Clinical decision support system for acute kidney injury

Scope
The aim of our project is to develop a proof of concept for a clinical decision support system in the domain of acute kidney injury (AKI). Our focus lies on training a bayesian network for evaluating a patient's likelihood of having AKI. A bayesian network is a directed cyclic graph that represents multiple random variables and their conditional dependencies as probability functions. This way, based on a given evidence, the probability of another random variable can be calculated after the network was trained.

Problem and significance
AKI affects a large portion of the elderly population. It is mostly asymptomatic and has a high risk of death, as there is no trivial treatment once it breaks out. Today, recognizing kidney injury requires continuous monitoring of creatinine and other lab values. Since these values change as kidney function is affected, subtle alterations may be ignored, especially when many patients must be monitored at once. As a consequence, a significant portion of patients is diagnosed for AKI too late. In contrast to a human, an automated algorithm can monitor even minute lab changes for an arbitrarily large number of patients and consider several other factors simultaneously. A timely identification of risk patients may lead to a faster response of physicians, preventing AKI onset. Thus, the patients experience better prognosis, leading to faster recovery, reduced mortality rates and avoidance of further complications. This leads to reduced costs for health systems as well as benefits for the patients.

Solution
The first step in our approach was to identify factors which are indicative of the development of AKI from literature sources. These are mainly creatinine values taken from blood or urine samples but also comorbidities (such as heart failure or diabetes) and demographics. For training purposes, a real dataset consisting of both patients with AKI and without it was needed. This set was obtained from the anonymized Multiparameter Intelligent Monitoring in Intensive Care II (MIMIC II) database from PhysioNet. The resulting model was discussed with experts from the Charité hospital in Berlin and adjusted using their expert knowledge to improve accuracy. With the help of the network, a patient's risk for AKI can be recognized earlier, for example in the emergency room or intensive care unit (ICU). Thus, biopsies can be avoided, the outbreak of AKI prevented and lives can be saved.

What to expect?
This expert session serves as an introduction to the risk of acute kidney injury, as well as today's technologies against it using machine learning. We will introduce Bayesian networks and focus on the tools we selected to design them. Furthermore, we will present the developed models and the results achieved with them. Finally, we discuss the question: to what extent can "intelligent machines" be useful in healthcare?