BLENDED LEARNING APPLIED TO THE ARTIFICIAL INTELLIGENCE TRAINING

M. Petrova
University of Ruse "Angel Kanchev" (BULGARIA)

Abstract

Artificial Intelligence is a very extensive area that combines many sub-regions and spheres. Training in disciplines related to this area and very extensive and specific. The implementation of blended learning, combined with the latest introduction in the educational process contributes to better utilization of practical tasks and skills. An example of such an introduction is a web-based virtual laboratory that allows simulations of individual solutions to practical tasks in the discipline of artificial intelligence. A study was conducted on the discipline of the Bulgarian universities. The article presents a methodology for conducting the exercises in the discipline of artificial intelligence at University of Rousse "Angel Kanchev", which will include such a web-based laboratory. The model for conducting the exercises is also presented. The aim is to show that the introduction of such a type of laboratory as a learning tool will contribute to better learning of students' material. Presented are the benefits of this type of blended learning for both sides - trainers and students.

Keywords: Blended learning, Artificial Intelligence training, Virtual Laboratory.

1 INTRODUCING THE DISCIPLINE OF AI

Education in recent years has undergone many changes and will continue to change in the future. This is owing to the evolving information technology. Thanks to them appears Blended Learning, which combines a variety of ways to provide information such as software web-based courses combined with practical knowledge management. And more specifically Blended Learning combines the three most prevalent forms of education worldwide - lectures, e-learning and self-study. The concept of blended learning is rooted in the idea that learning is not just a one-time event - learning is a continuous process. Mixing provides different advantages over the use of each learning environment individually. Mixed learning built into the learning process will lead to optimization of learning outcomes and better curriculum performance. [1]

Issues related to the potential of information technology in facilitating the learning process of knowledge and the use of different types of media in teaching and learning are limited to studying the effectiveness of the presented information through the use of interactive multimedia. Flexible individual approaches should be used to communicate with learners, combining the way of face-to-face teaching, but combining with new trends in the learning process. [2]

Artificial Intelligence, as an area of development promises to be the future of Information Technology, and for this reason it is necessary to emphasize the training in this field.

1.1 The course Artificial Intelligence

2017 was a breakthrough year for Artificial Intelligence, through which unprecedented advances in understanding technology with AI have been achieved. While there is still much work to be done, artificial intelligence allows us to do much more and far more effectively than before. Before artificial intelligence was technology that everyone was afraid of. And the idea that computers can think and learn like us, raises concerns that at some point we will stop to understand them and can control them. But now that we are moving in a direction other than the creation of a human-like artificial intelligence, we can look at its progress as a tool for the development of every industry. At the same time, people are increasingly asking themselves, is the artificial intellect really as scary as we thought before? [3].

Artificial Intelligence is a very interesting area to study, it is the future of information technology, which has the potential to improve people's lives. It will start to integrate in all platforms and technologies to improve any other sphere. This is because it comes from many areas and is applicable in many different ways. For this reason, specialists working in this area should focus on developing the algorithms in the field and attracting more young talents to it.
Informatics and Information Technologies and study the discipline of Artificial Intelligence. Proving that the foundations of the AI are studied at the Bulgarian higher schools.

Table 1 Universities teaching under the Artificial Intelligence subject in Bulgaria.

