# First Experiences Implementing Predictive Analytics Tools in a Clinical Routine Setting

Examples from the Heidelberg University Hospital

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***Abstract*—The rise of Artificial Intelligence(AI) is ubiquitous. In healthcare it is seen as a key technology supporting clinicians in their daily routine. The PART research project (Predictive Analytics of Robustness Testing) aims to develop an AI driven system which has the focus on networked device monitoring, profitability analysis and predictive maintenance in a clinical environemt. However before thinking about sophisticated AI algorithms at Heidelberg University Hospital we experienced a variety of difficulties according to medical device data acquisition from various manufactures and data protection which have to be solved first. This paper focuses on those difficilitues in a very early stage of the project and makes suggestions for suitable solutions.**

***Keywords-clinical artificial intelligence; artificial intelligence in healthcare; monitoring networked medical devices.***

## I. BACKGROUND

The University Hospital Heidelberg is a maximum care center running most of its patient record systems electronically. An important part of the information systems architecture is the integration of medical devices especially in the operating room [1]. Having those devices integrated, it is important to know which device is up and running, which one has got a problem and needs maintenance. The Predictive Analytics for Robustness Testing (PART) project aims to develop a monitoring system for networked medical devices of various manufactures in everyday clinical practice. The focus is on profitability analysis, predictive maintenance and monitoring of networked medical devices using data mining strategies. The monitoring system should manage a wide range of devices from various manufacturers within the clinic. This work presents first experiences in designing and implementing such a vendor-independent monitoring system facing the real world setting of a university hospital. Subsequently, the complexity of the development will be briefly outlined from the perspective of a hospital.

## II. METHODS & RESULTS

There are several obstacles according to medical devices, device data and data protection that have to be taken in advance of realizing a powerful monitoring system. First, one has to address problems caused by heterogeneity. Medical devices are mostly, due to reasons of independence, from different manufacturers. This ranges from infusion pumps to the latest CT or MRI scanners. Even though there are standards for networked medical devices in operation rooms (e.g., IEEE 11073) [2][3], the communication of these medical devices works mostly via proprietary interfaces and protocols and manufacturers are very reluctant disclosing those interfaces, or implementing given standards. Further, expensive medical devices like CT scanners usually have extensive maintenance contracts which include that maintenance, repair and service may only be performed by a

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service engineer of the manufacturer itself. Collecting relevant data from such medical devices, e.g., getting information about the condition and operating status is demanding. Gathering data by additional attached IoT sensors in a sterile environment like an operation room is under serve restrictions due to aspects like patient safety. This makes it very difficult to just gather data from each networked device and analyse it. In PART the current question is not which data mining algorithms fit the most for our needs, the question is where is the data coming from in the first place. Hence, we are looking in all directions and started working with simulated medical device data as well to get familiar with the data mining approaches. Another subject is data protection and privacy. By monitoring medical devices, collecting and analysing data it could be possible to draw conclusions about patients, treatment and the work of clinical personnel itself. This is sometimes seen very critically by the clinic staff and requires a close examination and further steps like anonymization of the medical device data. Although networked medical devices in clinical environments produce a high volume of data, it is quite challenging, as described above, to access, evaluate and generate added value from this data treasure. In order to develop a multi-vendor system that uses AI for monitoring, profitability analysis and predictive maintenance, one has to address those mentioned issues first.

## III. DISCUSSION AND OUTLOOK

At Heidelberg University Hospital our strategy is to work closely together with device manufactures to address the former mentioned issues like heterogeneity, proprietary interfaces and protocols and lack of medical device data itself. Further with the experience made, we have lowered our aspiration on our way to a AI driven system for predictive maintenance and start with simple descriptive analytics on simulated medical device data. When established, such a monitoring system has several benefits for the clinic. It should make the complete IT infrastructure more robust and stable. Detecting problems of networked medical devices in early stages or in a best case scenario, before they are going to happen, saves maintenance time and costs. Further, with workload statistics of the medical devices one gets a good tool for tracking the usage and can adapt the inventory accordingly.

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