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Intelligent tools in business to business training

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Abstract: *This paper contributes an overview of application of intelligent tools into the sector of b2b training. We present three prototype intelligent tools developed with artificial intelligence techniques (neural-networks and fuzzy-logic) which have been successfully applied to business training.*

Keywords: *intelligent, neural-networks, fuzzy-logic, business, training*

1. INTRODUCTION

Integrating neural networks and fuzzy logic creates powerful expert decision systems. In recent years, the research area of hybrid and neural processing has seen a remarkably active development. Furthermore, there has been an enormous increase in the successful use of hybrid intelligent systems in many diverse areas such as speech/natural language understanding, robotics, medical diagnosis, fault diagnosis of industrial equipment, education [8], e-commerce [7], recommendation and information retrieval [9]. However, their application into the fields of business training has not been examined extensively in literature.

The structure of the rest of our paper is the following. The second section presents the architecture of the intelligent tools. Conclusions are presented in the last section along with recommendation for further work in this area.

2. DESCRIPTION OF INTELLIGENT TOOLS

2.1. AN EXPERT SYSTEM FOR EMPLOYEE'S CLASSIFICATION INTO PROJECTS

Our system has the following functional characteristics:

1. Connectivity with the corporate database that contains the staff, employers and post records.
2. Use of neurofuzzy techniques for the inductive (through examples) training of complex fuzzy terms. These terms contribute to the evaluation of the data and the final decision phase.
3. Supervised retraining of the neurofuzzy network when recommended by the administrator.
4. Fuzzy models that design and develop the fuzzy inference engine.

5. Combination – processing of the fuzzy elements for the final data evaluation.
6. Flexible and friendly user interface (Visual Basic input forms).

Our system is consisted of certain components (Figure 1) that need to be integrated into the expert system for the extraction of the final output (evaluation mark of the employee)

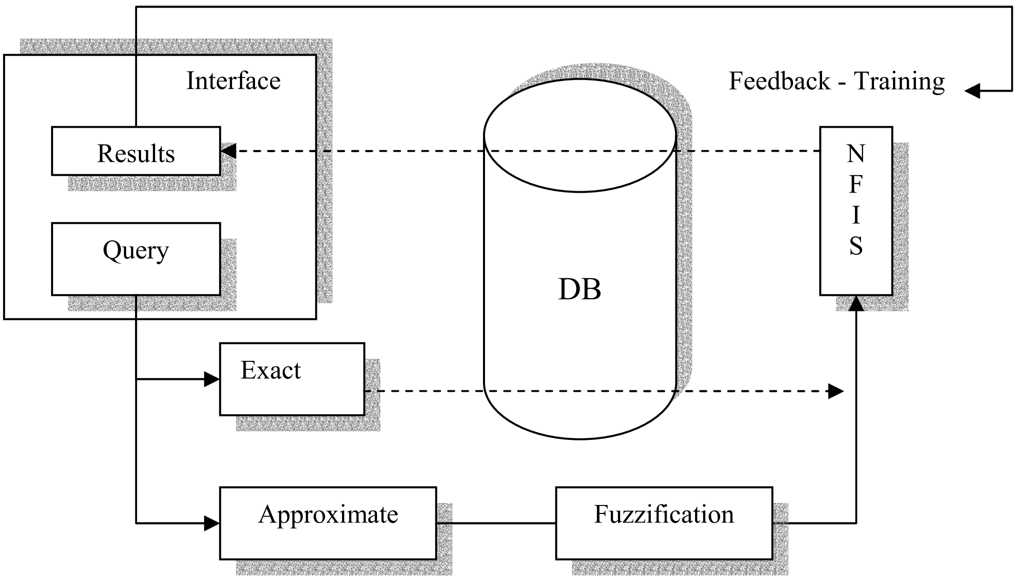

Figure 1: The simplified architecture of the system

The query/job opportunity is formulated using the following 6 fields:

1. Age
2. Education
3. Additional Education (Training)
4. Previous employment (Experience)
5. Foreign languages
6. Computer knowledge

Generally, the query is consisted of two parts: the exact and the approximate. The exact part corresponds to binary criteria that the candidate *must* fulfill. In case of multiple binary criteria, the database is filtered so that all Boolean expressions are satisfied. The approximate part of the query is fuzzyfied and fed as an input to a Sugeno type FIS [3] and [4].

The output of the FIS is the evaluation mark of the employee concerning a certain project task (how suitable is the unemployed for the task).

2.2. E-CONTENT RETRIEVAL WITH THE SOM ALGORITHM

The system has the capability of document retrieval from databases aiming at the preparation and presentation of an e-learning course. The system is capable of retrieving certain educational texts by the users according to their ‘‘physical’’ questions.