<table>
<thead>
<tr>
<th>Studying the subject Artificial Intelligence according to the curriculum</th>
<th>Name of the discipline</th>
<th>Term</th>
<th>Lectures</th>
<th>Seminar exercises</th>
<th>Exercises</th>
<th>Form of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Burgas Free University /BFU/ [4]</td>
<td>Artificial Intelligence</td>
<td>4</td>
<td>30</td>
<td>20</td>
<td>0</td>
<td>Exam</td>
</tr>
<tr>
<td>2 St Cyril and St Methodius University of Veliko Tarnovo [5]</td>
<td>Artificial Intelligence - optional</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>15</td>
<td>Exam</td>
</tr>
<tr>
<td>3 University of Economics Varna [6]</td>
<td>Intelligent systems</td>
<td>8</td>
<td>45</td>
<td>0</td>
<td>30</td>
<td>Exam</td>
</tr>
<tr>
<td>4 New Bulgarian university [7,8]</td>
<td>Introduction to Artificial Intelligence</td>
<td>4</td>
<td>30 hours</td>
<td></td>
<td></td>
<td>Current control</td>
</tr>
<tr>
<td></td>
<td>Games with elements of artificial intelligence</td>
<td>8</td>
<td>30 hours</td>
<td></td>
<td></td>
<td>Current control</td>
</tr>
<tr>
<td>5 Plovdiv University Paisii Hilendarski [9]</td>
<td>Artificial Intelligence</td>
<td>6</td>
<td>45</td>
<td>0</td>
<td>30</td>
<td>Exam</td>
</tr>
<tr>
<td>6 &quot;Angel Kanchev&quot; University of Ruse [10]</td>
<td>Artificial Intelligence</td>
<td>6</td>
<td>30</td>
<td>0</td>
<td>30</td>
<td>Exam</td>
</tr>
<tr>
<td>8 The Technical University of Sofia [12]</td>
<td>Neural Networks - optional</td>
<td>6</td>
<td>30</td>
<td>0</td>
<td>30</td>
<td>Exam</td>
</tr>
<tr>
<td>9 University of Library Studies and Information Technologies ( UNIBIT )</td>
<td>Artificial Intelligence and Expert Systems</td>
<td>7</td>
<td>30</td>
<td>0</td>
<td>30</td>
<td>Exam</td>
</tr>
<tr>
<td>10 Konstantin Preslavsky University of Shumen [14]</td>
<td>Artificial Intelligence</td>
<td></td>
<td></td>
<td>no information found</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>11 South-West university &quot;NEOFIT RILSKI&quot; - Blagoevgrad [15]</td>
<td>Artificial Intelligence</td>
<td>7</td>
<td></td>
<td>no information found</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>12 Varna Free University &quot;Chernorizets Hrabar&quot; [16]</td>
<td></td>
<td></td>
<td></td>
<td>no information found</td>
<td>Exam</td>
<td></td>
</tr>
</tbody>
</table>

The study and the results presented in Table 1 show that twelve universities lay the foundations of the area and provide the necessary initial knowledge. The study also led to further conclusions, such as:

- The main name of the discipline that is encountered is "Artificial Intelligence," but occurs in combination or one that only affects one sub-region. In two of the universities, the discipline is optional, as in Veliko Tarnovo University "St. St. Cyril and Methodius ", if the students choose it, the main aspects of the field are studied. While at the Technical University of Sofia, besides being elective, it affects only one subfield Neural Networks. This is an area that they first started their development, and is already in use in many industries. Which gives an advantage to those skilled in the art, but they are lagging behind in others not less important.

- Seven out of twelve universities have called their Artificial Intelligence discipline, covering only the main aspects of the field and being studied statistically on average during the third year of university education. This is understandable because of the need for learners to have studied programming and algorithms. Here is also New Bulgarian University, whose discipline is "Introduction to Artificial Intelligence".

- New Bulgarian university is the only university that teaches in a second compulsory discipline "Games with Artificial Intelligence Elements". Which leads to a deeper study of the discipline.

- "Artificial Intelligence and Expert Systems" is the discipline of the University of Library Science and Information Technology, which shows that they also study the basics of the field, but not thoroughly. They emphasize the sub-area Expert Systems.

- Two of the universities found that the discipline is being studied, but no additional information is available - Shumen University "Bishop Konstantin Preslavski" and South-West University "Neofit
So far, we have shown that the discipline and the main subdivisions are being studied, but none of the universities are deepening, and this leads to the conclusion that young specialists know certain information, but apparently it is not enough to get them to work in this field. Here we come to the problem of attracting interest in young professionals. How teachers can present the information in depth and interesting.

This is the main problem that has led to the need to create a new methodology for conducting Artificial Intelligence exercises to be combined with Online Virtual Labs.

2 THE ARTIFICIAL INTELLIGENCE SUBJECT AT UNIVERSITY OF ROUSSE

ANGEL KANCHEV

In order to develop a methodology that is effective and contributes to the training of students, it is first necessary to study the existing method of learning. Next is a presentation and comparison of the sub-disciplines studied at the University of Rousse. It has been found that young specialists are also trained in the most significant subarea. They get knowledge in:

- Search in state space
- Presentation of knowledge
- Planning
- Natural language
- Neural Networks
- Genetic algorithms

The first three topics are also studied in all universities studied, and Natural Language and Genetic Algorithms are taught at 3 of 6 universities, Neural Networks at only two universities.

