ИСПОЛЬЗОВАНИЕ ОБРАБОТКИ ЕСТЕСТВЕННОГО ЯЗЫКА ПРИ РЕШЕНИИ ЗАДАЧ В ПРОЦЕССЕ ОБУЧЕНИЯ СТУДЕНТОВ

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Аннотация: Решение проблем в обучение это тот необходимый навык, к применению которого хотят привлеч студентов многие страны мира. Именно поэтому решение проблемы обучения и повышение успеваемости студентов – это вопросы, изучением которых занимаются многие педагоги и психологи. При этом компьютерные обучающие программы, наряду с другими методиками обучения, занимают значительное место в решении этого вопроса.

Среди компьютерных образовательных систем преобладают системы, использующие технологии искусственного интеллекта. Интеллектуальные обучающие системы способны оказать помощь в принятии решений и мониторинге посредством иерархического отслеживания всех процессов обучения студентов, а также в оценке, определении образовательных потребностей, привлечении знаний и навыков, в руководстве процессом обучения, выявлении ошибок студентов, объяснении того, где студенты совершают ошибки, в реализации индивидуальной траектории обучения.

Во время компьютерного обучения студенты сталкиваются с проблемой решения задачи и последующей записью решения в текстовом виде. По этой причине в результате проведённого нами исследования был разработан модуль обработки естественного языка (NLP), который позволяет студентам анализировать задачи, которые они будут решать с помощью визуальных инструментов и преобразовывать их в тексты. Для решения этой проблемы нами был использован метод, базирующийся на основе правил и шаблонов.

Для создания модуля NLP, в первую очередь, создается хранилище объектов для каждого типа задачи. Анализируя понятия этих объектов, определяются последовательности предложений элементов, необходимых для формирования осмысленного целого. После определения этих элементов в структуре шаблона создается таблица правил путем определения их отношений друг с другом и значений, которые они могут получить в рамках этих отношений. Эти операции выполнялись отдельно

для каждого типа задачи. В ходе решении задач, база данных контроллера NLP может быть расширена в соответствии с потребностями.

Ключевые слова: обработка естественного языка, искусственный интеллект, решение проблем, обучение.

USE OF NATURAL LANGUAGE PROCESSING IN PROBLEM SOLVING TRAINING OF STUDENTS[1]

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Abstract: Problem solving takes place in instructional programs as a skill that one's want to bring students acquire many countries in the world. That is why problem, problem solving and raising student achievement on problem solving are topics that many educators and psychologists study on. In these students computer applications are also take a considerable place along with variety of instructional methods. Among computer supported educational systems, artificial intelligent technologies have become prevalent and its importance increase regarding its attributes of helping decision making and monitoring by means of hierarchical trace of all learning processes of students, evaluating, determining educational needs, bringing knowledge and skills, guiding, detecting students' mistakes, explaining where students make mistakes, realizing individualized learning.

During the computerized problem solving activities, the transformation of the scenes that the students will create to text, is very important in terms of experiencing problem formation by students. Because it is very difficult for students to create a problem in textual format.

For this reason, this study has developed a Natural Language Processing (NLP) module that enables students to analyze problems that they will create with visual tools and transform them into texts. In doing so, a rule-based and template-based method is used.

In order to create the NLP module, first of all, an object store is created for each problem type. By analyzing the concepts of these objects, the sentence sequences of the elements necessary for forming a meaningful whole are determined. After these items are determined, the rules table is created in a template structure by determining the relations with each other and the values they can get within these relations. These operations were performed separately

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for each problem type. According to the applications, the database of the NLP controller can be expanded according to the needs.

Key words: Natural Language Processing, Artificial Intelligent, Problem Solving, Teaching

1. Introduction

Problem-solving topic stands as a skill in curricula to be taught to students in not only Turkey but also many other countries around the world try to earn to their students. For this reason, the structure of problem and problem solving and increasing success in problem solving is a topic studied by many educators and psychologists. One important point discussed in these studies is visualization of verbal problems. Visualization of problems is crucial in order to understand the expressions and the scenario in the problems. In this way, students could not only comprehend the problem but also be able to intervene or change it, experience the changes that may arise in the problem with different values, and construct a problem.

In studies carried out for effective teaching of problem-solving, besides many teaching methods, the applications employing computer technologies also have an important place. Thanks to the opportunities provided by computer technology, students are able to perform problem-generating activities using the visual objects involved in problems, and the problems they will create at this time can be turned into a text. Thus, verbal problems, which are difficult for students to understand, can be transformed into meaningful and easily understandable forms by using visual objects. After the objects in the problems are placed in the scene, the natural language processing method can be used to analyze the problem-generating situation and to form a meaningful sentence.

