

FEATURES OF SMART LEARNING AT HIGH SCHOOL

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Abstract

Infocommunication technologies are increasingly intruding into the learning process, including higher education. The widespread access to omnifarious information resources from various telecommunication devices — computers, tablets, smartphones — taking into account the relatively high coverage of the territory with wireless communications, provides the necessary conditions for creating individual learning opportunities based on objective indicators of learning material and mastering the required skills and abilities. You must take into account already existing experience and established tradition, the ability to perceive new and prepared to use a variety of modern ICT solutions to educational institutions, not only students, but also their teachers as well as the willingness of the relevant learning and teaching materials. To implement this, it is necessary to form not only educational-methodical materials, but also an adequate control and measuring environment, which allows obtaining objective assessments characterizing the process of studying the discipline and the quality of mastering the material.

For this purpose, the authors propose to create a model of an intellectual lecture-presentation with a built-in testing subsystem, in which there is a possibility of a step-by-step study of the educational material with the fixation of the quality of mastering the material in the form of certain indicators. Such indicators may include: the time spent on each element (slide) of the course, taking into account the number of reference to this element; the dynamics of answers to test questions — an indicator reflecting the speed of mastering the educational material; the number of correct and incorrect answers, as well as the number of missed questions when performing tests — an indicator reflecting the volume of assimilation of educational material, etc. The analysis of the collected quantitative indicators allows you to determine the dynamics of the study of the course and build an individual trajectory of the student's learning, as well as develop appropriate recommendations for studying the course, which may appear after any slide, which is determined by the result of the analysis of the time and test results. Moreover, these recommendations can be both advisory and directive, compulsory.

Thus, the created model of intellectual lecture-presentation allows you to form an objective “electronic educational portrait” of a student, taking into account his individual characteristics, interests and abilities, which makes it possible to study and assimilate not only formal knowledge, but also support the desire to learn new things.

Keywords: educational-methodical materials, e-learning, intellectual lecture-presentation, smart learning, testing, electronic portrait of student, training trajectory.

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1. Introduction

As you know, the teacher and students participate in the learning process. In addition, they need educational-methodical materials, including theoretical information, practical tasks and examples, laboratory work. The work is based both on the classroom mode with the direct interaction between students and teachers, and on the students' independent work mode. Taking into account the capabilities of modern infocommunication systems, educational-methodical materials is advisable to submit in electronic form, so that there is the possibility of its phased study with tracing the quality of the learning material in the form

of certain quantitative indicators. It is also important to note the individual features of the study of the material that are characteristic of a particular person. Certain estimates of this may be the temporal characteristics of how long a student is “staying” in one or another educational block, how dynamically he answers test questions, etc. The combination of these data allows building an individual trajectory of student learning, as a kind of integral assessment of his work in the study of the discipline. And the accumulation of a bunch of such trajectories will allow us to introduce a comparison mechanism, as a result of which each student can be recommended to correct the learning trajectory if it is “falling out” of the nominally successful range [1–4].

2. General information

Given the significantly expanded information base in the infocommunication environment, the individual, independent work of students is also becoming increasingly important, which not only has all the reasons for this, due to the available content, but also contributes to the development of independent work skills, which is extremely important for a future specialist in a developing and rapidly changing labor market, when once acquired competencies require continuous improvement, and sometimes cardinal changes in accordance with changing technologies and processes in society. However, you should pay attention to the fact that the content available on the Internet is often not perfect, which can cause significant harm to learning if the student works independently. Therefore, we need verified methodological guidelines that will help prevent possible risks from erroneous or false information, which, unfortunately, are available in the open Internet environment. For this, it is necessary to determine the main source of generating new educational information, which can have both electronic and traditional structure in the form of printed publications (Figure 1).

