Motivation Support in E-Learning by User Model and Job Offer Comparison Evaluation

Ján Lang, Maroš Bednár

Abstract: *Evaluating job opportunities can be a complex and stressful process. Jobs selection is often driven by our qualification, competencies, capabilities, personal interests etc. In this case we map our professional and personal abilities and knowledge to selected job offers. For better evaluating is necessary to know the profiles and basic information about each component. In this paper we consider user model and job offer model as components. We explore the possibilities of representation of the components and their comparison. It is supposed that the result of the comparison can include motivational specificity. Finally recommendations were discussed for future e-Learning system specification.*

Key words: *User Model, Job Offer Model, Comparison, Motivation.*

INTRODUCTION

Motivation is an essential part of every human activity. Regarding to evaluating job opportunities which can be a complex and stressful process its role only increases. Jobs selection is often driven by our knowledge, skills, competencies, qualification, capabilities, personal interests etc. Here we can encounter a set of problems. It could be hard to browse through and navigate in the amount of job offers. The problem may be also in finding that we do not meet the required conditions for selected job offer. Alternatively that we lack selected knowledge skills and competencies and so on. Hence one of the motives could be the fact that education increases chances of success in the labour market [2]. Nowadays there are many available open or commercial e-Learning courses. But for a successful e-Learning system might not be considered a system that utilizes the most advanced technologies [7]. Research shows [4] that over-combining of advanced technologies can have disruptive effect in the classroom. The problem of e-Learning systems from our point of view is also the insufficient motivation of its users. Finally students are motivated at least by a successful graduation. Other users of such systems directly may not have such motivation even their motivation may be weaker. Moreover, human access is in many ways strongly pragmatic. We think that possible solution of the problem could rely in extension functionality of such e-Learning system. The recommended functionality would show the user suitability for the selected job considering its cognitive profile. Such functionality is missing in current e-Learning systems. Nevertheless, there are efforts for better binding of the labour market and education community through mapping of activities e.g. Qualifications and Credit Framework QCF[9]. This work deals with the motivational specifics of e-Learning system. As significantly motivating we consider the interpretation of the results of the comparison models of a learner with models of some job offers. The next section describes the options for modeling and analysis and possible ways of word processing for their subsequent comparison. We also provide proposed method for comparison of models and discussion the results of performed experiments.

RELATED WORKS

At present there are already a large number of educational systems even open and online. These systems may consist of simple presentation of an educational content to Complex Control Systems CCS, Learning Management Systems LMS respectively Content Management Systems CMS. In our analysis of the related works we were looking for specific motivational attributes of those systems. We were also inspired by successfully applied process in software engineering domain related to models e.g. feature in the model driven generation of software artifacts [8]. The analyzed related projects were

9 http://www.accreditedqualifications.org.uk/qualifications-and-credit-framework-qcf.html

ATutor (www.atutor.ca), Moodle (www.moodle.org) and Sakai (www.sakaiproject.org). During our analysis we met a set of common features that represent certain standard for a class of similar systems. We have identified a set of specifics of the analyzed systems which can induce motivation of the user. The analyzed systems do not have common all provided features. Some of them are specific. Nevertheless, none of the analyzed systems had a functionality that could provide information about the qualification growth respectively about the approximation to the selected job positions. After evaluating the analysis of e-Learning systems, focusing on specifics of the tools and motivation for learners [5] we can say that they do not fully meet expectations but each of the systems has its own dominant characteristic.

