early-concept learning: real-time low-data predictions on trajectories with gaps, learning on trajectories with systematically missing data (mainly epidemiology and treatment) and time-series data
- Semi-supervised and active learning: label/infomation exploitation in evolving feature spaces
- Validation of the combination of models and patterns drawn from partially overlapping populations or samples

**Interacting with the experts**
- Experiments on acquiring new forms of information from an expert (mainly epidemiology and clinical research)
- Dynamics of expert delivered knowledge
- Interoperability of models and patterns

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**AI and mHealth apps for patient empowerment**

**Motivation**
- Chronic diseases cost EU economies around 125 billion euros a year. While the help of mHealth technology, patients can be empowered and supported in their self-management.
- The source of data are Ecological Momentary Assessments (EMA).

**Approach**
- The radial barchart visualization shows a cluster of severly affected tinnitus patients in 77%.
- Empowering and supporting in their self-management.

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**Using Entity Neighbourhood to Improve Entity-Centric Prediction**

**Motivation**
- The identification of different disease phenotypes can contribute to the determination of a suitable treatment pathway for patients.

**Approach**
- We propose a combination of a bottom-up clustering using soft-organizing maps and a top-level clustering using k-means to deal with the following issues:
  - Containers are representative to a specific phenotype?
  - How can one test high-dimensional clusters of patients involving dozens of hundreds of features?
  - How can one juxtapose multiple phenotypes and highlight characteristics that differentiate themselves from the population average?

**Results**
- Using the patient questionnaire data, we identified two phenotypes: a hypertensive, high blood pressure condition and a cluster of very low blood pressure readings.
- The radial barchart visualization shows a cluster of LBP suffering severe diabetes in 73 dimensions.

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**Main ongoing projects @ KMD**
- ImmuneLearning (2019 - 2022): EFRE “Entwicklung eines Eines zur Digitalisierung von Immunantwort bei Sentinelzellen durch Hilfe von Data Mining Methoden” (with Umea University OVIU)
- CHIRDS (2017-2020): EJ III Joint Action on “Implementing good practices for chronic disease”
- DISCARD (2013-2016): DFG project “Optimising Stream Classification with Ensembles and Active Inferences” (with Umeå University)

**Further cooperations in medical research**
- Epidemiological Research Learning on high-dimensional longitudinal data (U Medicine Gniebow)
- Clinical Research: Modelling and predicting patient evolution on streams with gaps - clinical studies & mHealth (U Medicine Regensburg)