Professional preliminary work of the teacher, based on the study of advanced scientific, technical and

technological achievements, allows building a “tree” of education, where the central object on which everything else is formed is the textbook or its replacement content. At the same time, this can be as a traditional printed textbook, if it reflects everything that was noted, but it can also be some kind of distributed electronic information base. The meaning of this is that the boundaries separating true, verified information from possible erroneous or false one should be professionally and responsibly delineated. Since the textbook or its replacement content contains a very significant and detailed amount of information, it is advisable, using the capabilities of infocommunication systems, on the basis of it to prepare a more concentrated methodical material in the form of an electronic presentation [5–7], for example, in the form of PowerPoint presentation which includes additional software subsystems that provide “intelligent” support for the student.

An “intellectual” presentation can be built on other platforms as well, being the initial training material. It can be just a text document or augmented reality. It is important that this methodical implementation meets the originally set goals, i.e. provides a better understanding and comprehensibility of the discipline, and also is not overly difficult to implement and, therefore, pointlessly expensive. For example, to study the multiplication table, expensive multimedia

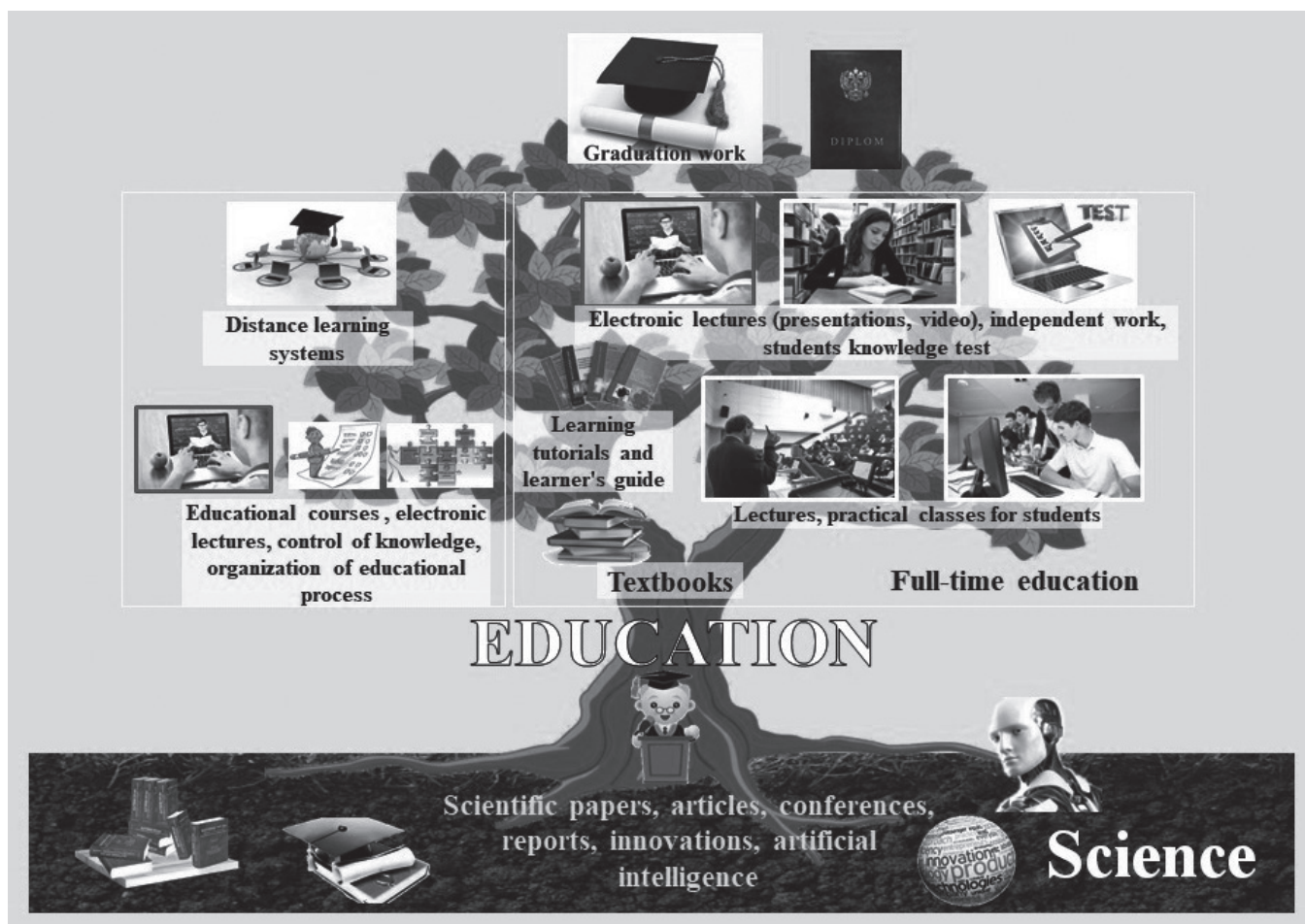


Fig. 1. “Tree” of education

solutions are unlikely to be needed, while to study the anatomical features of the human structure, it is justifiable to use more advanced and complex solutions for the formation of educational material [8–12].

3. The model of intellectual lecture-presentation

The mentioned guidelines can be built by forming an electronic educational-methodical resource, for example, a lecture-presentation, with the possibilities of intellectual processing of the results obtained from measurements of various parameters that quantitatively characterize the learning process of students.

The beginning of the formation of an intellectual lecture-presentation is the choice of the platform on which it will be implemented. Without losing the generality of consideration, we will focus on the PowerPoint presentation [13–15] with the addition of the necessary software solutions, which will be discussed below. Note that this solution was repeatedly tested in practice when implementing engineering courses at a technical university and showed high “consumer” and operational ratings, both on the part of students and teachers [16, 17].