JOB OFFER MODEL AND USER MODEL

There was not available functionality providing information about the qualification growth respectively about the approximation of the selected job positions in none of the analyzed systems. E-Learning provided by upper mentioned systems as an activity is surely useful but it does not implicitly motivate. The user can get feeling while engaged in course activity but without any reason or meaning. Mapping constantly evolving user model to job offer models may give the user implicit feedback. Such functionality would require the need for comparing both of the models; the job offer model and the candidate user model, as an explicit representation of his properties [1]. The candidate will play the role of a user of such e-Learning system as learner. It is a strong presumption that the user as the candidate will have to extend his model of properties (the level of his knowledge, skills and competences), so that it the most correlate to the model of the job offer properties. The model of the job offer properties we tried to get by the analysis of job offers of selected web job agencies. Currently, there are a large number of internet portals, where are job offers presented in the form of advertisements. Since each of them has its own structure of the advertisement it is necessary to identify the common elements. We have analyzed four employment agencies': www.profesia.sk, www.cpljobs.sk, www.ponuky.sk and www.prace.cz. We have selected ten properties for performing comparison that tentatively correlate to the properties of a candidate. For models comparison the survey of knowledge in the form of a questionnaire would be very important. Job sites used catalogs of type positions to categorize offers. For their unification it was necessary to carry out an analysis of such catalogs with jobs classification. Different structure of the job description at different job portal may cause further problems. So we have analyzed four type positions portals with their description: www.pozicie.sk, www.istp.sk, www.nsp.sk and www.nsk.sk. We have also compared them to International Standard Classification of Occupations ISCO-08[10]. After analyzing we decided to use profesia.sk because it contained much information about the job offer and the actual requirements for the employees in rather structured template. Creating the user model consisted of two phases. First the user created his profile using the form. Subsequently the profile was being adjusted according to the user behavior and applied to predefined heuristics. Such explicitly expressed knowledge was recorded in ontology which would add missing terms to the user profile. Whereas the descriptions of jobs were of textual nature we decided to represent the model based on textual description. This required preprocessing of individual descriptions. Preprocessing of natural language is such a form of the text modifications in which the original text becomes less human readable but the computer is more useful. Such modification of the text reduces the amount of data and increases efficiency when comparing with other texts. Problems arise thanks to ambiguities of natural language. To address these issues the linguistic methods and techniques of natural language processing were being used. The most common techniques are lemmatization and stemming. From individual words were originating

10 http://www.ilo.org/public/english/bureau/stat/isco/isco08/]

lemmas during the process of lemmatization. These lemmas represented a word in basic form. Stemming is a technique of searching the root of the word. This process resulted in stems. To achieve the more accurate comparison of models certain transformation [3] of the user profile and job offer was necessary. After performing preprocessing it was necessary to create a model based on the text. Documents may not only be represented as a text form but there are several ways to represent them [6].

MODELS COMPARISON

Our proposed method defines a process in four basic steps: creating the user model, creating job offer models, comparisons of the models and recommendations. The user model, which is shown in Figure 1, is based on information contained in the user profile. This profile sets the user individually according to his skills and experience. The profile contains also so-called personal skills. The main part of the model is the class User which includes the domain-independent and the domain-specific characteristics. Domain independent characteristics represent mainly records of the user interaction. Domain-specific features are almost identical to domain-specific characteristics of the job offer.

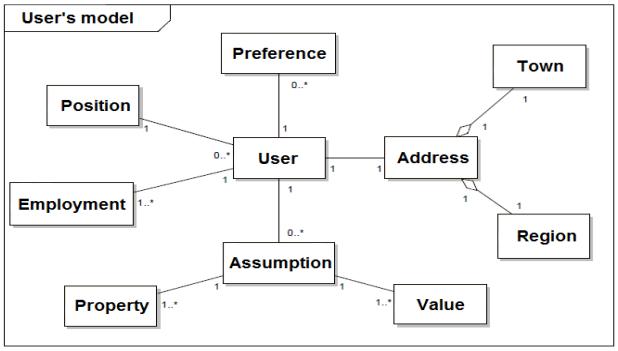

Figure 1. User's model

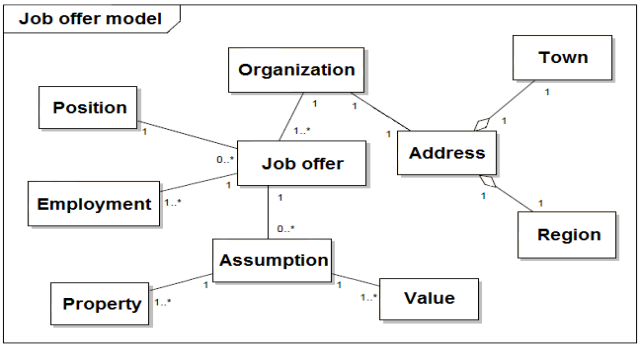

Figure 2. Job offer model

The user takes preference by interaction with the system. This interaction is recorded and then evaluated. Under the interaction we mean a list of visited working areas or search settings. Responsible for the evaluation is a method, which passes through records and looks for applying predefined heuristics. In the case of applying heuristics the user model is adjusted which results in increasing or decreasing the preferences for the region. Job offer model is made quite analogous to the user model. Job Offer is the base class of the model (Figure 2). The model includes domain-specific characteristics. One of them is the class Assumption that specifies the requirements of a job offer. Both classes Property (e.g. education) and Value (e.g. Bachelor) inherit from Assumption. When comparing all the information is used regarding the requirements of jobs. System creates a temporary list of unfulfilled requirements in the model comparison. The list of unfulfilled requirements is then used to create recommendations for improving the user's knowledge, skills and competencies. The result of the comparison is the similarity expressed as a percentage similarity. The final assessment is composed of several evaluated categories. The user can adjust the weight of the various categories according to his requirements. In the base state each evaluation category has the same weight.

