

PhD Proposal

Process Mining: intentional process model generation for recommendation

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Location : Université Paris 1 Panthéon-Sorbonne, Centre de Recherche en Informatique, 90, rue de Tolbiac 75013 Paris, France

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No application will be considered after the 1st of June 2014

Keywords: intention mining, process mining, ontologies

Research subject

Context

Research and practice on process mining have increased in the last few years as the importance of process modelling has been recognized (Perceptivesoftware, 2012; Gartner, 2013). Process modelling in organizations allows:

- To facilitate the understanding and to increase the awareness of the process among the different stakeholders,
- To guide the stakeholders while enacting the process,
- To manage, execute and control the process in a semi-automatic or automatic way,
- To manage the changes and control their impacts,
- To reuse the model for a better productivity and quality of the products.

Process mining has several goals (van der Aalst, 2011):

- Discovering process models from event logs,
- Analyzing the conformance between a prescribed and the discovered process models,
- Improving the prescribed process models.

The discovered process models using current process mining techniques are defined in terms of activity, with BPMN or Petri nets for instance (van der Aalst, 2011). We believe human ways of working are not activity oriented but rather intention oriented: we act according to a goal and we

employ a strategy to achieve this goal. The intention can be complex so we need to define sub-intentions and strategies to achieve those intentions until achieving the final intentions. Another strategy can be employed to achieve an intention if the first strategy was not successful. This process is then rather complex and it is hard to represent it as a simple sequence of activities, even if they include fork or decision nodes.

The Centre de Recherche en Informatique has been working on intentional process models for nearly 15 years and proposed Map, a metamodel to build models to “represent multi-approach processes and plan different possible ways to elaborate the product based on the notion of intention and strategy” (Rolland et al., 1999).

Our objective is similar to process mining’s ones: we want to discover intentional process models, compare intentional process models to detect gaps and improve intentional process models from the discovered elements. We also want to provide recommendations to users based on the discovered intentional process model and on their current traces.

In previous works, we proposed an approach based on Hidden Markov Models to discover intentional process models as maps (all papers of Khodabandelou et al, 2013). This approach is able to discover strategies from event logs, the intentions and the relations between them. However, the labeling of the strategies and the intentions and the determination of the level of abstraction is done manually by analyzing the semantic of the related events.

Objective

The first objective of this PhD project is to propose a new approach to discover strategies and intentions, their semantic, level of abstraction to construct automatically or semi-automatically intentional process models as maps. This approach can be based on existing intentional metamodels as KAOS (Dardenne et al., 1993), i* (Yu, 2011) or Map (Rolland et al., 1999).

The second objective is to propose recommendation techniques to guide users of systems while enacting a process. Using the discovered process model and the current traces of the user, the techniques should provide adapted recommendations.

Research questions

Several questions must be raised and answered during the PhD project:

- Is it possible to correctly label the found intentions and strategies on an automatic or semi-automatic way (e.g. with the help of ontologies)? We believe ontologies have to be built from the labels of the activities stored in the traces. Those ontologies of activities have to be mapped with ontologies of intentions to associated non labelled intentions to a label. A semantic analysis of the activities has to be done to build the corresponding ontologies. Other solutions than ontologies have to be studied and evaluated.
- Is it possible to define multilevel maps from event logs? A section of a map (a triplet defined as <source intention, target intention, strategy>) can be theoretically decomposed into another map. The mining technique should be able to discover that a process involves different levels of abstraction of intentions, to define these levels and to organize the intentions and strategies in the corresponding level.
- Is it possible to discover hard goals and soft goals from event logs? Hard goals represent goals which results can be measured (“Increase revenue” for instance); soft goals often

represent nonfunctional requirements (qualitative requirements that cannot be evaluated quantitatively, “Increase quality of GUI” for instance). The proposed mining technique should discover both kinds of goals.

- Is it possible to identify intentions and strategies related to specific stakeholders? It would be interesting to discover intentional process models that combine the points of view of different stakeholders and differentiate their intentions and strategies within the same models. We could imagine the intentions and strategies differ because of the level of experience of the stakeholders, their responsibilities or tasks, their culture and background etc.
- Is it possible to provide recommendations to users while enacting a process based on the discovered intentional process model and their current traces? We believe intentional models can provide recommendations to users in an adequate way as they are close to human ways of working and thinking. Moreover, by understanding and modelling the stakeholders’ ways of working and thinking into intentional process models, the model can be reused by other stakeholders to be guided while enacting a process according to their intentions by following the strategies that best suit their context and experience, or by defining new strategies. The recommendation should take into account the discovered intentional process model from existing traces but also the current trace of the stakeholder, as we could infer the intention he/she has in mind at this particular moment, to provide him/her more adequate strategies.

Application domains

This PhD project will be mostly applied to the domain of Information Systems Engineering and in particular to method engineering. We want to understand the ways of working of actors while creating a software or information systems (during the modelling and developing tasks mostly).

Implementation

ProM (<http://www.processmining.org/prom>) is the open source tool developed by the process mining community in Java. The last objective of this PhD project is to implement a plugin that will support the developed approach and share it with the process mining community.

