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Abstract

In the past years, everyday life has been profoundly transformed by the development and widespread of digital technologies. General, as well as specialized audiences, have to face an ever-increasing amount of knowledge and learn new abilities. This first edition of the EASEAI workshop tried to address that challenge by looking at software engineering, education, and artificial intelligence research fields to explore how they can be combined. Specifically, we brought together researchers, teachers, and practitioners who use advanced software engineering tools and artificial intelligence techniques in education. And researchers and teachers in education science who address the problem of improving the awareness regarding digital technologies through a transgenerational and transdisciplinary range of students.

1. INTRODUCTION

In the past few years, the world has seen a tremendous digital transformation in all of its areas. In consequence, the general public needs to be able to acquire an ever-increasing amount of digital literacy and at least some level of proficiency with modern digital tools. While modern software engineering relies heavily on Computer Assisted Software Engineering (CASE) tools and development methodologies (to improve productivity, quality, and efficiency of development teams), those tools remain targeted towards experienced practitioners and computer science remains taught in a very classical way. At the same time, the rise of artificial intelligence allows one to provide automated support, automate the processing and review of documents such as dissertations and other kinds of exercises, or to provide predictions of the needs of students.

This context seemed to be a perfect opportunity to foster interesting discussions in a workshop that gathers people from many different communities (software engineering, education science, artificial intelligence, machine learning, natural language processing, etc.), through the common lens of how advanced software tools and techniques might be used as a catalyst for a better way to teach various types of students.

The primary goal achieved by EASEAI was to gather researchers, teachers, and practitioners who use advanced software engineering tools and artificial intelligence techniques on a daily basis in the education field and through a transgenerational and transdisciplinary range of students.

The first area covered by the workshop is the use or development of innovative software tools to improve the quality of education in the fields of both computer and science and other disciplines. This theme includes the advancement in tools designed to help individuals (ranging from children to seniors) acquire better computational thinking skills and improve their digital literacy. It also covers the development and use of tools designed to support the acquisition of scientific or technical skills.

The second area targeted by the workshop relates to the adaptation of modern software engineering tools and methodologies to the needs of beginner computer science students or the context of other academic fields. Indeed, it is common in the industry to either use techniques such as code versioning, testing, code smells, quality metrics, code review, continuous integration, etc. or tools such as *Git*, *SonarQube*, *BugFinders*, *Jenkins*, etc. However, it is neither common nor trivial to integrate these techniques and tools in software engineering education. Nevertheless, efforts in this direction demonstrated their benefit for education. For instance, tools such as *Hairball* or *Dr Scratch* have been designed to review the quality of code developed by youth or novice coders. They are essentially static code analysis tools made approachable for younger coders. Recently, these tools have gathered some interest due to their positive impact on the growth of computational thinking in young coders. Similarly, agile development methods have become very popular in the software industry. Many of their founding principles (focus on customers, iterative appropriation of complex artifacts, self-organization of teams, etc.) might be applicable in education. Gathering and discussing feedback of experiences relating to agile in education would be one of the contributions to this area of the workshop.

The third discussion area of the workshop is related to the support that Artificial Intelligence (AI) might provide to teachers regarding the improvement of pedagogical tools. Contributions to the workshop would include developments in the field of automatic grading and feedback provided to students through machine learning. Issues addressed in this area relate to how advanced tools such as automated translation applications or replace-as-you-type spell checkers might be proactively used in education. It also discusses the use or development of artificial intelligence techniques designed to help improve the recommendations provided to support personalized curricula. And methods defined to predict the engagement and risks of dropping out of students through machine learning.

Through these areas, the workshop aimed to achieve convergence between research works focusing on the education of a varied range of target audiences, both from younger to senior students and from aspirant computer science specialists to a broader audience. In turn, this blending of different audiences generated interesting discussions and future directions relating to the intricate balancing of teaching technical and specialized topics to audiences that need only a cursory yet accurate overview of the subject (e.g., the need to teach what AI is to social network users).

2. WORKSHOP FORMAT

The EASEAI workshop accepted original papers describing positions and new ideas, as well as new results and reporting on innovative approaches. We followed a single-blinded review process and, in total, we received 15 submissions, out of which 9 papers were accepted for publication and presentation. Each submission has been reviewed by three members of the program committee.

One of the main objectives of the workshop was to provoke discussions and exchanges of ideas between participants coming from different research communities. To foster and trigger those discussions, two weeks before the workshop, we assigned discussants[1] to papers accepted for presentation. We asked each author to send a pre-print of their paper to their discussant. And to each discussant (the author of another accepted paper), to prepare a one-slide summary to open the discussion after the presentation of the paper. The template[2] contains the following questions to answer:

- What are the main contributions of this paper?
- What do you like the most in this paper?
- What would be the next steps to expand the contributions further?
- How could you or your research contribute to the research presented in this paper?

3. SUMMARY OF CONTRIBUTIONS

The workshop itself took place on the 26th of August in Tallinn. It started with a keynote presentation followed by three sessions. During each session, the author was given 20 minutes to present his work plus 10 minutes for the discussion. Each discussion started with the presentation of the one slide summary by the discussant.

