A Study on Goals of Process Mining in Health Care

Manjula Sanjay Koti[a] and S. Satheesh Kumar[a]

[a]*Master of Computer Applications, Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka ,India*
E-mail: manjula.dsce@gmail.com, Satheesh.dsatm@gmail.com

Abstract: Currently, with lot of competition in health care market, most of the hospitals are focusing on stream line of the processes to deliver high quality care at the same time by reducing costs. Accordingly, it is very critical to explore and process the data collected by health care sectors. Process mining is a research area that lies between computational intelligence and data mining on one side and process modelling and analysis on other side. Hence process logs are maintained to discover, monitor and improve the real processes. Majority of the hospitals have adopted the methodology of lean thinking in order to improve patient care and this has led to significant improvements in the clinical processes. This paper deals with the concept of lean methodology and also discusses the concepts and various algorithms and applications in process mining.

Keywords : Process Mining, Clinical Processes, Process Modeling Languages.

1. INTRODUCTION

Data mining is the analysis of data for finding relationships and patterns. The patterns are an abstraction of the analysed data. Abstractions reduce complexity and makes information available for the recipient. The aim of the process mining is the extraction of information about business process. Process mining encompasses techniques tools and methods to discover, monitor improve real processes.by extracting knowledge from event logs. Process mining evolved in the context of analysing software engineering processes by cook and wolf in the late 1990s [1]. Public hospitals has to adopt to key process indicators(KPI's).majority of the hospitals have process which has the capacity to report and monitor the performance with statistics ,while this method does not provide with the improvisation of process[2]. Business process re-engineering or clinical process re-engineering both are initiatives to focus on continues improvements to gain competitive advantage from hospital perspective for services oriented and increasingly becoming patient cantered to service the health care[3].

2. LITERATURE SURVEY

In [1] the authors has described about hospital information system and system record information about business processes and clinical processes. Process mining applied to the organizations and how data can be extracted from logs.in health care. In [2] the author described about the execution of process mining in industries and flow of process in organizations and also described about event logs. In [3] the author described a measure to quantify discrepancies between a process model and the actual behaviour as registered using event-based data.

The idea of applying process mining in the context of workflow management systems and two problems are defined. The first problem is to find a workflow graph generating events appearing in a given workflow log. In [4] the author described about patient journey and clinical process to redesign a holistic approach in redesign process. In [5], the author described about lean thinking methodology to improve patient care. In [6], the author described about the basic concept of methodology and what are the necessity of workflow management system. In [7], the author explained about the history of processes and how the processes are competitive in various environments. In [8], the author described about the goal of process mining and how logging data are use full to construct the process models. In [9], authors describes about dominant modelling language in the field of process mining and its use full to create process models.

In [10], the author describes about the automated construction of simulation models, model extensions. In [11], the author describe about data mining techniques, process models, types of representation and algorithms. In [12], The authors described time stamp of the event and the data elements recorded with event. In [13] the author described about the application of process mining and medical treatment process of the complex environment. In [14] the author described about the modelling languages rules and behaviour when models executing in the process. In [15] the author described about the algorithms which generates the order relating events. In [16] the author described about the algorithms, and events when generate and reconstructs the process models.

3. GOALS OF PROCESS MINING

The goal of the clinical process redesign is to improve the poorly coordinate patient journey when the patient move to multiple departments this should also account for continues fine tuning and adjustment of ever transient in the hospital system redesign process [4]. Nowadays, most of the hospitals around the world have adopted "lean thinking" methodology to improve patient care and their clinical process. A huge amount of data can is collected in the hospital information system and systems record information about the process in the form of event log [5]. While in the health care process mining concentrates on execution of health care processes. Lean thinking provides insight to understand the patient flow process that helps in effective coordination and implementation of this is not the sufficient to relief the hospital wide crisis, when an issue with availability of beds still exists.

Various statistical techniques are used in health care data analysis to report and forecast health care performances [6]. Process model is a graphical representation of business process that gives the dependences between activities which needs to execute for realizing a separate business objective. Various process modelling languages are used to represent process models for example using business process model and notation [BPMN], event driven process chains [EPC] or petri nets, in the field of process mining petri nets represents the dominant modelling language [9]. Process mining is a research area that lies between congenital intelligence and data mining on one side and process modelling and analysis on the other side. Process mining extracts knowledge from event logs that are available from information systems and this leads to discover, monitor, and improve the real process. Process mining accounts for automated process discovery, conformance checking, social networks or organizational mining and automated consecutive of simulated models [10].

Positioning of the three main types of process mining: (*i*) Discovery (*ii*) Conformance Checking (*iii*) Enhancement

Process models comprise of a set of activity models and the constraints between them and these models reduce the complexity by taking into account characteristics of interest. Figure 1 depicts positioning of three main types of process mining. Process models cab be graphically represented by business process that depicts the dependencies between activities and these has to be executed as a whole to realize a specific business objective. The representation of process models can be achieved by various process modelling languages viz., business process models and notation [BPMN], event driven process chains [EPC] the representation of

dominant modelling language will be done by petri nets when the formal expressions of the petri nets language is strong and BPMN provides imitative semantics that are easier to understand for recipients, even though if he does not process a theoretical back ground in informative.
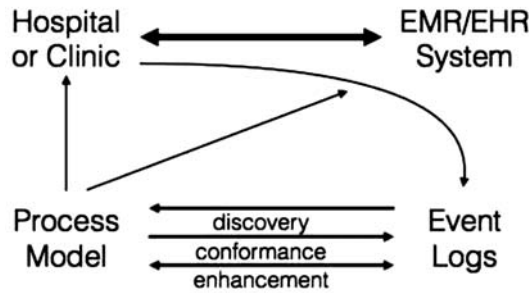

Figure 1: 3 types of EHR/HIT process mining

The missing link between data mining, traditional model driven business process management can be provided by process mining .process models exhibit concurrency and these are in comparable to classification and association rules in data mining[11].Process mining is not only limited to control flow discovery but practitioners and academicians easily identify the process models by using event logs. The main source of origination for event logs is either through generic EIS or through hospital information system. Information about the start or complete of process tasks along with related context data and time stamps are maintained by event logs [12].

