

SEGSys: A Mapping System for Customer Segmentation Analysis on Energy Consumption

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ABSTRACT

With increasing energy use in the residential sector, demand-side management is essential to complement supply-side interventions to meet future demands and reduce costs. This paper develops a customer segmentation analysis system, *SEGSys*, to explore the heterogeneity of residential energy demand profiles and provide insights of customer segmentations. This system support customer segmentation analysis according to the energy consumption pattern, intensity, geographic neighborhoods, and socio-economic characteristics of customers.

Keywords: *Customer segmentation, energy consumption, mapping, visualization.*

INTRODUCTION

With the wide use of smart meters in energy sectors, large amounts of smart meter data have been generated. Smart meter data offers a unique opportunity to understand household energy use and their lifestyle. Customer segmentation is technique in the toolbox for understanding customers. The insight of customer segmentations has the potential to enhance targeting and tailoring of demand response and energy efficiency programs, as well as improving energy reduction recommendations.

In this work, we have developed customer segmentation system, *SEGSys*, that supports the analysis based on consumption intensity, representative load patterns, neighborhood, and socio-characteristic. It uses a dynamic clustering algorithm to perform segmentation of time-series data in groups or clusters by similarity. This system has a friendly user interface for visualization, and for user interaction through mapping.

1. OVERVIEW

A complex customer segmentation analysis system is developed to investigate the insights of energy consumption and customer groups in energy sector. Figure 1 shows an overview of the system architecture. This system supports both online and offline customer segmentation analysis based on consumption intensity, patterns, geographic neighborhoods, and scio-economic data of customers, and the visualization of the analysis results using mapping.