In order to be able to conduct a specific analysis of the student’s behavior during the study of the discipline, it is necessary to introduce a certain set of parameters by which the assessment is carried out and the training trajectory is formed (Figure 2). It should be noted that it is important to know some initial data that allows you to somehow establish the “origin of coordinates”, relative to which subsequent actions and comparisons will be carried out.

Of course, these initial data depends on the discipline being studied and should be determined by the teacher-developer of the course.

However, a general set of such parameters can be formulated, which can be used in the formation of the scenario first, and then the course itself. The first thing to do is to identify certain information blocks into which the methodical material of the course can be divided in order to appropriately control the study and assimilation of this content. In Figure 2 these blocks with numbers 1–6 are shown in the form of rectangles. The dashed line is the initially set time that the student must spend on studying this block.

It is quite clear that reading and studying each of these blocks will take some time, and this time will usually be different. It is initially set by the course developer based on his pedagogical experience and the complexity of the proposed material in the block. Subsequently, after the accumulation of practical data, these times are specified, i.e. there is a more adequate adjustment of the requirements displayed by the dashed line for real practically obtained data on the trajectories of students.

Figure 2 shows the training trajectories of some fictional students “Ivanov” and “Petrov”. The initial conditions for these students are the same, which is determined by the dashed lines. However, in the process of studying the course, they show different time results of “staying” in certain blocks during their study. Moreover, in Figure 2 circles around the numbers indicate the moments of transition from one block to another. Solid rectangles shows blocks where students spent less time than originally planned and diagonally filled rectangles show blocks when students spent more time compared to the dashed line.

The testing subsystem is constructed in a similar way, when students are required to answer a number of questions, each considered as a separate unit, which takes different time. In addition, the testing subsystem notes successful and unsuccessful answers, the number

