Big Data for Medical Analytics

BIG Medi Ytics

Population Health and Chronic Disease Management

Kidney disease

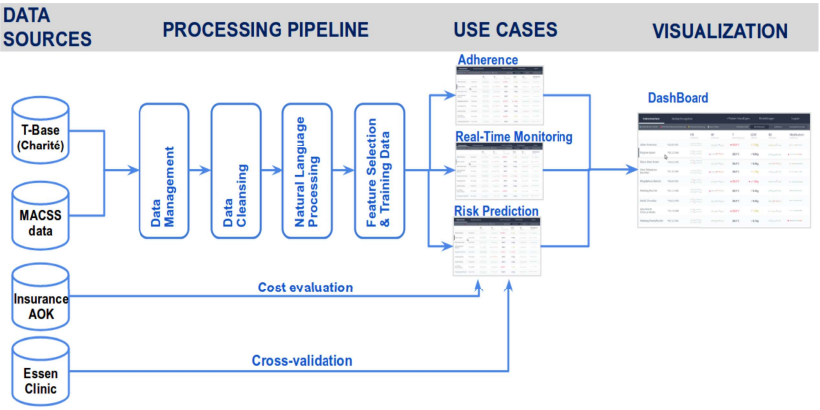
Introduction:

Malfunction or rejection of transplanted kidneys cause a high financial burden for the German healthcare system. A key reason for transplant rejection is therapeutic non-adherence, other reasons are not fully elucidated yet. Big data analytics and machine learning are technologies with a tremendous potential to reveal (unexpected) patterns and risk factors that are relevant for long-term transplant survival.

Costs caused by patients after KTx (Charité)

Year	Costs per Year	Number of Cases	Costs per Case per Year
2015	1.913.955€	1.835	1.043,03€
2016	1.863.104€	1.822	1.022,56€
2017	3.447.812€	1.766	1.952,33€

System Architecture:



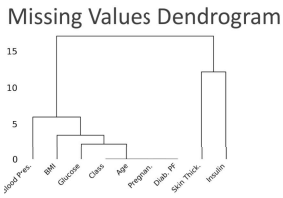
Cleansing:

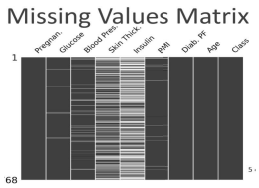
purify

Python library to ease data wrangling, cleansing, and EDA

Support for handling missing values:

- Listwise deletion;
- Mean/ median/ mode imputation
- Linear regression





➢ Goals: Reduction of re-hospitalizations as well as reduction of graft loss for kidney transplant patients

Adherence:

- The degree to which a patient correctly follows therapies and medical advices
- **Non-adherence** is one of the main reasons for unwanted re-hospitalizations and loss of kidney function

→ Monitoring adherence has a high impact for the treatment of patients in terms of outcomes and thus cost reductions

DashBoard:

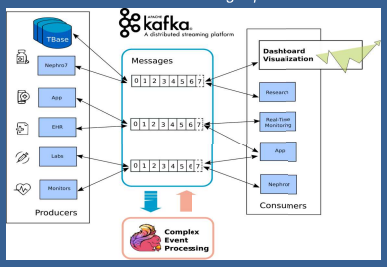
- **Visualization** of patients according to adherence
- **Data:** Real-time APP data, TBase
- **Method:** Rule-based adherence ranking based on data from MACSS platform

Real-Time Monitoring:

Data Source:

- Producer/consumer software design
- Updates of data can trigger generation of messages (events) in real time
- All important events are available in the moment when needed

Stream Processing Pipeline

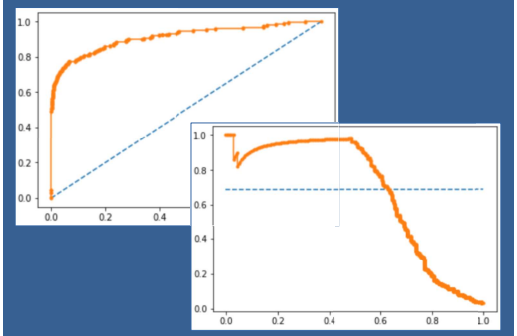


Complex Event Processing:

- Real-time stream processing for detection of sequence of events
- Matching of patterns, generated by experts
- Irrelevant data is discarded, allowing the process potentially infinite data streams

Risk Prediction:

- **Task:** Predicting the probability that an endpoint occurs in near future
- **Targets:** Re-hospitalization, mortality, infections, graft loss, ...
- **Data (retrospective):** 15 years, 8k patients
- **Features:** ~300 (demographic, vital, lab,...)
- **Method:** Gradient Boosted Regression Trees
- **Train/Dev/Test:** 80/10/10, 20-fold x-val
- **Preliminary Results (mortality):**
- **ROC:** 91.10 (stdev: 2.57)
- **Prec/Rec F1:** 86.72, 56.06, 68.10



AUC-ROC and Precision/Recall Curve for predicting mortality

BIG DATA VALUE PUBLIC-PRIVATE PARTNERSHIP
This project is part of BDV PPP
CHARITÉ UNIVERSITÄTSMEDIZIN BERLIN
DFKI
HPI
AOK Die Gesundheitskasse.
Universitätsklinikum Essen
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780495.