**Name of student:** Mickael LIU

**Name of your Level:** L0

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**Paper title:** Intentional Process Mining: Discovering and Modeling the Goals Behind Processes using Supervised Learning

**Keywords specific to the paper:**

intention mining, trace, supervised learning, Hidden Markov model, goal modeling, event log

**Summary of the main contributions:**

Understanding people’s goals is a challenging issue that is met in many different areas such as security, sales, information retrieval, etc. Intention Mining aims at uncovering intentions from observations of actual activities. While most Intention Mining techniques proposed so far focus on mining individual intentions to analyze web engine queries, this paper proposes a generic technique to mine intentions from activity traces. The proposed technique relies on supervised learning(a category of machine learning that uses labeled datasets to train algorithms to predict outcomes and recognize patterns) and generates intentional models specified with the Map format. The originality of the contribution lies in the demonstration that it is actually possible to deconstruct processes to extract the underlying intentional plans built by people when in action, and specify them in models.

Process Mining has been a topic of interest that has attracted a growing number of publications for the past 10 years. The need of companies to better know their processes, model them, check their alignment with strategic goals, monitor their evolutions has generated a wealth of applications, from business process monitoring to reverse engineering and software process modeling, which in their turn raise new research issues.

Several methods were recently proposed to mine intentions from observed behaviors. The key idea is to extract sequences of activities from records to evaluate and predict the users’ intentions that resulted in those activities. In these works, intentions are considered as “goals to be achieved by performing processes”.

Intentions must be modeled, and dependencies between them and other concepts such as resources, tasks, strategy, systems functions, etc. be specified. The main contribution of this paper is a mining method that produces intentional process models.

In the context of Information Systems (IS) engineering, intentional process mining can be useful at different stages of the process model lifecycle, for instance

1. at the requirements level, to get the actual users' goals rather than assumed ones,
2. at the project management level, to check the alignment between a prescribed objectives and the actual processes model
3. at the application level, to supervise users activities and provide them with more useful recommendations at runtime.

This paper presents the Supervised Map Miner Method, an intentional process mining method that uses supervised learning and Hidden Markov Models to generate intentional models specified with the Map format. The focus is not only on understanding how different intentions in a process are connected but also on recognizing that intentions can be optional. The method explains the various strategies used to achieve these intentions in different situations. The big deal here is that the method doesn't just say there are intentions or categorize them vaguely; it actually names and organizes them in a way that humans can understand, using a formal language. So, it makes the intentions behind the studied processes clear and formal.

The Supervised Map Miner Method can be distinguished from the other approaches of intention mining field by several novelties:

1. The inputs in our approach are a set of traces of activities related to users and no single entity such as queries, logs, etc.
2. Contrary to the other approaches, our method analyzes processes enacted by users to obtain a common goal,
3. The multi-level topology of activities, strategies and intentions requires a mathematical model, whereas in the other approaches, using classification techniques is enough to classify a single input into a class of intention,
4. This method offers high-level intentions models as results, contrary to the other approaches that discover only low-level intentions. This difference is fed by the fact that the method assumes there are strong correlation and dependency between users’ activities and they are not a single, independent and uncorrelated entity.

In practice, the Supervised Map Miner Method could be used whenever intentions are known and can be modeled in advance. This is for instance the case in the Enterprise Architecture context where not only business processes are supposed to be implemented by their organizations, but also strategic objectives, missions, business goals are well-known and can be modeled. In this situation, the Supervised Map Miner Method could be used to monitor alignment with best practice strategies (for audit), target strategies (to monitor change), or to facilitate strategic emergence. In the engineering context, the Supervised Map Miner Method can be used to understand which methods are actually used and how, and to inform recommendation techniques for people who need guidance. There is little doubt many other applications will be found in the future.

What if intentions are not known and modeled in advance? Both issues are hard: unsupervised learning (Unlike supervised learning, unsupervised learning algorithms are not given labeled training to learn the relationship between the input and the outputs.) is an obvious answer to the first one. This approach is promising as it generally shows better results than supervised learning. However, the problem is that we would like to keep making mined intentions explicit. This implies that a new element, such as ontology, should be introduced in the method to generate the names of the intentions.