How much can a single webcam tell to the operation of a water system?

Matteo Giuliani, Andrea Castelletti, Roman Fedorov, and Piero Fraternali

Politecnico di Milano, Department of Electronics, Information, and Bioengineering, Milano, Italy
(andrea.castelletti@polimi.it)

Recent advances in environmental monitoring are making a wide range of hydro-meteorological data available with a great potential to enhance understanding, modelling and management of environmental processes. Despite this progress, continuous monitoring of highly spatiotemporal heterogeneous processes is not well established yet, especially in inaccessible sites. In this context, the unprecedented availability of user-generated data on the web might open new opportunities for enhancing real-time monitoring and modeling of environmental systems based on data that are public, low-cost, and spatiotemporally dense. In this work, we focus on snow and contribute a novel crowdsourcing procedure for extracting snow-related information from public web images, either produced by users or generated by touristic webcams. A fully automated process fetches mountain images from multiple sources, identifies the peaks present therein, and estimates virtual snow indexes representing a proxy of the snow-covered area. The operational value of the obtained virtual snow indexes is then assessed for a real-world water-management problem, where we use these indexes for informing the daily control of a regulated lake supplying water for multiple purposes. Numerical results show that such information is effective in extending the anticipation capacity of the lake operations, ultimately improving the system performance. Our procedure has the potential for complementing traditional snow-related information, minimizing costs and efforts for obtaining the virtual snow indexes and, at the same time, maximizing the portability of the procedure to several locations where such public images are available.