NLP has the first place in future-oriented research and practice related to artificial intelligence. The aim of NLP is to design, implement and develop systems that can analyze, understand and create the natural language that people use (Nabiyev, 2016). Natural language processing brings together theories, methods and technologies developed in many different fields such as artificial intelligence (information display, planning, reasoning, etc.), formal linguistic theory (language analysis), theoretical linguistics and computer-assisted linguistics, and cognitive psychology (Oflazer, 1993).

In the light of the information above; in this study, the NLP module was developed which allows analyzing and textualizing the mixture problems generated by students by means of visual tools. In doing so, a rule-based and template-based method is used.

2. Method

2.1. *Analysis of Mixture Problems*

During the review carried out for this type of problem, problem clusters were formed by classifying the problems with the same structure appearing in sources. So, mixture problems were grouped according to the number of substances mixed. The quantities, units, (gr, kg, liters, ratios), and percentages of the ingredients and the resulting mixture constitute the data provided for solving the problems. In such problems, the operations include combining the mixtures in another container, discharging and evaporating part of the mixture. In this way, it is possible to prepare problems by making mixtures of certain substances, adding the pure substance to the mixture (solid-solid, solid-liquid, liquid-liquid) or adding another mixture of the same kind. In the context of analysis of mixture problems; Table 1 shows the properties of the mixture and substances required for a possible problem.

The percentage, quantity and ratio information given in Table 1 increases depending on the number of mixtures used while generating the problem.

Table 1. Properties Used in Mixture

Substance properties:	Mixture properties:
Substance quantity (m)	Mixture quantity (M)
Substance unit (gram, kg, litre, ratio)	Mixture unit (gram, kg, litre, ratio)
Substance percentage (n%)	Mixture percentage (n%)

2.1.1. Object Relations in Mixture Problems

The objects used in mixture problems as well as relations among the resulting mixtures are shown in Figure 1.

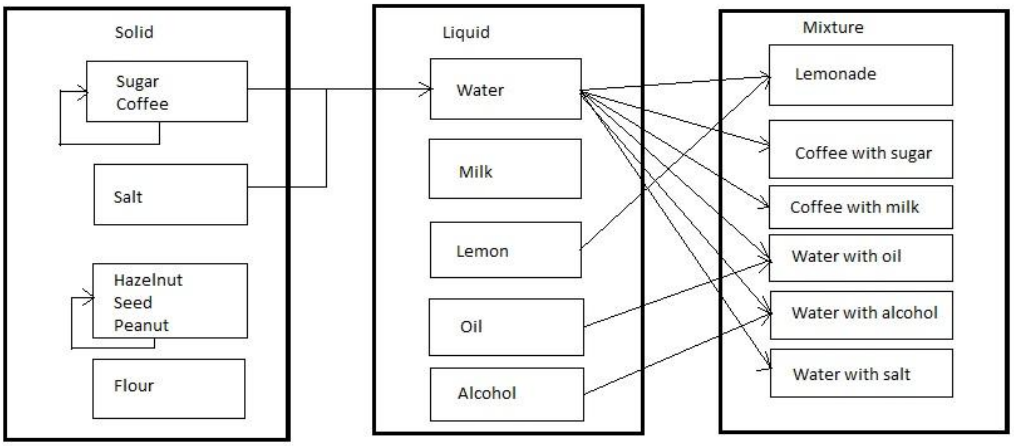


Figure 1. Object relations in mixture problems

According to the relations shown in Figure 1; solid substances can be mixed with solid substances, liquids, and mixtures containing the its own type. Liquid substances can also be mixed with solids, liquids and mixtures containing their own type.

2.2. Natural Language Processing Module (NLPM)

Problems to be generated by students are first converted into text by the natural language controller module. In doing so, a rule-based and template-based method is used. In order to construct the NLP module, an object pool is first formed. Then, the concepts regarding these objects are analyzed, and syntax of the elements necessary for forming a meaningful whole was identified. Next, their relationships with each other and the values they can acquire within these relations are determined. In the applications, the NLPM database auditor can be expanded depending on needs.

Examples for running of the NLP module for mixture problems are described below.

Rule for single mixture, untreated problems:{(Value %), (Substance_Name), (Available), (Total_Qnt), (Mixture_Name), (Selected_question pattern)}

Treated problems with two or more mixtures/substances.

