1. A framework for creating automated online adaptive tests using multiple-criteria decision analysis

Abstract: Towards the last decade, digital education has become a burning issue in the related scientific literature and involves the production of Intelligent Tutoring Systems (ITSs). ITSs are adaptive educational applications that enrich the tutoring and learning processes with "intelligence" by divulging the abilities and weaknesses of each student, in order to provide him/her with a personalized learning experience. A crucial factor of adaptive learning systems is testing, and indeed adaptive testing. It is a challenge to create an adaptive test that includes the most suitable exercise/question/activity of a large pool of test items for a particular learner taking into consideration her/ his particular learning characteristics, needs and ability. In this paper, a framework for creating automated adaptive tests using multiple-criteria decision analysis and the weighted sum model is presented. The presented framework takes into consideration multiple students' criteria along with the types of exercises and the desirable learning objective. The aforementioned assessment framework was incorporated in two adaptive e-learning systems and was fully evaluated. The evaluation results are very encouraging.

2. Ability Assessment Based on CAT in Adaptive Learning System

Abstract: Ability level of learner is the important dimension of adaptation in adaptive learning system. There are great differences in the capacity dimensions between different learners. Even for each specific learner, his ability level changes in the learning process. In order to more effectively evaluate the learner's ability level and to support the personalized learning, we integrate the computerized adaptive testing (CAT) module into adaptive learning system in this paper. We put forward the architecture of integrating computerized adaptive testing module into adaptive learning system, and analyze the algorithms of adaptive testing based on item response theory and three parameters logistic (3PL) model. Via CAT, the test result updates the learnerpsilas ability level in student model. So based on the new ability level of learner, adaptive learning system can support the personalized learning with the adaptive content and the adaptive navigation.

3. Adaptive learning: A new approach in student modeling

Abstract: Here is described the implementation of adaptivity in Moodle: a specific but very common Learning Management System. After a preliminary study about the adaptive built-in features in moodle learning management system, and the capabilities ready to perform a suitable student modeling, the research team extended Moodle capabilities with a specific data model, student model and tutoring engine to perform automatic monitoring and sequencing of learning objects for each particular learner. The future implementation of this project is related to testing activities in order to prove the efficiency method in content and course delivery.

4. Adaptive memory: Survival processing enhances retention

Abstract: The authors investigated the idea that memory systems might have evolved

~~to help us remember fitness-relevant information-specifically, information relevant to survival. In 4 incidental learning experiments, people were asked to rate common nouns for their survival relevance (e.g., in securing food, water, or protection from predators); in control conditions, the same words were rated for pleasantness, relevance to moving to a foreign land, or personal relevance. In surprise retention tests, participants consistently showed the best memory when words were rated for survival; the survival advantage held across recall, recognition, and for both within-subject and between-subjects designs. These findings suggest that memory systems are "tuned" to remember information that is processed for fitness, perhaps as a result of survival advantages accrued in the past.~~

5. Adaptive quizzes to increase motivation, Mark engagement and learning outcomes in a first year accounting unit

Abstract: Adaptive learning presents educators with a possibility of providing learning opportunities tailored to each student's individual needs. As such, adaptive learning may contribute to both improving student learning outcomes and increasing student motivation and engagement. In this paper, we present the findings from a pilot of adaptive quizzes in a fully online unit at an Australian higher education provider. Results indicate that adaptive quizzes contribute to student motivation and engagement, and students perceive that adaptive quizzes support their learning. Interestingly, our results reveal that student scores did not increase significantly as a result of the introduction of adaptive quizzes, indicating that students may not be best placed to assess their own learning outcomes. Despite this, we conclude that adaptive quizzes have value to increase student motivation and engagement.

6. Adaptive test system of student knowledge based on neural networks

Abstract: An information adaptive test system of student's knowledge was proposed. It is based on the three-criterion decision-making model of transferring between the test difficulties levels using neural network. Knowledge check results in the groups of students studying in the distance learning system Moodle were compared with knowledge check results groups of students who were trained using the improved EduPRO system. This comparison, based on experimental data confirmed the effectiveness of the proposed approach.

