Editorial – Making Water Smart

Data science and artificial intelligence technologies are changing the world around us faster than ever before and the field of Hydroinformatics is no exception to this. As water systems become more instrumented, so the challenges associated with collection, management and analysis of data become more significant. This special issue 'Making Water Smart' explores new approaches, techniques and applications of data science and AI to the many and varied challenges presented in the delivery of sustainable, safe and cost-effective management of our water systems.

The accurate and granular sensing of data is of fundamental importance to the application of AI systems to enable them to deliver high quality results. The special issue addresses sensing and instrumentation challenges through the development of *internet of things* methods for the collection of hydrometeorological and flood monitoring data (Mendoza-Cano *et al.* 2021) and through the capture of high-resolution water demand data in commercial buildings (Melville-Shreeve *et al.* 2021). Innovative data capture technologies are explored in Prettyman *et al.* (2021), investigating the use of uninhabitated aircraft systems for stress monitoring at stormwater facilities. The development of intelligent methods to augment and analyse sensed data is described in three further contributions: Palmitessa *et al.* (2021), which uses ensemble modelling to enable soft-sensing and sensor validation within urban drainage tunnels, Cassidy *et al.* (2021), which describes a suite of cloud-based digital tools to enable real-time monitoring and non-revenue water reduction, and Bowes *et al.* (2021), which uses reinforcement learning to improve real-time control of stormwater systems.

In the AI community it is now widely recognised that technologies are unlikely to be making decisions entirely autonomously and that expert operators must be considered in the development of new technologies. This is reflected here through contributions focusing on the interaction with the user to support decision making. Ewing & Demir (2021) incorporate the user in flood simulation via an ethical serious games approach and the concept of interactive decision support is addressed in the response to failure events in water distribution networks by Nikoloudi *et al.* (2021). Decision support is also the focus of Milašinović *et al.* (2021) through the use of control theory for hydropower systems and the visualisation of the outputs of evolutionary algorithms is addressed through the use of the compass plot in Wang *et al.* (2021).

These papers showcase the innovation required to leverage modern data science and AI approaches in the water sector and collectively point the way towards a future of novel measurement techniques, new methodologies and more intuitive human interaction to truly 'Make Water Smart'.

Ed Keedwell
Director of Research for Computer Science, College of Engineering, Mathematics & Physical Sciences,
Harrison Building, Streatham Campus, University of Exeter,
N Park Rd, Exeter EX4 4QF, UK

doi: 10.2166/hydro.2021.100

REFERENCES

Bowes, B. D., Tavakoli, A., Wang, C., Heydarian, A., Behl, M., Beling, P. A. & Goodall, J. L. 2021 Flood mitigation in coastal urban catchments using realtime stormwater infrastructure control and reinforcement learning. *Journal of Hydroinformatics* **23** (3), 529–547.

Cassidy, J., Barbosa, B., Damião, M., Ramalho, P., Ganhão, A., Santos, A. & Feliciano, J. 2021 Taking water efficiency to the next level: digital tools to reduce non-revenue water. *Journal of Hydroinformatics* **23** (3), 435–465.

Ewing, G. & Demir, I. 2021 An ethical decision-making framework with serious gaming: a smart water case study on flooding. *Journal of Hydroinformatics* **23** (3), 466–482.

Mendoza-Cano, O., Aquino-Santos, R., López-de la Cruz, J., Edwards, R. M., Khouakhi, A., Pattison, I., Rangel-Licea, V., Castellanos-Berjan, E., Martinez-Preciado, M. A., Rincón-Avalos, P., Lepper, P., Gutiérrez-Gómez, A., Uribe-Ramos, J. M., Ibarreche, J. & Perez, I. 2021 Experiments of an IoT-based wireless sensor network for flood monitoring in Colima, Mexico. *Journal of Hydroinformatics* **23** (3), 385–401.

Melville-Shreeve, P., Cotterill, S. & Butler, D. 2021 Capturing high-resolution water demand data in commercial buildings. *Journal of Hydroinformatics* **23** (3), 402–416.

Milašinović, M., Prodanović, D., Zindovic´, B., Stojanović, B. & Milivojević, N. 2021 Control theory-based data assimilation for hydraulic models as a decision support tool for hydropower systems: sequential, multi-metric tuning of the controllers. *Journal of Hydroinformatics* **23** (3), 500–516.

Nikoloudi, E., Romano, M., Memon, F. A. & Kapelan, Z. 2021 Interactive decision support methodology for near real-time response to failure events in a water distribution network. *Journal of Hydroinformatics* **23** (3), 483–499.

Palmitessa, R., Mikkelsen, P. S., Law, A. W. K. & Borup, M. 2021 Data assimilation in hydrodynamic models for systemwide soft sensing and sensor validation for urban drainage tunnels. *Journal of Hydroinformatics* **23** (3), 438–452.

Prettyman, K., Babbar-Sebens, M., Parrish, C. E. & Babbar-Sebens, J. M. 2021 A feasibility study of uninhabited aircraft systems for rapid and cost-effective plant stress monitoring at green stormwater infrastructure facilities. *Journal of Hydroinformatics* **23** (3), 417–437.

Wang, Q., Guan, M., Huang, W., Wang, L., Wang, Z., Liu, S. & Savić, D. 2021 Visualisation of the combinatorial effects within evolutionary algorithms: the compass plot. *Journal of Hydroinformatics* **23** (3), 517–528.