Sentence 1 – Mixture Added

{(Value %), (Substance_Name), (Available), (Total_Qnt), (Mixture_Name), (Pouring_qty)}

<Poured into mixing bowl>

Sentence 2 – Pure substance added

{ (Total_Qnt), (Substance_Name), (Pouring_qty), (Poured into mixing bowl)}

Sentence 3 - Mixture Bowl

Questions without data:

{(New_mixture), (Selected question pattern)}

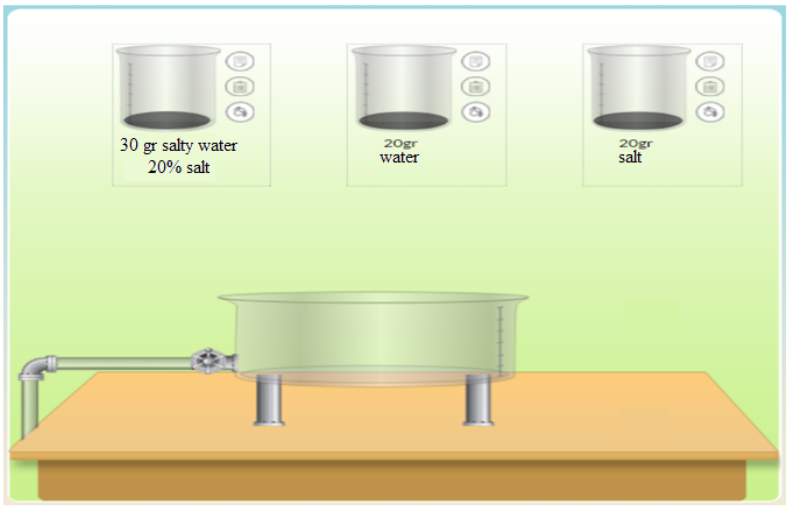
Questions with total quantity:

{(New_mixture), (Total_Qnt), (Mixture_Name), (So), (Selected question pattern)}

Questions with value %:

{(New_mixture), (Value %), (Substance_Name), (So), (Selected question pattern)}

Problem 1: There is 30 gram salty water with 20% salt. 20 gr water and X gram salt is added then. The resulting mixture has 40 % water. So, what is X?



Problem creation process:

1. To the first bowl, 30 gr Salty water with 20 % salt was added.
2. To the second bowl, 20 gr Water was added.
3. To the third bowl, X gr Salt was added.
4. All of the mixture I was poured in a large bowl.
5. All of the mixture II was poured in a large bowl.
6. All of the mixture III was poured in a large bowl.

Figure 2. The scene of problem1

Text Pattern
{ (20 %), (Salt), (in), (30 gr), (salty water)(all)}

Sentence 1: *poured into the mixture bowl*
Sentence 2: { (20 gr), (water), (all), (poured into the mixture bowl)}
Sentence 3: { (X gr), (salt), (all), (poured into the mixture bowl)}
Sentence 4: { (New mixture),(40%), (water), (so), (what is X)}

The NLP controller module basically functions as follows: It is compared against the rules table formed for the NLP controller whether the objects on the screen, the concepts selected for the objects, and the values taken by these concepts constitute a meaningful whole so that the screen is converted into text by means of the sentence complying with the template.

Conclusion

Of studies aiming to increase success in problem solving, the applications employing computer technologies besides many teaching methods have an important place (Hoffman & Spatariu, 2008). In most of the studies using computer technologies, positive attitude was developed among students towards problem solving by increasing their willingness and enthusiasm (Huang, Liu & Chang, 2012). In addition, it is stated that computer technology has the potential to encourage mathematical learning processes (Lopez-Morteo & Lopez, 2007). Many of these studies revealed an increase in students' academic achievement in problem solving (Li & Ma, 2010).

Programmable and useable qualities of software in studies employing computer technologies has to do how problems will be modelled with such software with as well as the context selected. Since computers cannot think and make decisions in human competence, it is not easy for them to cover all or most of the possible problems in the context. As a matter of fact, this situation is closely related to possible sentence structures in the relevant language and types of problems in teaching programs (Rich, 1983).

The advantage of the template NLP is that it does not require all details to be processed in order for the scene to be converted into context. In this method, the basic items that constitute the problem are certain, and each of these items is connected to an object on the screen. Not all objects may be absolutely necessary to form a problem, but each element of the problem is necessarily associated with another element. For this reason, the objects which are essential or redundant on the screen can be identified using the graph model, departing from the objects available on the screen. However, in order to be able to do this, problems must be well analyzed and there is a graph model constructed with a stable rule table.

In this study, 538 mixture problems of different types were investigated, an object pool was created, and the syntax of the items needed to form a meaningful whole was identified by analyzing the concepts belonging to these objects. Once these items were identified, the relationships with each other and the values they can acquire within these relationships were determined. Thanks to the applications, the database of the NLP controller can be expanded according to needs.

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