Topics that are not taught, but which fall under the training of other universities are Expert Systems, Robotics, Fuzzy Logic, Planning, and Learning Systems. They are also important, but because the semester is 15 weeks it is normal not to be able to walk around all areas. It was found that the practical exercises and study the programming language Python, where lost three practical exercises. In the curriculum of the specialties, there is no study of the programming language that the teachers of the discipline have to catch up to keep pace with the rapid pace of development in the field. If there is a discipline in which to study the Python programming language, the learning process of the discipline will allow you to study at least one subarea from the Artificial Intelligence or to focus more on an already studied subarea.

As found in earlier studies, the main problem is that no virtual artificial intelligence lab has been found to allow for visual representation of algorithms for more than two subareas of artificial intelligence. Also, no methodology has been found to compare the individual performance algorithms and outcomes.

The idea of creating a methodology that combines visual presentation of information through a methodology that compares algorithms came from all the studies made, combined with my own experience as a student. It has been found that many people work in this area and all its sub-areas, but only specifically for certain branches of such a dynamic area. Combining the whole area in a laboratory and a methodology is a difficult, but not an unachievable goal. The benefits of making a web-based laboratory with a visual presentation of information will greatly improve its understanding and interest in it. The Algorithm Comparison Methodology will define the roles and interactions in the learning process by defining the sequence of tasks and actions. Creating a laboratory of this type through visual presentation will not reduce the teacher's work, but will increase it. But this will increase the interest of the trainees and, accordingly, their achievements. The methodology will be presented in the form of task groups. Each set of tasks will encompass a separate sublime from artificial intelligence. Tasks will have a different level of difficulty to make the learning process more effective. Each task will contain a condition, and for each condition, several algorithms will be proposed to solve the task with which it can be solved.
3 METHODOLOGY FOR CONDUCTING PRACTICAL EXERCISES IN THE DISCIPLINE

The design of a virtual laboratory in this area should be consistent with the current methods and principles for developing such a system. Consideration should be given to how training in the discipline and what aspects are emphasized. Due to the limited training time, the following methodology is recommended for practical exercises.

3.1 Methodology for conducting the practical exercises in the subject Artificial Intelligence

1 Each subgroup has a set of tasks with different difficulty. They are presented theoretically in the laboratory and the teacher has the right to correct them if necessary.

2 The teacher presents the tasks of the students by theoretically explaining their context. It further explains them by showing block-diagrams of different algorithms. Draws attention to the fact that each task can be solved by more than one algorithm and that learners have to solve the task at least in two ways.

3 The student reads the lectures, listens to the instructions of the lecturer and starts a practical solution of the tasks through the web-based virtual laboratory, taking the following steps.

3.1. Reads a task condition.

3.2. Consider possible solutions, which algorithms can be applied to the task. Make a comparison if necessary, which is discussed with the lecturer.

3.3. Chooses a solution - an algorithm
   3.3.1. If it did not make an algorithm choice returns to step 3.2.
   3.3.2. If an algorithm is selected, it is applied to solve the task through the web-based virtual lab. At this step, the student himself indicates the correct solution to the task.

3.4. Solve the problem
   3.4.1. If the task is not properly solved
      3.4.1.1. Viewing decision
      3.4.1.2. Detecting an Error
      3.4.1.3. Return to step 3.4.
   3.4.2. If the task is properly solved

3.5. Get the result

3.6. Save the task - Here the student can save this solution with the help of the laboratory and proceed to the second possible solution with another algorithm.
   3.6.1. If the student has made at least two correct solutions to the task, go to step 3.7.
   3.6.2. If the student has only reached one solution to the task, he should go back to step 3.3. to solve the task in a second way.

3.7. Discussion of result with the lecturer - the differences in the solution of the task are discussed.
   3.7.1. If the teacher thinks that the learning material is not well-used, a new task is given and passes to step 3.1.
   3.7.2. If the teacher considers that the curriculum is being used theoretically and practically to the next subject of the discipline.

3.8. In a more advanced learning process, the teacher can get a student to solve the task using another algorithm and then compare the two solutions and draw conclusions.

