Improving river flood forecasts using machine learning and water observations from river camera images

Lead Supervisor: Varun Kumar Ojha, University of Reading, Department of Computer Science
Email: v.k.ojha@reading.ac.uk

Co-supervisors: Sarah L. Dance, University of Reading; Sanita Vetra-Carvalho, University of Reading

We aim to draw water information of from river cameras for river flood forecasting using machine learning algorithms. This project involves processing of a large volume of data (river camera images) and analogue measurements on river observation. In this project, we use state-of-the-art machine learning algorithms (like deep learning neural network), adapt, and develop algorithms/procedure for the particular need of the project with the focus on developing online water observation system. The developed method will be validated with existing flood forecasting models and using Synthetic Aperture Radar (SAR) satellites images of Tewkesbury 2012 flooding event. The project is multi-disciplinary research involving an excellent team of supervisors with the necessary background in machine learning, hydrology, observation systems, and data assimilation to successfully advise and guide the student throughout the project

a. river camera image   b. segmentation images

Fig 1. Example of steps involved in planned water-observation method development using deep leaning.

Fig 1. is an example of receiving an image and processing that to segment into different objects with the help of object detection and image segmentation techniques. We plan to use several hundreds of images like in Fig 1. To train deep learning neural networks and built a predictor that predicts/monitors river water level. This project receives water camera images from our industry partner Farson Digital Ltd who installs and manages a large and growing set of river cameras in the UK and the Republic of Ireland. They will provide image data and their expertise in river observation networks.

Training opportunities:
The student will have an opportunity to do a placement with our industry partner Farson Digital Ltd to experience field work. At the same time student is expected to attend workshops and summer schools like Data Assimilation & Scientific Computing summer school and Advanced Course on Data Science & Machine Learning (ACDL) summer school. Also, courses at the University of Reading like CS3DM16: data mining), CS3AI18: artificial intelligence and NERC Data Assimilation training benefit student to develop environmental data scientist portfolio.

Student profile:
A successful student should be knowledgeable in programming skills and have a strong mathematical background and an interest to work in a multidisciplinary environment and applied research. It is desirable that the student has already had some experience in machine learning or image processing, but it is not essential. The student is expected to have completed a computer science, applied mathematics, or engineering degree.