

The Future for Computational Intelligence Education: A Case Study of Postgraduate Courses at De Montfort University

This article summarizes the way we teach Computational Intelligence (CI) at postgraduate level at De Montfort University (DMU). The University is based in the center of England, in a city called Leicester. We have over 18,000 students studying a mixture of courses at undergraduate, taught post-graduate and post graduate research level.

The Centre for Computational Intelligence (CCI) (<http://www.cci.dmu.ac.uk>) has been in existence for 11 years. Currently, it consists of 13 academic staff and 26 PhD students. The Centre has a philosophy of teaching high quality CI and leading international research. Why is this? Firstly, it is important that we train future CI workers. Our view that CI should play an important role in industry and commerce as well as academia means that we should expose students to these important ideas. Secondly, staff members prefer to teach in their area of research. All staff members in the CCI have a significant teaching commitment so where courses are run in their research area, they are naturally the best people to teach these courses. But perhaps the most important reason is that, in our experience, most students thoroughly enjoy learning about fuzzy logic, evolutionary computing and artificial neural networks!

The MSc Intelligent Systems (IS) and MSc IS and Robotics (ISR) programmes are delivered via on-site and distance learning at the Masters level. These courses have been running successfully on-site for almost six years and the DL mode is now in its third

year. The two courses share seven out of eight modules, the eighth being a second robotics module for the MSc ISR and a data mining module for the MSc IS. Initial decisions were necessary to determine the content of the courses. There are a large number of topics that could be considered, but the areas of fuzzy logic, neural networks, evolutionary computing, knowledge-based systems and logic programming encompass much of what is considered to be CI. Other topics include robotics and data mining, both of which provide ideal application areas for applying the previously mentioned techniques.

In order to deliver the course effectively, it is useful to consider approaches to learning and teaching in higher education. Most of the modules include

both theoretical and practical work. The assessments allow the students to investigate appropriate topics in their own way, thus, there is an attempt to facilitate experiential learning as defined by [1]. A further example of this approach in practice can be seen in the design of the OU module, Artificial Intelligence for Technology in [2], [3].

We aimed to deliver the courses by adopting an approach that embraces modern technology in such a way that the students have appropriate learning experiences, whether they are studying on-site or through distance learning. DMU already uses the Blackboard virtual learning environment as a platform for providing e-learning materials for all students and this is used extensively, though not exhaustively, in all faculties. It was



MSc students working on their entry for the Robot Challenge, Vienna, March 2010.

therefore an obvious choice as the main platform for the MSc. As both the on-site and the DL students study the modules concurrently, the experiences need to be as similar as possible. Some practices have been adopted for all modules and this includes the use of a discussion board on Blackboard that is assessed based on the number of contributions over the semester rather than the quality of the content. The discussion board helps to create a virtual learning environment which is identified as being important for students engaging in e-learning by [4]. It encourages students to become more of a cohort, communicating with each other, whether on-site or through distance learning and it can help the latter students feel less on their own. Other practices used, though to a lesser extent, are blogs, a Facebook group and more recently, a wiki for sharing subject-related ideas.

One of the modules being taught is Fuzzy Logic. It is taught over a ten-week period and the students on campus have two hours of lectures and one hour of laboratory work using Matlab. The DL students work concurrently with on-site students supported through the e-learning mechanisms described above. The topics studied are: Operations on Fuzzy Sets, Implication and Mamdani Systems, Takagi-Sugeno Fuzzy Inference Systems, ANFIS, Preference Modeling, Group Decision Making with Fuzzy Preference Relations, Type 2 Fuzzy Logic and Applications of Type-2 Fuzzy Logic. The topics of Preference Modeling, Group Decision Making and Type-2 Fuzzy Logic reflect the strong research interests of the tutors (Dr Chiclana, Dr Carter, Dr Coupland and Prof John). Matlab is used to enable students to gain an understanding of fuzzy systems in practice. The DL students are sent a text book: *Fuzzy Logic with Engineering Applications* by Timothy Ross (Wiley, 2004), as well as a personal copy of Matlab and various research papers.

As with all modules on the MSc programme, the students answer a set of questions on the previous weeks' lesson via the discussion board each week... Discussion board contributions account for 10% of the marks on all of our modules.

The remainder of the assessment is through two assignments: a Matlab fuzzy system to be written in a particular domain and a report tackling questions about the more advanced topics of Preference Modeling and Type-2 Fuzzy Logic.

We try to encourage the group to do things together in order to build the sense of a cohort. For example, we take them to the Robot Challenge (robotchallenge.at) held in Vienna each year. Undergraduate students who attend a weekly robotics club also travel to the Robot Challenge. We find that such activities enable the undergraduate and postgraduate students to develop relationships based on their common subject interest which, in turn, adds to the feeling of a shared community within the CCI. We meet DL students, where possible, both at DMU and at the Robot Challenge, if they choose to attend. We encourage students to publish work where appropriate. We were able to meet some DL students at the IEEE—ICE-GIC computer games conference in London where a student presented his paper based on one of the assignments for the course. Another student attended out of general interest. A number of students have published work resulting from both their projects and from module assignments.

We gather feedback both formally (questionnaires) and informally (emails, Skype chats, meetings) from all students. The feedback received is often very detailed, especially from DL students and is usually very positive. Any issues raised by students through their feedback are addressed quickly. We have also received excellent feedback from both the previous and the current external examiners. Case studies of past students' experiences on the course can be found on the course web pages: www.cse.dmu.ac.uk/msccir.

References

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