Mining Teaching Behaviors from Pedagogical Surveys

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Domain knowledge incorporated in the mining process can improve it, in particular by constraining the patterns discovered. In this paper we show how some domain knowledge (embodied as constraints) combined with sequential pattern mining can be applied to pedagogical surveys, in order to identify frequent teachers behaviors.

1. INTRODUCTION

In the educational context, domain knowledge has been gained for years in the studies performed on each particular aspect of the educational process, and educational data mining is a privileged field to apply domain driven data mining (D3M) (see for example (Antunes2008), where a method for mining students' behaviours is proposed). Mining teaching behaviours however, are much harder, since teachers are at most only evaluated at the end of the curricular unit, usually by pedagogical surveys filled by their students.
In this paper we propose a methodology to mine teaching behaviors, from surveys filled by students, making use of some domain knowledge. In particular we propose a set of constraints to apply to sequential pattern mining, in order to identify how teachers respond to their evaluation, collected from students' surveys.

2. MINING PEDAGOGICAL SURVEYS

Unlike students, teachers are not evaluated in a quantified way. Indeed, their performance is usually appreciated through pedagogical surveys, that in general comprise a long set of questions with a reasonable number of choices, usually divided in topics. We are just interested in surveys with closed-ended questions with multiple choices that follow some order (as in the Likert scale (Likert1932).
Since our goal is to identify frequent behaviors among teachers, and pedagogical surveys are filled by several students individually, the first step is to get the global evaluation collected for each teacher on each time period. From the application of basic statistics (mean or mode, for example) to the set of individual questionnaires evaluating a single teacher for a single time period, we determine the set of items that characterize teacher's behavior in that period.

Fig. 1. Mining methodology

Since teachers teach along time, a teacher may be represented as a sequence of his performance in each semester, with his performance being represented as an itemset with the results achieved for each question in the pedagogical surveys. With teachers represented as temporal sequences is then possible to apply sequential pattern mining to identify frequent behaviors (Antunes2008) and try to anticipate their evolution Fig. 1.
The next challenge faced is to decide what domain knowledge may be useful on mining teaching behaviors. Indeed, what we need to understand is how teachers evolve along

time. In this manner, the most interesting knowledge is the one that can contribute to distinguish among teachers that improve their performance against the ones that do not.
Pushdown automata (PDA) in Fig. 2 establish a set of meta-patterns that can guide the discovery process, reducing the combinatorial explosion on discovered patterns, allowing for the discovery of relevant patterns in the scope of teaching evolution. In each meta-pattern, relations among the values of specific questions are established, both for a single semester and along time.

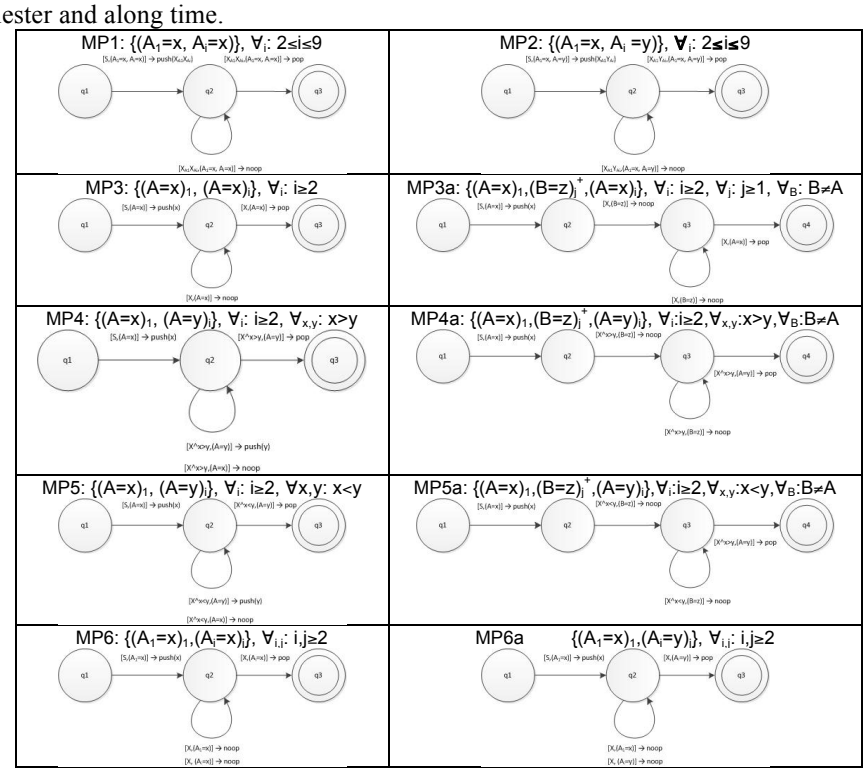

Fig. 2. Meta-patterns to constrain sequential pattern mining process

Each PDA is composed of a stack, a set of states and transitions that are constrained by the current state and entry, but also by the top of the stack – the context (Antunes2008). For example, MP1 catch patterns that have between two and nine variables with the same value in the same semester, for example $(assiduity=good,\ security=good)_{2011}$. On the other hand, MP3 catch patterns where some variable has the same value for more than two semesters, for example $(assiduity=good)_{2010}(assiduity=good)_{2011}$.

Experimental results on mining real pedagogical surveys are interesting, with the proposed meta-patterns covering all the discovered patterns. The next step is just to enrich each teacher record with his verification of each meta-pattern, creating a more significant training data set, and then train a classifier for anticipating teachers' performance.

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