~~7. Affectively Intelligent User Interfaces for Enhanced E-Learning Applications~~

~~**Abstract:** In this article we describe a new approach for electronic learning applications to interact with their users. First we discuss our motivation to build affectively intelligent User interfaces that can recognize learning related emotions and adapt to these through User modeling. In the remainder of the paper we describe the experiment we designed to elicit learning related emotions from students in order collect their physiological signals while they are experiencing those emotions and to classify those physiological signals into emotional states with pattern recognition algorithms.~~

8. Building pipelines for educational data using AI and multimodal analytics: A "grey-box" approach

Abstract: Students' on-task engagement during adaptive learning activities has a significant effect on their performance, and at the same time, how these activities influence students' behavior is reflected in their effort exertion. Capturing and explaining effortful (or effortless) behavior and aligning it with learning performance within contemporary adaptive learning environments, holds the promise to timely provide proactive and actionable feedback to students. Using sophisticated machine learning (ML) algorithms and rich learner data, facilitates inference-making about several behavioral aspects (including effortful behavior) and about predicting learning performance, in any learning context. Researchers have been using ML methods in a "black-box" approach, ie, as a tool where the input data is the learner data and the output is a given class from the chosen construct. This work proposes a methodological shift from the "black-box" approach to a "grey-box" approach that bridges the hypothesis/literature-driven (feature extraction) "white-box" approach with the computation/data-driven (feature fusion) "black-box" approach. This will allow us to utilize data features that are educationally and contextually meaningful. This paper aims to extend current methodological paradigms, and puts into practice the proposed approach in an adaptive self-assessment case study taking advantage of new, cutting-edge, interdisciplinary work on building pipelines for educational data, using innovative tools and techniques. Practitioner Notes What is already known about this topic Capturing and measuring learners' engagement and behavior using physiological data has been explored during the last years and exhibits great potential. Effortless behavioral patterns commonly exhibited by learners, such as "cheating," "guessing" or "gaming the system" counterfeit the learning outcome. Multimodal data can accurately predict learning engagement, performance and processes. What this paper adds Generalizes a methodology for building machine learning pipelines for multimodal educational data, using a modularized approach, namely the "grey-box" approach. Showcases that fusion of eye-tracking, facial expressions and arousal data provide the best prediction of effort and performance in adaptive learning settings. Highlights the importance of fusing data from different channels to obtain the most suited combinations from the different multimodal data streams, to predict and explain effort and performance in terms of pervasiveness, mobility and ubiquity. Implications for practice and/or policy Learning analytics researchers shall be able to use an innovative methodological approach, namely the "grey-box," to build machine learning pipelines from multimodal data, taking advantage of artificial intelligence capabilities in any educational context. Learning design professionals shall have the opportunity to fuse specific features of the multimodal data to drive the interpretation of learning outcomes in terms of physiological learner states. The constraints from the educational contexts (eg, ubiquity, low-cost) shall be catered using the modularized gray-box approach, which can also be used with standalone data sources.

9. Computer adaptive testing for student's knowledge in C++ exam

Abstract: In adaptive learning systems for distance learning attention is focused on

adjusting the learning material to the needs of the individual. Adaptive tests adjust to the current level of knowledge of the examinee and is specific for their needs, thus it is much better at evaluating the knowledge of each individual. The basic goal of adaptive computer tests is to ensure the examinee questions that are challenging enough for them but not too difficult, which would lead to frustration and confusion. The aim of this paper is to present a computer adaptive test (CAT) realized in MATLAB.

10. Impact of Adaptive Educational System Behaviour on Student Motivation

Abstract: In this work we try to connect research on student modeling and student motivation, particularly on the relation between task difficulty and engagement. We perform experiments within widely used adaptive practice system for geography learning. The results document the impact of the choice of a question construction algorithm and target difficulty on student perception of question suitability and on their willingness to use the system. We also propose and evaluate a mechanism for a dynamic difficulty adjustment.

