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Book Review

Process Mining: Discovery, Conformance and Enhancement of Business Processes

Considerations of patient and clinician workflow are crucial for successful implementation of healthcare IT. Workflow technology (WT) represents an emerging class of software products that enable advanced modeling, execution and analysis of processes [1]. Important components within the workflow technology software suite are tools for a technique known as process mining. Process mining can be defined as a methodology for obtaining graphical and computable process models from event logs associated with particular workflows or processes. Process mining is relatively new scientific domain with many new emerging algorithms and tools and, until now, has lacked a textbook that provides a comprehensive overview of this domain.

Process Mining: Discovery, Conformance and Enhancement of Business Processes, published in the fall of 2011, attempts to fill this need [2]. The author, Will van der Aalst, is an internationally recognized workflow technology expert, author of numerous articles and books on the subject, and was a keynote speaker at MedInfo 2004. The current book covers process mining topics across all industries; healthcare experts will find much that is relevant to their own domain, especially a chapter sub-section detailing a healthcare case study (mining gynecological oncology processes in a Dutch hospital).

Processes are present on many levels in healthcare. On a patient level, one can look at how a disease of a patient progresses in time and how a single patient interacts with different specialties and facilities. Analysis of variability of such care is a perfect match for process mining. From the clinician perspective, process mining can analyze current versus ideal sequences of clinician work on a patient level, clinic level or a healthcare network level. *Process Mining* will appeal to audiences looking to analyze their event logs, including IT experts, clinical informaticians, and tech-savvy executives.

The book looks at processes from four perspectives: (1) the *control-flow perspective*, which examines the ordered sequence of activities involved in the process and characterization of all possible paths a process may take; (2) the *organizational perspective*, which focuses on resources recorded in the event log (e.g., people, systems, roles, departments) and how they are related; (3) the *case perspective*, which considers how an instance of a single process projects on the overall model; and (4) the *time perspective*, which is concerned with the timing of events to identify bottleneck activities or resources and predict case completion time.

The book is structured into five parts: (1) "Preliminaries", (2) "From Event Logs to Process Models", (3) "Beyond Process Discovery", (4) "Putting Process Mining to Work", and (5) "Reflections". The first part offers an excellent introduction to process modeling and data mining. The reader will discover a comprehensive account of workflow related concepts and paradigms. One such example is the Yerkes-Dodson law that describes the relation

between workload and performance of people. It formalizes a common observation that in most processes, people will take more time to complete a task if their work list has only a few cases to work on. The second part continues the focus mainly on process discovery and describes in detail how to transform event logs to prepare them for data mining. It provides an overview of current process mining algorithms and describes in detail four such algorithms. The third part goes beyond process discovery and describes conformance checking (comparing a given process model with event logs) as well as additional workflow perspectives (organizational, case and time perspective). The fourth part focuses on current usage and applications of process mining, starting with an overview of existing process mining software tools. It then shows real-life examples of simple processes and presents case studies of less structured and more complex processes (including the healthcare case study in gynecological oncology). The final part of the book enumerates challenges and improvement opportunities in process mining.

In addition to verbal explanations, the book contains numerous detailed mathematical accounts of the phenomena in question. Such sections may be difficult for some readers; however, they can be skipped without compromising overall understanding. Despite offering good account of various mining techniques, an in-depth reader will have to do his or her own extrapolation to healthcare applications and experiment with selecting the best mining algorithm or adjusting a given algorithm's parameters to apply the methods for a given healthcare focus (e.g., exploring variability of care). However, existing published healthcare studies applying process mining in stroke [3,4], congestive heart failure [5], emergency care [6] or chronic kidney disease [7] provide additional guidance. The main value of the book is presenting a sound theoretical basis for process mining domain, providing an excellent overview of available mining algorithms and, most importantly, providing an exhaustive enumeration and evaluation of currently available commercial and open source process mining software packages.

Process mining represents a relatively young scientific domain within workflow technology that is not well known and recognized by experts in data analysis and data mining. The need for a single reference book to cover process mining in detail is very clear and *Process Mining: Discovery, Conformance and Enhancement of Business Processes* is an excellent textbook that fills this need.

References

- [1] Haux R, Seggewies C, Baldauf-Sobez W, Kullmann P, Reichert H, Luedecke L, et al. Soarian – workflow management applied for health care. *Methods Inf Med* 2003;42:25–36.
- [2] Van der Aalst WMP. *Process mining: discovery, conformance and enhancement of business processes*. 1st ed. New York: Springer; 2011.
- [3] Mans R, Schonenberg H, Leonardi G, Panzarasa S, Cavallini A, Quaglini S, et al. Process mining techniques: an application to stroke care. *Stud Health Technol Inform* 2008;136:573–8.

- [4] Panzarasa S, Quaglini S, Micieli G, Marcheselli S, Pessina M, Pernice C, et al. Improving compliance to guidelines through workflow technology: implementation and results in a stroke unit. *Stud Health Technol Inform* 2007;129:834–9.
- [5] Helmering P, Harrison P, Iyer V, Kabra A, Slette JV. Process mining of clinical workflows for quality and process improvement. HIMSS conference proceedings; 2012.
- [6] Rebugue A, Ferreira DR. Business process analysis in healthcare environments: a methodology based on process mining. *Inform Syst* 2012;37:99–116.
- [7] Huser V, Starren JB. EHR data pre-processing facilitating process mining: an application to chronic kidney disease. *AMIA annu symp proc*; 2009.

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