Helping to teach machine learning

An interview with Tom Viering and Gosia Migut (founders of the TU Delft Machine Learning Teachers Community)

TU Delft is on an important mission: to make AI education available to all students. Since the technology has now become woven into the fabric of our everyday lives, it is ever-more important to equip students with an innovative AI education.

Driven by this goal, educators at TU Delft are joining forces to ensure that students gain an in-depth understanding of machine learning. Among them, Tom Viering and Gosia Migut stand out as the pioneers and co-founders of the TU Delft Machine Learning Teachers Community. This community is an accessible platform where teachers can collaborate, share resources, and learn from each other to drive educational excellence.

Tom Viering: 'In 2020, I began developing a course for the AI minor 'Engineering with AI', and I didn't know where to start. There was a vast amount of material available, as many courses on machine learning already existed – but they weren't necessarily of the quality I required.'

Gosia Migut had been developing a machine learning course for the bachelor's programme, and shared a similar story: 'We knew machine learning was being taught, but I did not know where to find a good starting point, or who to reach out to. That's when the idea arose: why not bring machine learning teachers together?'

Susanne van Aardenne (a member of the AI Initiative Education Team) was instrumental in helping Tom and Gosia to join forces, as she knew that they both had ideas for more collaboration on machine learning education.

Creating a community for collaboration

Tom and Gosia's vision was to create a community where teachers could engage easily with each other to share resources, collaborate, and reduce redundancy in their work. Gosia: 'Everyone seemed to be doing double the work, and reinventing the wheel over and over again. It seemed that it would be much more efficient to work together and share resources.'

Tom said that they also recognized the importance of fostering connections among teachers: 'The first step was to get to know each other. I saw all those names in the study guide, but I did not really know anyone. It was extremely helpful to match a name with a face, and overcome the initial barrier to reach out to them.'

Gosia said that the community's goal was to make resources readily accessible to all TU Delft educators, from teaching PhDs to Professors: 'The idea was to do something low threshold, so we could easily find each other and, importantly, address questions to each other.

'We want to build better relationships with other machine learning educators, so everyone knows who can answer questions, and everyone has what they need to share and collaborate more easily'

We found a lunch meeting to be the ideal setting – immediately relaxed and informal, with everybody able to chat. That's how the first machine learning teachers lunch was created.'

Sharing experiences and best practises

Staff from across the faculties joined in with the first meeting enthusiastically, and many shared their wish for more interaction and collaboration. Gosia said that a relaxed atmosphere proved conducive to sharing experiences and grappling with common challenges: 'So many people had the same questions and struggles from students, such as installing Python packages or teaching students with little to no programming experience. It was a good moment to acknowledge that many of us are in the same boat, and it was indeed a confirmation that such an initiative was needed.'

The community has provided a platform for teachers to learn from each other and improve their own courses. They get a chance to present their courses or teaching methods, ask each other questions, and exchange working methods and approaches.

Tom said that one presentation was particularly inspiring, when colleague Sicco Verwer discussed an interesting method to incorporate peer feedback into his course – an approach he found extremely effective: 'Machine learning doesn't have only one-stop solutions, or one way to reach a goal, so it's very useful to look at each other's work in open-ended machine learning assignments. Through peer feedback, students learn a lot from each other's work and approaches, exchanging thought processes and figuring out intermediate steps. I had not considered this method before, so this was great peer feedback for me.

'I've applied this to my own course, and learned that students value seeing each other's work and learning different innovative approaches and ways of thinking. It's a useful alternative to reproducing the instructor's methods.'

Machine learning for different disciplines

An interesting insight for Gosia was how to introduce machine learning to students without a background in computer science – a challenging task for any computer scientist. A colleague at the teachers' lunches, Seyran Khademi, shared how AI can be introduced within architecture, where it is not necessarily an obvious element to learn or apply. By integrating machine learning applications step by step, in familiar applications and areas of use, students are convinced of AI's applicability and merit.

Gosia: 'Integration is great, convincing students of the utility of machine learning, and that's a valuable lesson to bear in mind when teaching. Relating machine learning to familiar concepts allows students to engage more easily, and it enriches your teaching with valuable examples, keeping your subject relevant and up to date. As someone who wants to improve machine learning education, this is right up my alley. Interactions with other educators allows us to reflect on our own teaching, tools and resources.'

Shared and open teaching materials

Another important goal is to create and share open teaching materials. Tom and Gosia are working on pilot projects with the AI Initiative's education team. They want to create platforms for open teaching materials and exchange of material so that teachers can learn from each other's expertise, create high quality material and save time.

Gosia: 'I have already used Tom's ethics slides from his ethics lecture. It really added value to my classes and allowed me to focus on adapting the material rather than starting from scratch.' Tom: 'I have made use of Gosia's assignments for my course too. Not only do we exchange materials, but we also take a deep look at them and help each other to improve them. Using a similar assignment is also very nice for our shared teaching assistant, saving him time as well.'

Gosia and Tom see a bright future for the community, reflecting the goal of teaching high quality machine learning at TU Delft and beyond. Gosia: 'We want to build better relationships with other machine learning educators, so everyone knows who can answer questions, and everyone has what they need to share and collaborate more easily.' Tom: 'We want to take small steps towards expanding activities and possibly broadening the scope. Our aim is to scale up with other universities, establishing a wider network so we can work more efficiently and learn from each other. Open discussions and shared materials ultimately contribute to a useful, interesting and high-quality machine learning education.'

AI Teachers' Programme

This project aims to develop a broad programme where 'in-AI' and 'with-AI' teachers are supported in developing AI education. It may involve exchanging knowledge on how to teach AI within a specific discipline area, but will also include focus groups so that teachers can together take stock of what it takes to integrate AI into the curriculum. AI staff members will emerge with a better understanding of AI and its applications within education. They will be able to keep pace with the impact of AI within their discipline, and tailor the curriculum accordingly. Within this programme, the Machine Learning Teachers Community was established in 2023.

Open Educational Resources

Developing open educational resources (OERs) is a central TU Delft policy, and the AI Initiative's education team is driving this for AI educational materials. In cooperation with other educational institutions, we aim to develop a repository of AI educational materials that every AI teacher can use. For this, we need clear frameworks of how AI can be applied within different subject areas. Publishing educational materials freely and openly online for a broad student population will ultimately attract more students to develop their AI knowledge within their domain.

Frans Oliehoek is using reinforcement learning to teach smart systems to make a series of decisions, enabling them to think in more abstract terms. Oliehoek: 'As a result, self-driving cars can deal with uncertainties, such as the effect of rain on road holding. Or anticipate other smart systems. The point of the simulations is to test the fundamental principles.'

Frans Oliehoek, Director ELLIS Delft Unit

ELLIS Delft

In 2019 TU Delft was selected by the European Laboratory for Learning and Intelligent Systems (ELLIS) as an ELLIS unit for research into artificial intelligence and machine learning with societal impact. The ELLIS Delft Unit brings together leading researchers from different disciplines and connects them with European counterparts, thereby ensuring a significant acceleration of knowledge. They focus on using learning techniques as a key enabling technology to deal with complex tasks, and on making intelligent systems adapt to their environment including social circumstances.

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