11. Interactive Teachable Cognitive Agents: Smart Building Blocks for Multiagent Systems

Abstract: Developing a complex intelligent system by abstracting their behaviors, functionalities, and reasoning mechanisms can be tedious and time consuming. In this paper, we present a framework for developing an application or software system based on smart autonomous components that collaborate with the developer or user to realize the entire system. Inspired by teachable approaches and programming-by-demonstration methods in robotics and end-user development, we treat intelligent agents as teachable components that make up the system to be built. Each agent serves different functionalities and may have prebuilt operations to accomplish its own design objectives. However, each agent may also be equipped with in-built social-cognitive traits to interact with the user or other agents in order to adapt its own operations, objectives, and relationships with others. The results of adaptation can be in the form of groups or multiagent systems as new aggregated components. This approach is made to tackle the difficulties in completely programming the entire system by allowing the user to teach the components toward the desired behaviors in the situated context of the application. We exemplify this novel method with cases in the domains of human-like agents in virtual environment and agents for in-house caregiving.

12. 计算机化自适应测验及应用于规模化考试的主要问题分析

Abstract: 计算机化自适应测验是评估学生个性化能力的有效测评方式,广泛应用于国外的 K-12 教育、升学考试和资格认证中。以考试技术改革为突破口,在规模化考试甚至是未来高考中实施 CAT,是促进教学测试评估和招考改革的有效措施。为此,本研究首先对 CAT 的技术部件、测试流程、不同类型以及与纸笔考试的异同进行梳理,并对其在国外教育中的典型应用和存在问题进行深入分析;继而在调研与分析国内中学教育"机考"现状及改革期望的基础上,对未来规模化考试

13. 基于 Agent 的智能 CBR 引导系统的结构设计

Abstract: 描述了一个应用软件 Agent 技术的智能 CBR 引导系统的结构设计。系统机架在引导界面 Agent 里融合了 CBR 思想。介绍了分布式的引导 Agent 的交互、引导系统的多媒体界面的设计思想,以及系统在专家系统开发工具上的应用。

14. Learning in the presence of concept drift and hidden contexts

Abstract: On-line learning in domains where the target concept depends on some hidden context poses serious problems. A changing context can induce changes in the target concepts, producing what is known as concept drift. We describe a family of learning algorithms that flexibly react to concept drift and I:an take advantage of situations where contexts reappear. The general approach underlying all these algorithms consists of (1) keeping only a window of currently trusted examples and hypotheses; (2) storing concept descriptions and reusing them when a previous context re-appears: and (3) controlling both of these functions by a heuristic that constantly monitors the system's behavior. The paper reports on experiments that test the systems' performance under various conditions such as different levels of noise and different extent and rate of concept drift.

15. Learning Style Recognition: A Neural Network Approach

Abstract: In adaptive and intelligent e-learning systems, amidst other parameters that help to provide tailored instruction learning style plays a very pivotal role, and adaptive learning systems tend to revolve around this predominant parameter. And therefore deducing learning style is requisite that will help in the adaptation process. Learner behavior is observed and recorded, and certain parameters are used to deduce learning style. This paper presents an inference engine which is actually a neural network with backward propagation which uses certain observed parameters to infer the learning style. The engine so developed incorporates a popular and widely accepted learning style theory. The system will be a part of a larger adaptive learning and assessment system.

16. Mechanistic insights into bacterial metabolic reprogramming from omics-integrated genome-scale models

Abstract: Understanding the adaptive responses of individual bacterial strains is crucial for microbiome engineering approaches that introduce new functionalities into complex microbiomes, such as xenobiotic compound metabolism for soil bioremediation. Adaptation requires metabolic reprogramming of the cell, which can be captured by multi-omics, but this data remains formidably challenging to interpret and predict. Here we present a new approach that combines genome-scale metabolic modeling with transcriptomics and exometabolomics, both of which are common tools for studying dynamic population behavior. As a realistic demonstration, we developed a genome-scale model of Pseudomonas veronii 1YdBTEX2, a candidate

bioaugmentation agent for accelerated metabolism of mono-aromatic compounds in soil microbiomes, while simultaneously collecting experimental data of P. veronii metabolism during growth phase transitions. Predictions of the P. veronii growth rates and specific metabolic processes from the integrated model closely matched experimental observations. We conclude that integrative and network-based analysis can help build predictive models that accurately capture bacterial adaptation responses. Further development and testing of such models may considerably improve the successful establishment of bacterial inoculants in more complex systems.