Job offers recommendation

Title	Similarity [%]	Date from	Date of publication	Salary	Job
Java Developer	58,57	17.3.2012	9. 4. 2012 0:00:00	By contract	Programmer
Java Developer Senior	64,83	ASAP	17. 11. 2011 0:00:00	By contract	Programmer
SW developer C/C++	73,36	By contract	9. 4. 2012 0:00:00	1500	Programmer

Figure 3. Job offers recommendation

The user is displayed links to the recommended courses in case of insufficient fulfillment of the requirements listed in the job offer. The recommendations are based on catalog of type positions[11]. There is information about getting competencies or retraining. Result of recommendations is a list consisting of a maximum of ten jobs as is shown in Figure 3.

EVALUATION AND DISCUSSION OF RESULTS

We have performed several experiments during the development of the prototype for comparison models of jobs with user model. We also experimented with different preprocessing settings of models and their impact on the accuracy of valuation models similarities. Within the experiments were monitored the following objectives: the effectiveness of text preprocessing, the method's performance assessment and evaluating of the recommendations. For experiments we used data representing jobs from the portal profesia.sk which we acquired through our prototype. 50 jobs were extracted.

The effectiveness of text preprocessing

To determine the effectiveness of text preprocessing we used the extracted jobs to which we have brought artificially selected types of changes (change of word order; change the form of the word). After applying the changes to the job we have created vector model, and then we compared it with the vector of the job offer in its original form. After the change of the word order in the text it appeared different for the user, but their vector models were equal. This means that changing the word order does not influence the effectiveness of the models comparison. Differences within comparing models appeared in case of changing inflection of words. These differences were partially removed using lemmatization. Testing was performed on a set of ten descriptions. The text also contained various abbreviations of words, foreign words and did not include stop words. Percentage in finding lemmas was 50.3% at template paradigm and 37.6% by dictionary paradigm see Figure 4.

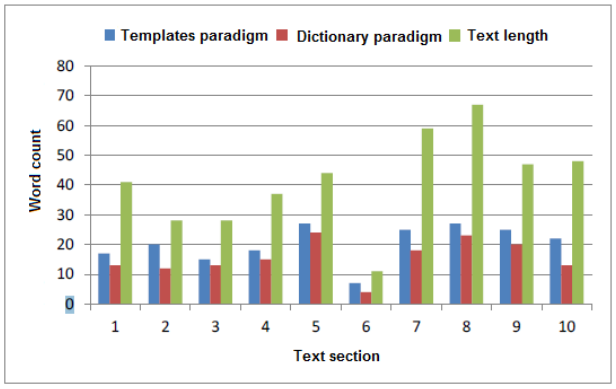

Figure 4. Lemmas searching comparison

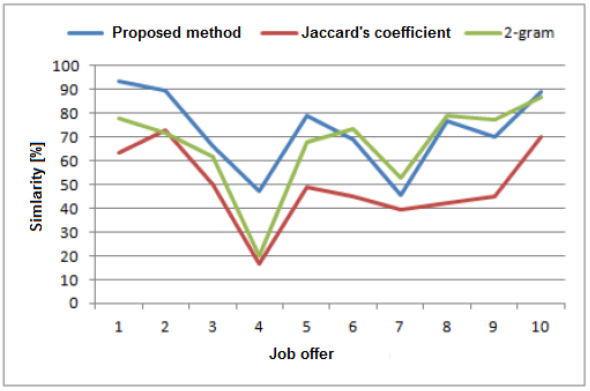

Figure 5. Success comparison

We found that editing text using lemmatization and removal of stop words increases the probability of compliance. Consequently, we have implemented our method extended by removing stop words and lemmatization and combined several methods of comparison, which resulted in 94.79% probability of compliance see Figure 5.

