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EDITORIAL

Preface to the Special Issue AI4MOOCs: Artificial Intelligence, Sensoring, Modeling and Assessment for MOOCs. A Step Beyond

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Nowadays, thanks to the possibilities offered by the Internet, and unfortunately also because of unexpected situations such as the COVID-19 pandemic, the demand for distance learning courses is growing. Massive Open Online Courses (MOOCs) in recent times have attracted great attention due to their peculiarity of having a very large number of learners. For a teacher who wishes to follow the learning processes of both the large class and the individual learners, a MOOC can be extremely hard to manage: the matters at hand, here, are related to student modeling, personalization/ adaptation of learning activities, and assessment, as well as prediction, of individual learning outcomes. To help teachers, recent years have witnessed a proliferation of techniques and systems based on Artificial Intelligence and, in particular, on Machine Learning.

This special issue of the International Journal of Artificial Intelligence in Education (IJAIED), entitled "AI4MOOCs: Artificial Intelligence, Sensoring, Modeling and Assessment for MOOCs. A Step Beyond", was designed to explore recent developments and applications of Artificial Intelligence, ranging over different aspects of MOOCs learning processes and management, including Artificial Intelligence and Embodied Learning, Deep Learning, and Adaptive Learning. The call for papers attracted fifteen papers which were peer reviewed by experienced IJAIED reviewers. Three papers were eventually accepted for publication, after at least two rounds of reviews. This Special Issue, then, provides the description of research that went through a thorough and extensive reviewing process. It covered various Artificial Intelligence aspects related to MOOCs learning processes. The three contributions have used Machine Learning and Natural Language Processing, two key aspects of Artificial Intelligence in Education (AIED) research that seem to be becoming more mature.

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The first paper, "An AI-Based System for Formative and Summative Assessment in Data Science Courses", by Pierpaolo Vittorini, Stefano Menini & Sara Tonelli describes a system and related experiments to improve both the performance and quality of formative and summative assessments in specific MOOCs for data science courses. Their system is based on natural language processing combined with a code analysis module to build an interactive assessment tool. The authors show that the use of artificial intelligence can be helpful to reduce the time for the assessment activity in terms of required effort of teachers.

The second paper, "Natural Language Generation Using Deep Learning to Support MOOC Learners", by Chenglu Li and Wanli Xing, examines the extent to which the deep-learning-based natural language generation models, can offer responses similar to human-generated responses to the learners in MOOC forums. In particular, this study examined the use of state-of-the-art deep learning models such as recurrent neural networks and generative pretrained transformer 2 (GPT-2). The results showed that the GPT-2 model could provide supportive and contextual replies to a similar extent compared to humans.

The third and last paper, "Towards Designing Profitable Courses: Predicting Student Purchasing Behaviour in MOOCs", by Mohammad Alshehri, Ahmed Alamri, Alexandra Cristea and Craig D. Stewart, presents a work that, starting from data generated by the various student activities in a MOOC's learning environment, builds a predictive model for student success. The aim is to tackle the problem of predicting drop-out students enrolled in a MOOC course. A deep learning approach is proposed as the machine learning technique to build the model.

The three works address the study of learning processes in MOOCS from different viewpoints, and with three completely different and innovative approaches. Consequently, they are a starting point for new discussions concerning MOOCs in a context where teachers, due to the large numbers of students, would have difficulty in effectively monitoring each learner individually.

This special issue opens up the potential for AIED in MOOCs, and shows it as an emerging research field. The published papers address some of the open issues with respect to assessment in science courses, human simulated responses and drop-out prediction, using novel artificial intelligence techniques. However, there are still other open issues that need to be further addressed by the AIED community. For instance, how to take advantage of current sensing capabilities to model users' interactions in mobile-based settings, with the aim to model affective aspects of the learners' interactions, so as to enhance adaptivity in MOOCs, towards an embodied learning experience. Another open research issue relates to the visualization of data collected in MOOCs, to allow for further insights about the course pedagogy and outcomes, and support the production of meaningful feedback for all the involved stakeholders. We hope this Special Issue will be a seed helping the research field grow, and produce further progress in intelligent MOOCs that harness emerging sensor technology.