Take AIM

Smith institute
for industrial mathematics and system engineering

Advanced machine learning for operational flood forecasting and mapping

TakeAIM Winner 2017:
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Considering the computational effort and expertise required to simulate 2D hydrodynamic models, it is widely understood that it is practically impossible to run these types of models during a real-time flood event. To allow for real time flood forecasting and mapping, an automated, computationally efficient and robust data driven modelling engine - as an alternative to the traditional 2D hydraulic models - has been proposed. The concept of computationally efficient model relies heavily on replacing time consuming 2D hydrodynamic software with a simplified model structure that is much faster but retains sufficient accuracy, which can then be used in real time flood forecasting, mapping and sequential updating.

The real time visualization module of the model will allow stakeholders to observe the state of the flood and take necessary actions. The novelty of the research is that it takes advantage of highly efficient machine learning algorithms and visualization tools to overcome the cost and time barriers in forecasting flood extent and depth in real time.

Due to climate change impacts and land surface dynamics, the world is possibly going to experience unprecedented flooding in the near future. Hence, to reduce the cost of damages and make prompt decisions, this adaptive and scalable model will play a vital role which is not possible with current fully distributed high resolution hydrodynamic models in real time, even though super computers could reduce computational time significantly. Therefore, this model has the potential to grab the attention of organizations dealing with disaster risk management, insurance policies and environmental consultancies.

The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the TakeAIM competition in 2017 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to undergraduate and postgraduate students working in the mathematical sciences. First prize was £1,250 of Apple vouchers, second prize £500 of Apple vouchers and six runners-up each received £150 of Amazon vouchers.