3.9. End
3.2 Model of training in the subject Artificial Intelligence for Practical Exercises

1 Preliminary preparation - carefully read the condition of the task and, if necessary, more than once. It also presents additional theoretical information to the task. In this way, the trainee chooses the most appropriate algorithm for the assignment from lectures. This is the first step where it is possible to determine the level of learning of the training material from the lectures.

2 Task solving - solving tasks of the respective type during practical exercises. Here the learners apply the acquired knowledge from the applied methodology above.

3 Multiple solving of tasks of one type - this step leads to reinforcement of the learner's knowledge. It can also be of great help to the lecturer, because he can see his own omissions and supplement or correct the tasks. The lab has besides task groups to each area and tasks with extra difficulty.

4 Analysis of achievement and feedback - Here conclusions are drawn about learners' learning, which would also be a good indicator of the teaching methodologies and methodology of the teacher.

Step 4 "Achievement and Feedback Analysis" - may be appropriate for implementation after each of the first three steps, which will lead to gaps being completed in advance and immediately before the relevant exercises of the given type are completed.

A virtual laboratory that is web based and can visually represent each algorithm will significantly improve the absorption of knowledge of trainees. They will have the opportunity to ask questions about the illustrative examples they will receive. In this way there will be better feedback between the trainee and the trainee. A clear framework for each algorithm will be built and the algorithms will be further developed. Because the lab will be web-based, it will have access to it from anywhere with an internet connection, which will also be a great advantage.

3.3 Presentation of a task in the laboratory by the lecturer and possible solutions for the student

The following is a description of a task that will be given as an example to the students and the group of algorithms with which it can be solved. This presentation will happen in the steps presented above.

The task of finding a way to a certain goal.

3.3.1 Step 1 - Preliminary preparation and task description.

This type of task is solved using the Search algorithms. Important features of search algorithms are completeness, optimality, and complexity. The complexity is determined in time or in memory. This type of task can be solved by uninformed search algorithms. That is:

- Depth-first search
- Breadth-first search

Information about this type of task is represented by a tree or a graph. The starting node starts, with each step expanding the number of unchecked nodes until it reaches the target node. From the way the number of unexploded nodes will expand, the algorithm to be used to reach the target node will be determined.

3.3.2 Step 2 - Solve the Problem

Students apply the solution to the task according to them. They can choose one of the two algorithms above and apply it to solve the task. Then, following the methodology described above, he has to solve the task using the other possible algorithm. Therefore, if the student has solved the task with an in-depth crawl algorithm and has reached the target solution, he / she must retain this solution and proceed to solve a task with a breadth algorithm. When it is ready for the second task, the student has the opportunity to open the two decisions one at a time and compare them. He can see where the differences between the two decisions are and understand them visually and practically, not just in words.
3.3.3 Step 3 - Multi-task solving of one type

Multiple problem solving in the way presented in step two with the help of a web-based virtual lab will bring many benefits to both parties. For learners, it will be easier to find out their own omissions and those of students. If necessary, they will be able to provide additional tasks and explanations if the students have not mastered the curriculum. This can be done by giving homework tasks that will be able to check online.

The benefits for trainees are that they can further explore and explore the results they have achieved, even from the comfort of their home. Additionally, they will be able to solve exercise tasks and communicate with their fellow students by discussing the tasks. Through the visual presentation of the task and the solutions, the student will get a better judgment when the algorithm will be more appropriate for a given task.

3.3.4 Step 4 - Analysis of achievements and feedback

This step is recommended to be used as often as possible. Its use will prove the assumptions in the above steps and the benefits of integrating a web-based virtual laboratory into practical exercises in Artificial Intelligence. The feedback will come at the end of the school year when the discipline exam will be held, because students will have a wealth of experience working with the lab and will easily judge which task with which algorithm can be solved. Then, a real analysis of the training will be possible.

Meanwhile, controls can be made to give preliminary results and, if necessary, to correct something.

4 CONCLUSIONS

By incorporating such type of laboratories into higher education training, a new type of training begins to form, combining in itself with a fraction of everyone else. Traditional learning, e-learning and intelligent systems are combined, and the convergence of these components will bring about a very wide-ranging advancement in education.

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