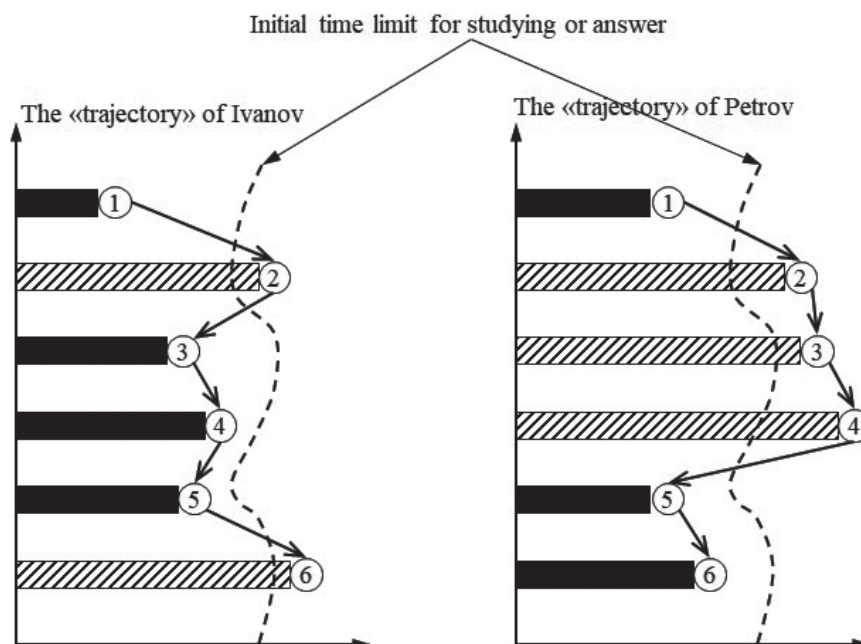


Fig. 2. Different “trajectories” of learning

of attempts to answer successfully and the number of missed questions.

As a result of the construction of such lecture-presentation, important information is accumulated about the student's training trajectory, which, through appropriate analysis, can result not only in a set of monitoring indicators received by the teacher, but also in an intellectual system that tells the student his further behavior in the form of certain recommendations, as well as reasonable restrictions and certain prohibitions.

So, let us denote by t_i the control time for the passage of the i -th block, shown in Figure 2 with a dashed line, and by t'_i — the real time that the student stays in this block. By $\tau_i = t_i - t'_i$ we denote the algebraic time difference of t_i and t'_i . We emphasize once again that the values t_i , t'_i and τ_i characterize each block, and each question in the tests. At the same time, indicators for the number of incorrect answers to each question, the number of correct answers, and missed questions are added to each question.

As a result, we have some functional that in general can be written as:

$$F(f_1, f_2, \dots, f_n). \quad (1)$$

Moreover, the expression characterizing each block, the number of which is taken as n , will look like this:

$$f_i = f(t_i, t'_i, \tau_i, k_i^c, k_i^{ic}, k_i^m), \quad (2)$$

where k_i^c is the number of correct answers, k_i^{ic} is the number of incorrect answers, k_i^m is the number of missed answers.

Although the indicators in formula (2) are quantified and are defined as decimal numbers in a traditional metric space, it is advisable to determine their mapping into the f_i function itself in a topological space, where the elements are corresponding logical recommendations to the student to improve the study of the discipline. In addition, the indicators should form a student's educational portrait for the teacher, reflecting his personal achievements in the study of the corresponding discipline.

General data on the student's trajectory and his portrait will be formed according to expression (1), which can ultimately serve as his corresponding assessment, according to the introduced measurement scale.

4. Software implementation of intellectual lecture-presentation

Before proceeding with the analysis of the results obtained and the formation of the functions presented in expressions (1) and (2), we consider the software implementation of the subsystems supplementing the PowerPoint platform, for which educational content is implemented in a number of technical disciplines. In an intellectual lecture-presentation, one can conditionally distinguish two subsystems: a training one, consisting of slides with the studied educational material, and a test one, containing various test tasks. To determine

the individual abilities of the student, as well as to identify possible omissions in the development of the studied discipline, the testing subsystem should record not only the time spent on the test, but also the nature of the test. In particular, the proposed tests can be divided into the following categories:

- A simple option is to select one or more correct answers, while the answers may or may not change their location upon subsequent entry into the testing subsystem. Such test options allow you to identify a lack of knowledge in the section as a whole, since they basically contain questions that cover the entire course under study.
- Calculation and input or selection of the calculated value from the proposed options, which develops the students' ability to use electronic educational material — remember and correctly apply the necessary formulas and graphs.
- The construction a logical chain of answers, as well as a task with establishing compliance, which allows developing logical thinking, which is required in many situations in life, as well as in solving complex technical problems.
- The construction of flowcharts, as well as the preparation of true statements that allow developing flexibility and originality of thinking, and ability to establish patterns.
- The construction of formulas from the source data, which develops the ability of students to memorize complex formulas (which will be useful in the further development of the course) and special attention, since it is necessary to draw up an expression in a clearly defined order, taking into account all the necessary signs: multiplication, division, summation, subtraction.
- Tests that combine several display options discussed above.