Requirements

The candidate must hold a M.Sc. in Computer Science (or equivalent). He/she must have very good skills in statistics, data and text mining, data analysis, java programming and be interested in process modelling and information systems engineering. The candidate should have good writing skills in English. He/she must be highly motivated, independent, with a real ability to organize and follow a schedule.

To apply

Send a detailed CV (resume) (in English), a motivation letter (in English), copy of official transcript of student record (B.Sc and M.Sc) (and translation if not in French, English or Spanish) and letters of reference to Rebecca Deneckère (rebecca.deneckere@univ-paris1.fr) before the 1st of June 2014.

References

Dardenne, A., Van Lamsweerde, A., Fickas, S.: Goal-directed requirements acquisition. Science of computer programming 20(1) (1993)

Gartner, <http://www.gartner.com/newsroom/id/2637615>, STAMFORD, Conn., December 16, 2013

Hug, Charlotte, Rebecca Deneckère, Camille Salinesi. [Map-TBS: Map process enactment traces and analysis](#). Colette Rolland, Jaelson Castro, Oscar Pastor. *International Conference on Research Challenges in Information Science (RCIS)*, May 2012, Valencia, Spain. IEEE, Sixth International Conference on Research Challenges in Information Science (RCIS), 2012, pp. 204-209. <http://dx.doi.org/10.1109/RCIS.2012.6240435>

Hug, Charlotte, Camille Salinesi, Rebecca Deneckère, Stéphane Lamassé. Process modeling for Humanities: tracing and analyzing scientific processes. Philip Verhagen. Annual Conference of Computer Applications and Quantitative Methods in Archaeology (CAA 2011), April 2011, Beijing, China. Amsterdam University Press, Revive the Past : Proceedings of the 39th Annual Conference of Computer Applications and Quantitative Methods in Archaeology (CAA), Beijing, China, 12-16 April 2011, pp. 245-255, 2012

Janković, Marko, Marko Bajec, Ghazaleh Khodabandelou, Rebecca Deneckère, Charlotte Hug, Camille Salinesi. [Intelligent Agile Method Framework](#). Leszek Maciaszek and Joaquim Filipe. *8th International Conference on Evaluation of Novel Approaches to Software Engineering*, June 2013, Anger, France. SCITEPRESS, Proceedings of 8th International Conference on Evaluation of Novel Approaches to Software Engineering, pp. 187-192

Khodabandelou, Ghazaleh, Charlotte Hug, Rebecca Deneckère, Camille Salinesi, Marko Bajec, Elena Kornysheva, Marko Janković. [Cots Products To Trace Method Enactment: Review And Selection](#). *21th European Conference on Information Systems*, June 2013, Utrecht, Netherlands. Proceedings of 21th European Conference on Information Systems

Khodabandelou, Ghazaleh, Charlotte Hug, Rebecca Deneckère, Camille Salinesi. [Process Mining Versus Intention Mining](#). Selmin Nurcan and Henderik A. Proper and Pnina Soffer and John Krogstie and Rainer Schmidt and Terry Halpin and Ilia Bider. *EMMSAD 2013*, June 2013, Valencia, Spain. Springer, Enterprise, Business-Process and Information Systems Modeling, 147, pp. 466-480, Lecture Notes in Business Information Processing

Khodabandelou, Ghazaleh, Charlotte Hug, Rebecca Deneckère, Camille Salinesi. [Supervised Intentional Process Models Discovery using Hidden Markov Models](#). Roel Wieringa, Selmin Nurcan, Colette Rolland, Jean-Louis Cavarero. *Seventh International Conference on Research Challenges in Information Science*, May 2013, Paris, France. IEEE, Proceedings of Seventh International Conference on Research Challenges in Information Science, pp. 1-11

Khodabandelou, Ghazaleh, Charlotte Hug, Rebecca Deneckère, Camille Salinesi. [Découverte supervisée de Modèles de processus intentionnels basée sur les Modèles de Markov Cachés](#). *XXXIème Congrès INFORSID*, May 2013, Paris, France. Actes du XXXIème Congrès INFORSID

Khodabandelou, Ghazaleh. [Contextual Recommendations using Intention Mining on Process Traces](#). Roel Wieringa, Selmin Nurcan, Colette Rolland, Jean-Louis Cavarero. Doctoral Consortium, *Seventh International Conference on Research Challenges in Information Science*, May 2013, Paris, France. IEEE, Proceedings of Seventh International Conference on Research Challenges in Information Science - Doctoral Consortium.

Perceptivesoftware, Digging for Value, Seven Gems of Process Mining, white paper, 2012

Rolland, C., Prakash, N., Benjamen, A., 1999. A Multi-Model View of Process Modelling, Requirements Engineering 4(4), 169-187

van der Aalst, W.M.P. Process Mining: Discovery, Conformance and Enhancement of Business Processes by, Springer Verlag, 2011 (ISBN 978-3-642-19344-6).

Yu, E.: Modelling strategic relationships for process reengineering. Social Modeling for Requirements Engineering 11 (2011)