3.1 Keynote

Thomas Deneux, Research Engineer in Neurorobotics at the CNRS (Paris, France), kicked-off the workshop with a keynote on *Using a learning robot to open the black box of artificial intelligence*. In his presentation, he addressed the challenge of demystifying the learning process of modern AI systems trained on large amounts of data. By drawing a parallel with animals whose brain processes sensory input to issue motor commands and learns from experience, Thomas Deneux gradually introduces the notion of neural networks. He then shows how a neural network can be used in a learning robot: ALPHAI, able to acquire skills in front of the public and coupled with real-time graphics interfaces that display the details of its algorithm. Complexity can be slowly added, depending on the audience, by adding layers to the neural network and unlocking additional sensors on the robot. Thomas Deneux concluded his presentation by showing a concrete example of how ALPHAI may be used with children, illustrating how modern AI and visualization techniques may be combined to improve the digital literacy of younger people.

3.2 Programming Education and Digital Literacy Awareness

Simonofski et al. [8] opened the first session of the workshop, dedicated to programming education and literacy awareness, by presenting their design of a workshop to introduce smartcities to schoolkids. This design includes the development of a technical solution as an introduction to programming using block-based languages and showed encouraging results during an initial evaluation in a classroom with 21 children. Lungu [4] followed by drawing similarities between the learning of a new (human) language and learning to use a new API. Those similarities drive the design of the system based on automated repository mining and knowledge mapping approaches used to guide a learner to improve his knowledge without the help of an external tutor. Closing this first session, Libert and Vanhoof [3] reported their findings on the preconceptions of secondary school students about concurrent programming and devised recommendations for the design of a course on the topic.

3.3 Automated Feedback and Evaluation Systems

After the lunch, we started the first session of the afternoon, dedicated to automated feedback and evaluation systems, with Resch and Yankova [6] presenting OKI (Open-Knowledge Interface), a digital assistant to support students in writing academic assignments. OKI is available as a plugin for Telegram, a popular instant messaging application, and includes project management aspects (e.g., by defining and reminding deadlines) and an assistant to help to search in the scientific literature. Along the same line, Patout and Cordy [5] followed by presenting their vision towards an automated writing evaluation systems, able to provide feedback to students while considering the specific context of the assignments. This system would be built following the typical machine learning pipeline by creating a corpus of texts acting as a training set, select a representative sample of humans with different backgrounds and ask them to assess the various texts, and finally build a learning model able to grade the different texts. Closing the second session of the workshop, Kylvaja et al. [2] presented an application of data clustering to provide automated feedback to students about their well-being related issues. Their work combined data processing methods and research-based knowledge to find the right balance between the different well-being indicators and design the clustering to provide the right level of feedback.

3.4 Teaching Advanced Software Engineering

The last session dedicated to teaching advanced software engineering started with Vescan [9] and the design and report of an active learning approach to teaching model checking. The approach is twofold: first, students had to used model checking in practice in a project setting, and second, students had to design a poster to present an advanced model checking research topic to their classmates. Results show that, although challenging from an organizational point of view with a limited amount of resources, adopting learning by doing approach helps students to understand model checking better. Then, Diosan and Motogna [1] reported on the integration of AI in a software engineering course where students had to develop AI-based applications solving real-world problems. Lessons learned from the study, performed by observing student teams, show that the setting of the course allows students to learn by doing and that software engineering students are not scared by AI. But also that the evaluation of such projects is difficult for teachers and that AI-based applications pose several challenges, including the amount of computational power required by some AI approaches. Finally, Serban and Vescan [7] reported on the development of a student-centered learning process and the E-learning platform supporting it for teaching advanced programming methods. The process and the platform include project-based learn-

[1]Paper discussants is a practice successfully adopted by the REFSQ (`https://refsq.org/`) and VaMoS (`http://www.vamos-workshop.net/`) communities.

[2]Our discussant template is available at `https://easeai.github.io`.

ing and laboratory assignments with formative assessment in the form of multiple-choice questions and tests designed by the students and a recommender system to test students based on their previous assessments. Overall, the evaluation of the process and platform shows a positive impact on the effectiveness of the learning process.

4. CONCLUSION

Computer science education, and more generally, digital literacy is of tremendous importance for populations to be able to understand and live in a world rapidly evolving with the development of new digital technologies. The 2019 edition of the EASEAI workshop addressed some of those challenges by gathering together researches from the education, software engineering, and artificial intelligence fields. As illustrated by the contributions to the workshop, various approaches are using active learning and project-based education to teach different topics, from general knowledge about smart cities to specialized software engineering topics like AI or model checking. The workshop also allowed to shed light on the new possibilities offered by the latest developments in software engineering and AI, like the design and implementation of recommender or automated feedback systems to personalize the learning environment to fit the strengths and weaknesses of individual students.

Also, the organization of a workshop is not an easy task. In the case of EASEAI, bringing three different research communities with different visions was challenging. First, to convince potential program committee members that an education workshop co-located with a software engineering conference was not meant to be technical and solution-driven, but also to reflect on the current challenges in digital education. And second, to manage a review process with a significant disparity of backgrounds among the program committee members and ensure that the different papers received a fair evaluation. For the latest, we made sure that each paper received reviews from people with a background in each of the three communities. Also, the different research backgrounds of the organizers helped to understand and clarify discussions of the submissions.

Finally, the 2019 edition of EASEAI was very interactive, as showed by the massive amount of discussions all along the day. In that regard, we believe that the discussant system adopted by the workshop helped to trigger those discussions, and we will use it again in the future.

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