During the implementation of the testing subsystem, it is possible to record response times, while to simplify the task, it is possible to determine not the absolute time spent on the test, but the deviation from the average value both up and down, and also set the time limit for the test, which disciplines the learner in a certain degree. It is also necessary to take into account the number of incorrect answers and the types of tests in which these errors were made, and based on these results, display a report that reflects the time spent on the tests, the total number of questions asked, the number of incorrect answers, as well as the numbers (or text with the task) of those questions where errors were made. Such report is the basis for the formation of the functions (1), (2) and subsequent constructing an individual trajectory of the student, reflecting the gaps in his knowledge, as well as the peculiarities of the perception of the material being studied, which will allow to pay more attention to the re-study of exactly the educational section where mistakes were made. The report can be displayed on the screen (Figure 3), printed, or saved to a file.

When implementing the testing subsystem, slides of varying complexity are created, as well as slides with

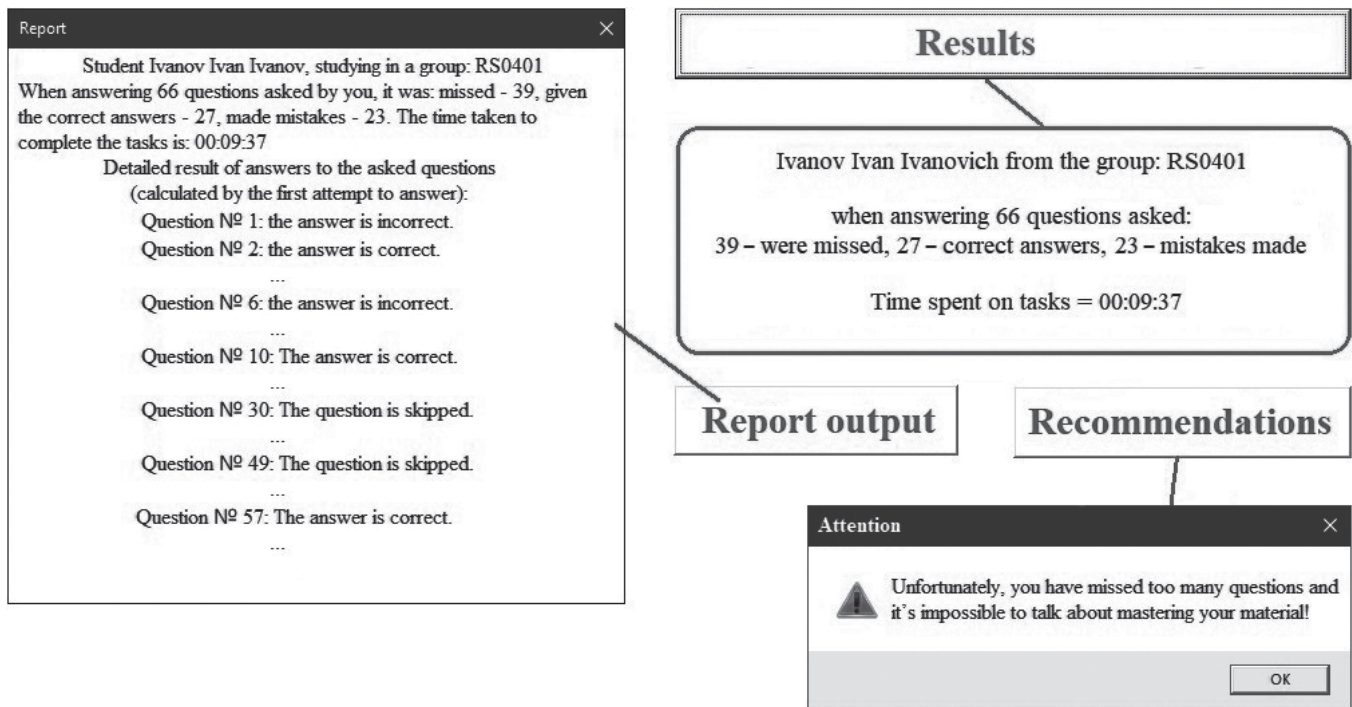


Fig. 3. Report of student's test completion

various multimedia support. A more detailed description of the creation of such slides is presented in [16].