17. On the impact of adaptive test question selection for learning efficiency

Abstract: In this paper we present a method for adaptive selection of test questions according to the individual needs of students within a web-based educational system. It functions as a combination of three particular methods. The first method is based on the course structure and focuses on the selection of the most appropriate topic for learning. The second uses Item Response Theory to select the k-best questions with adequate difficulty for a particular learner. The last is based on the usage history and prioritizes questions according to specific strategies, e.g. to filter out the questions that were recently asked. We describe how these methods evaluate user answers to gather information concerning their characteristics for a more precise selection of further questions. We describe an evaluation of the impact of a proposed method through two different types of experiments in the domain of learning programming, which both showed that our method for adaptive test question selection increases the overall learning outcome, especially for lower than average performing students. (C) 2010 Elsevier Ltd. All rights reserved.

18. Optimal Weighting for Exam Composition

Abstract: A problem faced by many instructors is that of designing exams that accurately assess the abilities of the students. Typically, these exams are prepared several days in advance, and generic question scores are used based on rough approximation of the question difficulty and length. For example, for a recent class taught by the author, there were 30 multiple choice questions worth 3 points, 15 true/false with explanation questions worth 4 points, and 5 analytical exercises worth 10 points. We describe a novel framework where algorithms from machine learning are used to modify the exam question weights in order to optimize the exam scores, using the overall final score as a proxy for a student's true ability. We show that significant error reduction can be obtained by our approach over standard weighting schemes, i.e., for the final and midterm exam, the mean absolute error for prediction decreases by 90.58% and 97.70% for linear regression approach respectively resulting in better estimation. We make several new observations regarding the properties of the "good" and "bad" exam questions that can have impact on the design of improved future evaluation methods.

19. Personalized Adaptive Learning using Neural Networks

Abstract: Adaptive learning is the core technology behind intelligent tutoring

systems, which are responsible for estimating student knowledge and providing personalized instruction to students based on their skill level. In this paper, we present a new adaptive learning system architecture, which uses Artificial Neural Network to construct the Learner Model, which automatically models relationship between different concepts in the curriculum and beats Knowledge Tracing in predicting student performance. We also propose a novel method for selecting items of optimal difficulty, personalized to student's skill level and learning rate, which decreases their learning time by 26.5% as compared to standard pre-defined curriculum sequence item selection policy.

20. Student behavior in a web-based educational system: Exit intent prediction

Abstract: The behavior of users over the web is one of the most relevant and research topic nowadays. Not only mining the user's behavior in order to provide better content is popular, but the prediction of the user's behavior is interesting and can increase user experience. Moreover, the business clearly desires such information to improve their services. In this paper we focus to the education domain as it belongs to the most dynamically transforming areas. Web based e-learning systems are nowadays reaching still greater popularity, because of possibilities they offer to students. We analyze various sources of "e-students" feedback and discuss today's challenges from the logging and feedback collecting point of view. Next, we focus on the prediction of student's next action within an e-learning application (in the mean of "stay or leave?" question). Such information can improve students' attrition rate by introducing various personalized approaches. We proposed the classifier based on polynomial regression and stochastic gradient descent to learn the attributes importance. In this way we are able to process a stream of data in one single iteration and thus we are able to reflect dynamic users' behavior changes. Our experiments are based on the log data collected from our web-based education system ALEF during three-year period. We found that there is an extensive heterogeneity in the users' (student) behavior which we were able to handle by using individual weights calculated for every user.