The basic idea of SOM [5], [6] is simple yet effective. The SOM defines a mapping from high dimensional input data space onto a regular two-dimensional array of neurons. Every neuron i of the map is associated with an n-dimensional reference vector $m_i = [m_{i1}, \ldots, m_{in}]^T$, where n denotes the dimension of the input vectors. The reference vectors together form a codebook. The neurons of the map are connected to adjacent neurons by a neighborhood relation, which dictates the topology, or the structure, of the map. The most common topologies in use are rectangular and hexagonal.

We summarize the basic elements of the system as following:

✓ Export of descriptors from the text of the multimedia material and transformation of these descriptors into compound search descriptions, in suitable vectors of characteristics

✓ Concretization of not supervised learning algorithm (SOM) for the successful information retrieval. The concrete methodology was preferred against the method of simple equation of keywords as well as the one that makes use of simple metric resemblance in the representation space of the texts (e.g. calculation of cosine between vectors and retrieval of those nearest in the vector that represents a question) because it provides better retrieval performance and releases the user from the need of creation of complicated educational components. The big advantage of the non supervised search models is that content managers are not obliged to create huge learning material (examples of questions with the connected answers). Taking into consideration that the user cannot be considered as an expert in neural networks training, the software search module is supposed to supply him/her with the capability to «search» the database intelligently, via the combination of the automatic exported characteristics and his/her own keywords.

The proposed methodology for the creation of the intelligent search system is based on the algorithm of Self-Organizing Maps or SOM of Kohonen. In the concrete application, the SOM maps are used for the automatic placement of the unstructured or half-structured and multidimensional data of text in such a way that similar entries in the map are represented near between them (Figure 2). Via a learning process, the final map allows the direct creation of teams of terms and teams of texts so that the distances between the different data can be directly used during the search and retrieval duration.

An example of a previous successful application of the SOM. networks in information retrieval is the web application WebSom [2]. This application is based on the export of descriptors of texts from different S.OM.s, which replace the department of pretreatment, and representation of texts, in combination with a self-organization of the retrieved texts. It also provides the capability of a two-dimension depiction of texts relative between them, so that the user has in his disposal a visual representation of the material in relevant categories. As recent researches have shown that the functionalism of such visualization considering the help that it provides in the final user is arguable, in the concrete work, we do not use the depiction of map. On the contrary, we provide the capability of information retrieval from the database according to the content of texts and we thus present the results in form of a list in a declining line of resemblance so that we decrease the difficulties faced by the users.

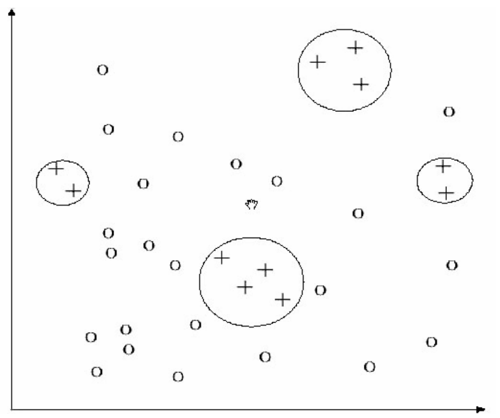

Figure 2: Neighboring neurons represent teams of texts with similar content

2.3. EXPERT CLASSIFICATION OF TRAINEES INTO KNOWLEDGE LEVELS USING SOLO TAXONOMY

The present expert system is based on an instrument of Collis & Romberg [1] that aims at the construction of the profile of an employee (student generally) according to the S.O.L.O. (Structure of Observed Learning Outcomes) taxonomy. The expert system is an innovative tool for the evaluation of staff or students at solving mathematical problems. It is a powerful training tool.

The expert system makes use of neurofuzzy networks upon the S.O.L.O. taxonomy. The subject of the present work is the classification of employees - students, in levels of knowledge with the use of questionnaires. The questionnaires contain five thematic units. Each thematic unit contains three questions. Each question corresponds to a level of knowledge. The five thematic units are: Arithmetic, Algebra, Perception of Space, Applications, Probabilities and Data. The three levels of knowledge are: Monodomic, Polydomic and Relational. The system classifies the employee – student separately in each thematic unit depending on his/her answers.

The system is separated in two parts. The first part connects the answers that have been given in the 5 thematic units, with the degree in which it belongs in each subject. There are five thematic units and 3 questions for each subject. The second part connects the degrees of each subject with the final degree.

In the first part, we use a neurofuzzy system: two fuzzy and one neural network. The first system calculates, using statistical elements, the weights of the answers in each subject. The second system calculates the weight of each subject according to the answers that have been given in each subject. We use a neural network of 3 inputs (MLP with Backpropagation learning process). The final output is the degree for each subject.

The second part calculates the final degree. The second part is separated in 4subparts. Each one connects the number of given answers with the weight of the particular level. The average of the three weights is the final output.

3. CONCLUSIONS

Three prototype intelligent tools for business training were briefly presented. Their application into the b2b sector has been evaluated by various plot tests indicated their great effectiveness. Future work includes the integration of the presented tools into a unified system.

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