The created testing subsystem records the following data: date and time of entry and exit to the course; for each slide is recorded the time t'_i spent on each element (slide) of the course, taking into account the number of entry into the course and the number of reference to this element (slide); a control time t_i is set that should be spent to study this element (slide), i.e. the rate is set for each of n slides, regardless of the number of entry into the course and the number of reference to this element. Based on the specified data, the duration of the course as a whole is calculated, as well as the time spent on the study of a separate element (slide).

The totality of the collected time parameters in the teaching and testing subsystems, as well as the results of the testing itself, are analyzed to identify the dynamics of the course learning, as well as to develop appropriate instructions in the form of "Recommendations and useful tips" that may appear after any slide. Such instructions can be both advisory in nature, for example, to be more attentive to the study, and directive, compulsory, namely, to return to the initial slide from which the study of this section began in order to master the material again.

Thus, the instructions "Recommendations and useful tips" included in the presentation accompany the studied course and is to attract the student's attention for a more careful study and assimilation of the proposed content.

The aggregate of all data obtained as a result of training using an intelligent lecture-presentation with a built-in testing subsystem is accumulated and used for further control of the student's knowledge, as well as for the subsequent development of the student's

individual educational trajectory and adjustment of the control time.

5. Conclusion

To create a full-fledged smart learning process, it is necessary to have both intelligent lectures-presentations in all studied disciplines, and a database indicating the disciplines studied, which, according to the current standard, are mutually influencing, as well as the score obtained in these disciplines. The creation of such a system, including individual training trajectories of students both in the study of material and in the control of knowledge (passing the test items), goes beyond the PowerPoint platform and requires the development of additional software, the creation of databases and the use of network technologies. In this regard, it is necessary that the interaction of these subsystems be one of the conditions for the implementation of smart learning ideas in general. We also note that the above applies not only to cases of the implementation of educational-methodical materials on the PowerPoint platform, but also to any other solutions [18–20]. The presence of three fundamental elements is crucial, namely:

- electronic implementation of educational content;
- quantitative assessment of the process of studying the discipline in the form of temporary assessments and assessments of the success of passing the tests;
- intellectual processing of quantitative data in comparison with the accumulated data of the "training trajectories" and the individual characteristics of the student, expressed in his grades.

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ОСОБЕННОСТИ SMART-ОБУЧЕНИЯ В ВЫСШЕЙ ШКОЛЕ

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Аннотация

Инфокоммуникационные технологии все больше вторгаются в процесс обучения, в том числе в высшей школе. Распространенный доступ к всевозможным информационным ресурсам с различных телекоммуникационных устройств — компьютеров, планшетов, смартфонов — с учетом достаточно высокого покрытия территории беспроводной связью обеспечивает необходимые условия для создания индивидуальных возможностей обучения с опорой на объективные показатели усвоения учебного материала и овладения требуемыми навыками и умениями. Кроме того, необходимо учитывать имеющийся опыт, установившиеся традиции, способность к восприятию нового, подготовленность к использованию современных различных инфокоммуникационных решений в организации образования не только обучаемых, но и их преподавателей, а также готовность соответствующих учеб-

ных и методических материалов. Для реализации этого необходимо сформировать не только учебно-методические материалы, но и адекватную контрольно-измерительную среду, позволяющую получать объективные оценки, характеризующие процесс изучения дисциплины и качество усвоения материала.