The method's performance assessment

Within the prototype, we implemented three methods of comparison. Each method uses the same method of preprocessing of the text, but not the same range. In our proposed method is preprocessed just a part of the model which is reflected in the speed comparison. Compared with the Jaccard's coefficient the proposed method achieved

11 https://www.istp.sk/english-information

better assesses. Better assessment was recorded for 2-gram method. However, it was a distortion. This most often occurred when comparing the level of computer and language skills. If for example in job offer was required knowledge of English and user provided knowledge of German language the methods 2-gram evaluated this comparison with some similarities but in fact this similarity was zero. High differences in valuation of methods were caused by insufficient requirements of the job offer. If the requirements were not defined in the job offer the proposed method considered them as accepted.

Evaluation of the performance

The total time spent by comparison plays an important role in real time comparing of the models. Table 6 shows the comparison of the three methods.

Table 6.

	Proposed method	Jaccard's coefficient	2-gram
Average time / offer	0.30151724	1.43809503	1.51707534

We can see that the proposed method is about 79% faster than method with Jaccard's coefficient in comparison of models. However if the two worse methods omitted the text processing their comparison speed would increase significantly to approximately an average of less than 0.12 seconds.

Comparison of methods for recommendation of job offers

We have also evaluated provided recommendations. We used the list of 50 job offers. Five job offers were randomly selected from the list to which the system should recommend similar offers. The results are shown in figure 6.

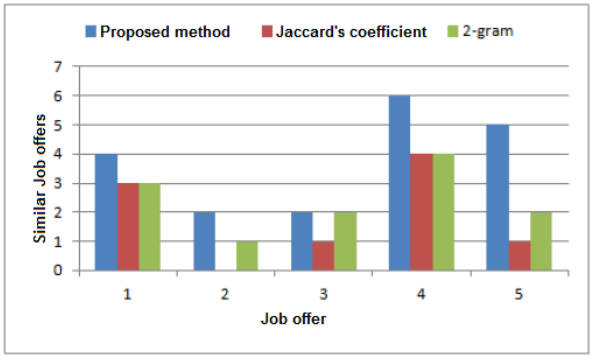

Figure 6. Recommendation of job offers

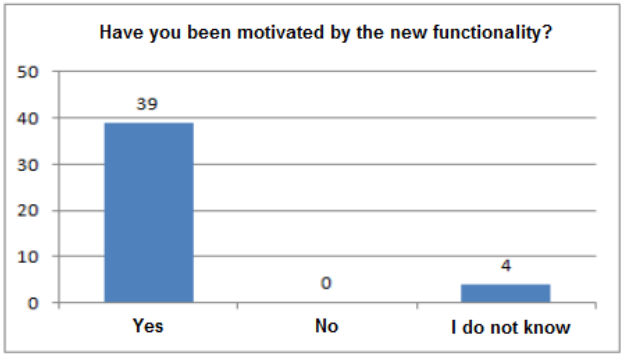

Figure 7. Questionnaire, question 3.

As we see, the proposed method identified the same or slightly larger list of similar job offers than the other methods.

Survey evaluation

To use the system represented primary managing the profile, monitoring recommendations for further education but also comparison of both models. This was essential functionality of our implemented LMS prototype. Therefore, we have prepared a questionnaire. The questionnaire aimed to verify the degree of motivation to use the system. Finally 43 respondents participated in the survey. Most respondents said that implemented functionality has motivational character see Figure 7.

CONCLUSIONS

The issue of e-Learning is now widely studied. One of the basic factors of e-learning should be a motivation. We have analyzed selected e-Learning systems. We have designed and implemented a method to compare the conceptual model of a job offer with a model of a learner competency. Implemented functionality showed motivational character. Mainly because the user was informed how well correlate his profile with the requirements of the job offer. In the context of data representation, we designed two flexible models (user, job offer) that support the consistent adding of new features. User model is extended by recording the behavior of the user in the system, while heuristics to apply records are domain-specific. In addition to the evaluation of the models comparison, the proposed method is extended to include recommendations for an update of the user's knowledge. We have implemented a prototype by which we conducted several experiments. Over these experiments we verified the effectiveness of preprocessing models and evaluation of the comparison. There were also conducted experiments to evaluate performance of the models comparison which showed that the method can be deployed as an on-line solution.

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The paper has been reviewed.