The greatest challenges for hospital management is to fill the gap between the actual clinical processes and the recommendations which are provided guidelines, hence there should exist some methods that (*i*) can measure the adherence of the actual process behaviour with respect to the expected behaviour (*ii*) identify the deviations which occur quite often and (*iii*) provide results, where the doctors can easily understand and focus on the identified deviations. Hospitals are facing process related problems which has proven to be capable of providing deep insight into process in a relatively time span .hospitals discover the by the application of process mining. Medical treatment processes are highly dynamic, complex, increasingly, multi-disciplinary and soften adhoc because of the complexity environment in which they are executed they usually involve several variables that can be handled differently depending on the specific patient being treated .therefore process models need to give freedom and should not restrict users in taking actions[13]. Process modelling language provides model edibility with respect to imperative languages when describing process behaviour. Imperative languages can be lead to unreadable and complex models in variable environment. Declarative languages do not model the allowed behaviour in this way there are more possibilities for executions since everything is allowed unless explicating forbidden. This is achieved by representing the process as a set of rules so that it can be executed in all possible ways as alone as these rules are respected [14].

Deterministic mining algorithm delivers the same result for the same input. α- algorithm [15] belongs to this category and this was the first algorithm which was developed and dealt with concurrency. The input for this algorithm is event log and this calculates the ordering relating the events which exist in the log. Genetic mining algorithm uses an evolutionary approach that takes into account the process of natural evolution. Genetic mining algorithm follows four steps: initialization, selection, reproduction and termination. Heuristic mining algorithm also uses deterministic algorithm but they incorporate frequencies of events and traces for reconstructing a process model [16].The idea behind these algorithms is to generate a random population of process models and to find a satisfactory solution by iteratively selecting and reproducing them by crossover and mutation over different generations.

4. CONCLUSION

The greatest challenge for healthcare management is to fill the gap between the actual clinical processes and the recommendations which are provided as guidelines. With regard to health care, process mining concentrates on the execution of healthcare processes. Process mining accounts for automated process discovery, conformance checking, social network and automated construction of simulated models. The three categories of mining algorithms viz; Deterministic, heuristic and genetic algorithms which are the main components in process mining has been discovered.

REFERENCES

[1] Process Mining - StB Prof. Dr. Nick Gehrke Nordakademie Chair for Information Systems Köllner Chaussee 11 D-25337 Elmshorn nick.gehrke@nordakademie.de

[2] Michael Werner, Dipl.-Wirt.-Inf. University of Hamburg Chair for Information Systems Max-Brauer-Allee 60 D-22765 Hamburg michael.werner@wiso.uni-hamburg.de

[3] Gaining Insight from Patient Journey Data using a Process-Oriented Analysis Approach-Lua Perimal-Lewis-School of Computer Science, Engineering and Mathematics, Flinders University of South Australia, GPO Box 2100, Adelaide 5001, South Australia.

[4] Shaowen Qin School of Computer Science, Engineering and Mathematics, Flinders University of South Australia, GPO Box 2100, Adelaide 5001, South Australia, Campbell Thompson, Medicine, The University of Adelaide, 5005 South Australia.

[5] Van der Aalst, W. M. P. 2011. Process Mining: Discovery, Conformance and Enhancement of Business Processes, (1st Edition) Berlin; Heidelberg:

[6] Van der Aalst, W. M. P., Andriansyah, A., Alves de Medeiros, A. K., Arcieri, F., Baier, T., Blickle, T., Bose, J. C., Van den Brand, P., Brandtjen, R., and Buijs, J. 2012. "Process mining manifesto," In BPM 2011 Workshops Proceedings, pp. 169–194.

[7] Paul Hakendorf Clinical, Epidemiology Unit, Flinders, Medical Centre, Flinders Drive, Bedford Park 5042 South Australia.

[8] Process Mining - StB Prof. Dr. Nick Gehrke Nordakademie Chair for Information Systems Köllner Chaussee 11 D-25337 Elmshorn nick.gehrke@nordakademie.de.

[9] Process Mining Techniques: an Application. to Stroke Care. Ronny MANSa,1 , Helen SCHONENBERG a, Giorgio LEONARDI b, Silvia. ...a Eindhoven University of Technology, The Netherlands 573.

[10] Declarative process mining in healthcare-Marcella Rovani ,Fabrizio M. Maggi,Massimiliano de Leoni Wil M.P. van der Aalst,University of Naples Federico II, Naples.

[11] Italy, University of Tartu, Tartu, Estonia, Eindhoven University of Technology, Eindhoven, The Netherlands.

[12] Patient journeys: the process of clinical redesign: David I Ben-Tovim, Melissa L Dougherty.