Learner Analytics in E-Learning: Fuzzy Logic, Affective, Cognitive and Decision
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Abstract: Interactive e-learning applications that do not take into consideration the individual needs of learners, may fail to employ appropriate tutoring strategies resulting into providing inadequate or even misleading tutoring advice to remote learners over the web. Recently, the recognition of human emotions in interactive e-learning applications has also been considered important although it had been overlooked for many years in the past. This talk will present and discuss research challenges and approaches towards learner analytics in e-learning applications and will review the research advancements on this topic that have been achieved in the software engineering lab of our department. One aspect, that will be analysed, is learner analytics based on observations through implicit user models taking input from at least three modalities of interaction, namely the keyboard, camera and microphone in conjunction with contextual information from the e-learning application. Contextual information differs depending on the kind of e-learning applications. For example, in educational games, the plot of the game contributes to the generation of further emotions on top of emotions experienced through the procedure of learning in other kinds of interactive e-learning applications whereas in collaborative learning, collaboration among students contributes to emotion generation on top of learning. The role of cognitive theories, such as OCC, for automatically personalising, all kinds of e-learning software, will also be presented and discussed. Four paradigms of fully developed e-learning systems, in our lab, will exemplify the above research. First, one virtual reality educational game that automatically analyses user data based on three cognitive theories, namely, one theory which analyses human plausible reasoning, another one which analyses how learners forget in combination with OCC theory that analyses contextual information in terms of human emotions. Secondly, a mobile e-learning application, that employs three modalities for emotion recognition and generation and analyses learner data based on decision theories, will be presented. Thirdly, emotion recognition and generation will be exemplified in an adaptive collaborative e-learning application. Finally, learner analytics based on fuzzy logic will be presented in the context of an e-learning system that adjusts automatically to the individual learning pace of learners. The talk will conclude by highlighting open research areas for further research.

Short Biography: Maria Virvou was born in Athens, Greece. She received a B.Sc. Degree in Mathematics from the University of Athens, Greece, a M.Sc. Degree in Computer Science from the University of London (University College London), U.K. and a Ph.D. in Computer Science and Artificial Intelligence from the University of Sussex, U.K.

She is a full professor, head of the department and director of post-graduate studies in the Department of Informatics, University of Piraeus, Greece. She is also editor-in-chief of the SpringerPlus Journal (Springer) for the whole area of Computer Science. She has been an associate editor of the Knowledge and Information Systems (KAIS) Journal (Springer) for the years 2008-2015. Additionally, she is a MEMBER OF THE editorial board of Monitoring and Surveillance Technologies Research (IGI Global) and of the International Journal on Computational Intelligence Studies (Inderscience). She has been co-founder and was general co-chair of the yearly conference series of KES-Intelligent Interactive Systems and Services which aimed at promoting research in the area of interactive multimedia and major applications such as e-learning and m-learning for the years 2008-2014. She has been the general chair / program chair of over twenty (20) International Conferences. Among them, she was general chair / program chair of 1. The Sixth, Fifth and Fourth International Conference on Information, Intelligence, Systems and Applications (IISA 2015, IISA 2014, IISA 2013), technically-sponsored by IEEE. 2. Seven annual International Conference on Intelligent Interactive Multimedia Systems and Services (KES-IIMSS-2014, 2013, 2012, 2011, 2010, 2009, 2008). She has been an editor of 15 collections of papers/ proceedings of International Conferences. She has been the principal investigator or co-investigator of over 15 national / international research projects. She has been the Director of the “Software Engineering” research lab for 12 years. The Software Engineering lab has achieved significant distinctions and has been one of the main contributors to
establishing the University of Piraeus as a top Organization for Computer Education. According to Microsoft Academic Search (http://academic.research.microsoft.com/), the University of Piraeus is ranked as 73 in the top 100 institutions out of 4334 organizations worldwide in the area of Computer Education. Maria Virvou has supervised 12 Ph.D. which have been completed successfully, all in the area of Computers in Education and Software Engineering and she is currently supervising 6 Ph.D. students and 10 post-doctoral researchers. Moreover, she has supervised more than 150 M.Sc. theses in the areas of Software Engineering applications and Computers and Education.

Her research interests are in the area of Computers and Education, Knowledge Based Software Engineering, user and student modeling, e-learning and m-learning, Intelligent Tutoring Systems, Knowledge-Based Software Engineering and Human-Computer Interaction and Affective Computing. Professor Virvou is author/co-author of five (5) books in Computer Science. The most recent among them are two monographs which have been published by Springer. One was published in January 2015, it is entitled “Advances in Personalized Web-Based Education” and it presents recent research in Personalized Web-Based Education. Another one was published in January 2014, it is entitled “Object-Oriented User Interfaces for Personalized Mobile Learning” and presents recent research in object-oriented user interfaces for personalized mobile learning.

She is author/co-author of over 300 research papers published in international journals, books and conference proceedings. According to Microsoft Academic Search (http://academic.research.microsoft.com/), Professor is ranked as 53 in the top 100 authors out of 58000 authors worldwide in the area of Computer Education. According to the same academic search, she is ranked as the top first author in the area of “student model” and “authoring tools”. Additionally, she is ranked in the top 100 authors in the area of “GUI (Graphical User Interface)” out of 28075 authors worldwide and in the top 100 in the area of emotion recognition. Her article "Combining software games with education: Evaluation of its educational effectiveness” Educational Technology & Society, Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force, 8 (2): 54-65 APR 2005 is included in the top ten full-length articles of the whole Journal. She was a co-recipient of the Best Applications paper award of the 29th Annual International Conference of the British Computer Society Specialist Group on Artificial Intelligence, Cambridge, UK, December 15-17, 2009. She has been an invited keynote speaker for the international conferences of Intelligent Computer Graphics 2011, the IEEE 2013 International Conference on Computer, Information and Telecommunication Systems IEEE (CITS 2013) and 6th International Conference on Intelligent Decision Technologies KES-IDT 2014.