С этой целью авторами предлагается создание модели интеллектуальной лекции-презентации со встроенной тестирующей подсистемой, в которой существует возможность поэтапного изучения учебного материала с фиксацией качества его усвоения в виде определенных показателей. К таким показателям могут относиться: время, затрачиваемое на каждый элемент (слайд) курса с учетом количества обращений к данному элементу; динамичность ответов на тестовые вопросы — показатель, отражающий скорость усвоения учебного материала; количество правильных и ошибочных ответов, а также пропущенных вопросов при выполнении тестов — показатель, отражающий объем усвоения учебного материала, и т. д. Анализ собранных количественных показателей позволяет определить динамику изучения курса и построить индивидуальную траекторию обучения студента, а также выработать соответствующие рекомендации по изучению курса, которые могут появиться после любого слайда, что определяется результатом проводимого анализа времени и итогами тестирования. При этом данные рекомендации могут иметь именно рекомендательный характер, но могут быть и директивами, т. е. иметь принудительный характер.

Таким образом, созданная модель интеллектуальной лекции-презентации позволяет сформировать объективный «электронный учебный портрет» студента, учитывающий его индивидуальные особенности, интересы и способности, что дает возможность изучения и усвоения не только формальных знаний, но и поддержки стремления к изучению нового.

Ключевые слова: учебно-методический материал, электронное обучение, интеллектуальная лекция-презентация, smart-обучение, тестирование, электронный портрет учащегося, учебная траектория.

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НОВОСТИ

Бесплатные инструменты для обучения ИИ для тех, кто не умеет программировать

Компания Microsoft выпустила решение Lobe для тренировки моделей машинного обучения. Оно нацелено на самую широкую массу пользователей, так как совершенно не требует знаний и навыков в программировании. То есть тренировать с ее помощью искусственный интеллект сможет каждый человек, даже никак не связанный с ИТ-отраслью. По заявлению разработчиков, Lobe позволяет создать модель машинного обучения с нуля всего за 10 минут.

Lobe — это автономная программа, устанавливаемая на компьютер или ноутбук и не требующая дополнительного подключения к облачным сервисам, она проводит все расчеты непосредственно на устройстве пользователя. На момент публикации материала Lobe была доступна только в бета-версии и только под Windows и macOS. Бета-версия Lobe имеет ограниченные возможности, по сути, демонстрирующие потенциал программы. На момент выхода беты она умела лишь автоматически классифицировать изображения. Пользователю требуется загрузить в программу заранее подготовленные файлы, после чего промаркировать их, и на выходе программа выдаст готовую модель. В Microsoft отметили, что, если точность распознавания изображений окажется недостаточно высокой, пользователь сможет самостоятельно повысить ее, дообучив программу.

Разработчики привели несколько примеров использования Lobe. При помощи этого сервиса можно тренировать модели машинного обучения, которые затем будут использоваться для анализа аэроснимков и фотографий живот-

ных и растений, распознавания масок на лицах людей, определения жестов и эмоций и даже видов спортивных упражнений. С помощью Lobe можно создавать модели для определения дыма и огня, что может пригодиться, например, для выявления лесных пожаров на ранней стадии. Еще один пример использования — создание модели машинного обучения для умных радионянь. Они смогут определить, спит ребенок или уже проснулся, и уведомить родителей о его пробуждении до того, как он начнет плакать.

Выпустив Lobe в свободный доступ и позволив простым пользователям делать то, на что раньше были способны лишь специалисты в сфере машинного обучения, Microsoft пошла по стопам Amazon. В июне 2020 года Amazon запустила сервис Honeycode для создания полноценных приложений, притом, как и в случае с Lobe, без необходимости написания программного кода. Honeycode можно пользоваться совершенно бесплатно, и доступ к нему открыт как обычным потребителям, так и крупным разработчикам. В Honeycode реализован специальный графический интерфейс с набором шаблонов для создания программ различного рода. Это, к примеру, менеджер мероприятий (Event Management), контроль бюджета (Budget Approval), менеджер оборудования (Inventory Manager), инструмент управления контентом (CMS, Content Tracker) и др. Сама Amazon в качестве примера приложений, разработанных при помощи Honeycode, привела планировщик задач (Simple To-do) и инструмент анализа работы сотрудников компании с клиентами (CRM, Customer Tracker).

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