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Mining Human Activity Patterns from Smart Home Big Data for Healthcare Applications

Nowadays, there is an ever-increasing migration of people to urban areas. Health care services is one of the most challenging aspects that is greatly affected by the vast influx of people to city centres. Consequently, cities around the world are investing heavily in digital transformation in an effort to provide healthier ecosystem for people. In such transformation, millions of homes are being equipped with smart devices (e.g. smart meters, sensors etc.) which generate massive volumes of fine-grained and indexical data that can be analyzed to support smart city services. In this paper, we propose a model that utilizes smart home big data as a means of learning and discovering human activity patterns for health care applications. We propose the use of frequent pattern mining, cluster analysis and prediction to measure and analyze energy usage changes sparked by occupants' behaviour. Since people's habits are mostly identified by everyday routines, discovering these routines allows us to recognize anomalous activities that may indicate people's difficulties in taking care for themselves, such as not preparing food or not using shower/bath. Our work addresses the need to analyze temporal energy consumption patterns at the appliance level, which is directly related to human activities. For the evaluation of the proposed mechanism, this research uses the UK Domestic Appliance Level Electricity dataset (UK-Dale) - time series data of power consumption collected from 2012 to 2015 with time resolution of six seconds for five houses with 109 appliances from Southern England. The data from smart meters are recursively mined in the quantum/data slice of 24 hours, and the results are maintained across successive mining exercises. The results of identifying human activity patterns from appliance usage are presented in details in this paper along with accuracy of short and long term predictions.