MULTIVIEW CLUSTERING TO DEFINE DISTRICT METERED AREAS IN A WATER SUPPLY NETWORK

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Abstract

Rational distribution of water in supply systems is a complex problem. This complexity increases if the system is large and the goal is to offer regular supply of clean water at the pressure required by consumers. Distribution systems may consist of thousands of consumption nodes interconnected by thousands of lines and the necessary elements to feed the network. Division into district metered areas (DMAs), understood as network partition into sub-networks with controlled inputs and outputs, is a strategic option which homogenises the elements, measurements, and design parameters of each sub-network. In this way, we gain accuracy and avoid bias in decision-making about supply management (Herrera, 2011). DMAs, due to inspection area reduction, facilitate the detection, identification, and monitoring of possible anomalies in the water supply, and are essential for explaining water demand behaviour.

This work addresses the problem of water network division into DMAs by the use of clustering performed from multiple views, which are independently used for clustering. In our application two data perspectives are used. One of them is associated with the consumption nodes and their graph structure into the water supply network. This first view is approached by spectral clustering (Ng *et al.*, 2001). The second view is related to the characteristics of the pipes. This view is addressed by clustering algorithms which work well with various natural inputs that take into account all the available information about pipes. Now, it is necessary to combine the information from these multiple points of view. To this purpose, we communicate both solutions negotiating their respective cluster memberships by the interaction of their configurations based on schemes of intelligent agents that can merge the respective information layers of each structure (Herrera *et al.*, 2012). The result of this proposal is a robust and very useful approach which combines pipe properties, nodes, and graph information associated with the supply network as a criterion to achieve system division. A real water supply system serves as a case-study to check the performance of the proposed division.

Keywords: clustering, graph theory, kernel methods, semi-supervised learning, multi-agent systems, water supply networks.

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