Technische Universiteit Eindhoven University of Technology

ProM process mining workbench

Discovery and Extension

AMC's Question

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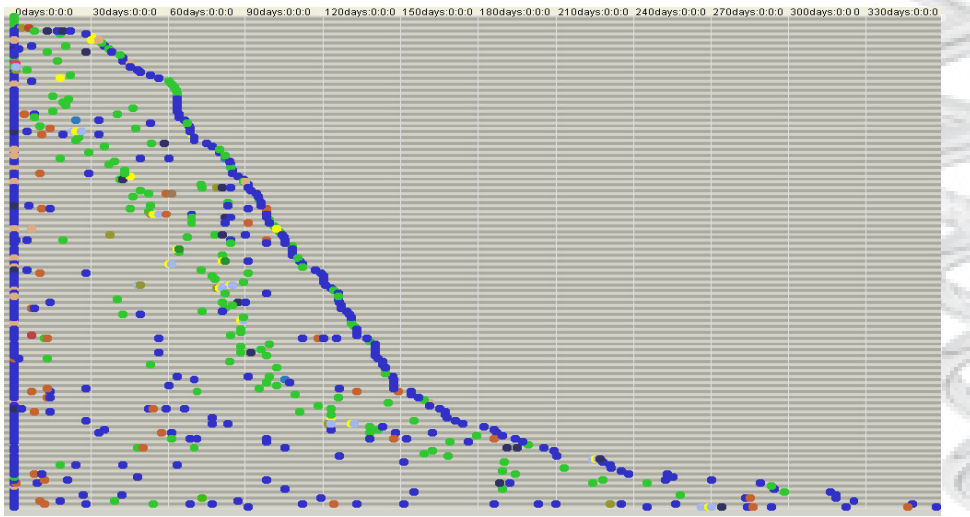
The AMC is one of the largest academic hospitals in the Netherlands which treats patients that are either requiring highly complex care or standardized, low-complex care. For the latter group of patients, the surgery department of AMC was interested in seeing whether the care process was organized efficiently and effectively. Using process mining the aim was to answer questions such as:

- Are there any medical departments for which high waiting times exist?
- Is there a huge variation in the number of diagnostic tests and therapeutic treatments that are requested?
- How can the process be optimized such that it can be performed with lower costs and within less time?



Screenshot of the dotted-charrt plugin of ProM 6 showing for a group of patients that there is a huge variation in the total treatment time. On the vertical axis the different patients are shown. Each action is represented by a dot and each type of action is visualized by a separate color. Moreover, the actions for each patient are shown using relative time

Process Mining

The goal of process mining is to extract process knowledge (e.g. process models) from event logs. Within a hospital these event logs may originate from an administrative system which take care of the documentation and billing of all services delivered to patients. One type of process mining is discovery. Without any other a-priori information it is possible to discover process knowledge (e.g. a model can be discovered which shows the typical steps taken before surgery). Another important type of process mining is extension. Here, additional information extracted from the log is projected on an existing model. For example, performance information may be projected on a discovered healthcare process in order to see for which examinations a long waiting time exists.

Results

Using process mining, for four different patient groups the associated care processes and its performance were discovered. Some of the results are the following.

Waiting times:

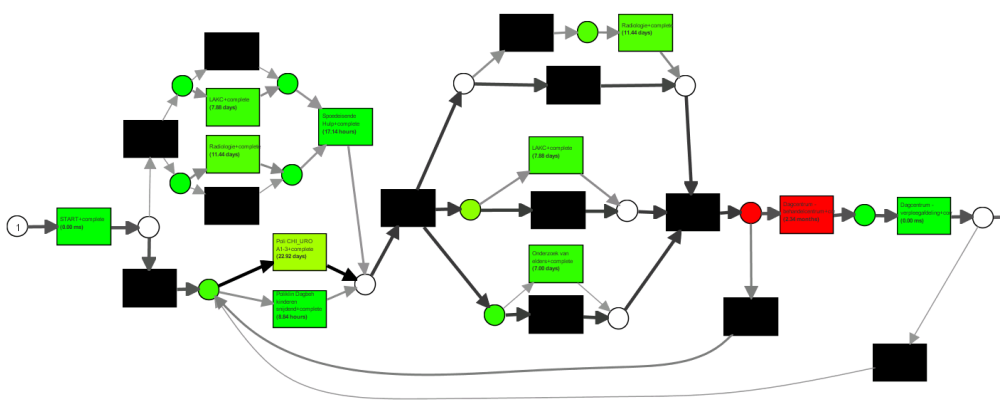
For a surgery on the outpatients' clinic, the operating theatre, and the daycare-center the average waiting time is 1 to 2 months whereas for 80% of the patients at most 2 visits to the hospital are needed before the surgery can take place. In case the waiting times would be halved this would mean that on yearly basis the waiting time for 300 patients is 12,5 years less.

Last consultation:

For only 12% of the patients, the treatment trajectory is finished by a consultation by telephone. In case this would have been 50%, this would have meant, on a period of 4 years, a saving of more than €10,000 and 38 hours less consultation time.

Costs:

For one large group of patients, it appeared that for 7% of them there are one or more actions that are not in line with the associated diagnosis of the patient. In case these actions would have been registered differently this would have yielded a considerable amount of income for the hospital.



Screenshot of a discovered process model in which an action is represented by a rectangle. For a group of patients, the process till surgery is shown. A green colored rectangle indicates a short average watiting time for an action whereas a red colored rectange indicates a high average waiting time. For example, for the surgery shown at the outer right side there is a long average waiting time of more than 2 months