Knowledge-Mining the Australian Smart Grid Smart City Data:
A Statistical-Neural Approach to Demand-Response Analysis

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Abstract

Large scale field trials of smart grid technologies provide important insights as they capture the complex interdependencies of all the key variables, including consumer behaviours, which are needed for their effective evaluation. We present the Australian Smart Grid Smart City program and describe its big data using a narrative approach to hasten understanding and further analyses by others. Then we present a novel statistical-neural approach to maximise knowledge extraction from large datasets of diurnal load profiles, and demonstrate its use in evaluating the effectiveness of two cost-reflective product offerings, a Network-type and a Retail-type product bundle. The methods of analyses include Principal Component Analysis and Self-Organising Mapping. The results for the mid-winter electricity consumption profiles of participating households in July 2013 in New South Wales showed consumption behaviour changes with up to 12% reduction in relative peak demand at 700 households who accepted the offerings compared to the control group. The resultant load factor of the high consuming outliers improved by about 18% under demand-response compared to the control group. The feature-based classifier also revealed which behavioural components change due to users᾽ demand-response activities; results compared favourably with third party consumer survey results.

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