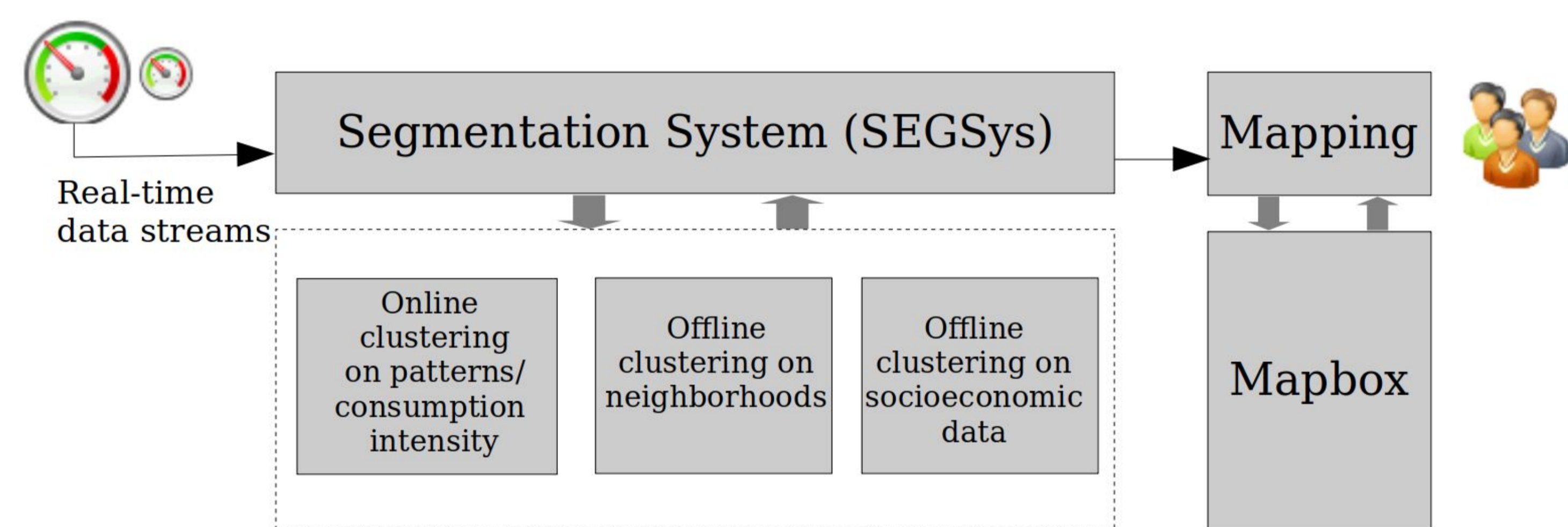


Figure 1 Overview of SEGSys

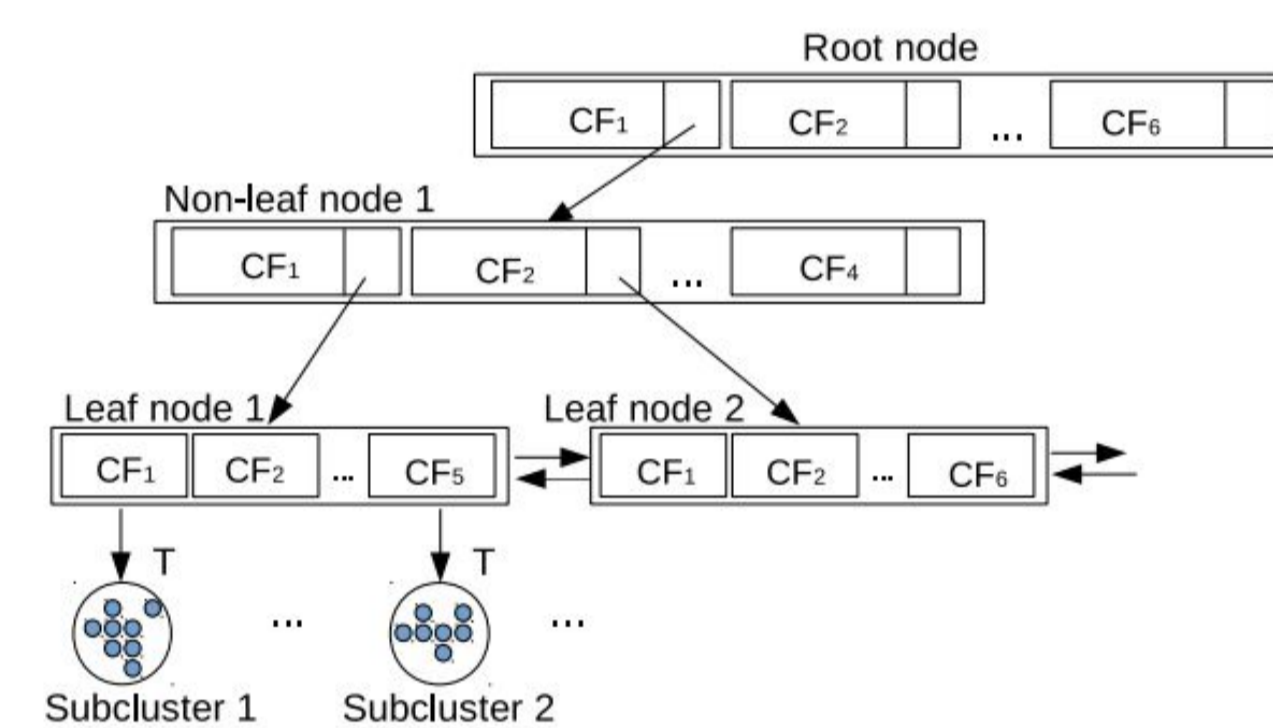


Figure 2 CF-Tree of BIRCH Clustering

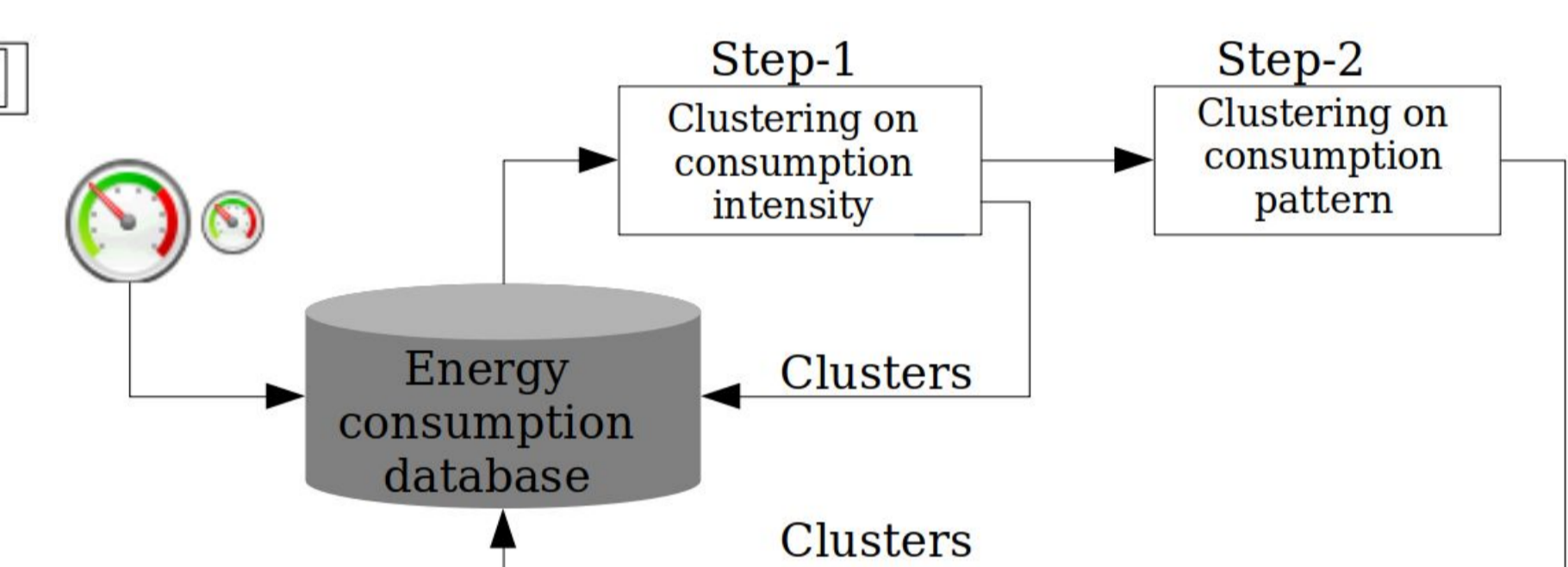


Figure 3 Two-step clustering method

2. SEGMENTATION ANALYSIS

The segmentation analysis is based on the following three methods.

2.1 Segmentation based on consumption intensity/patterns

- Use BIRCH clustering method (see Figure 2)
- Segmentation on consumption intensity: representative load profiles at low/medium/ high consumption for individual household
- Segmentation on patterns on normalized representative load profiles resulted from step-1 (See Figure 3)

2.2 Segmentation based on geographic neighborhood

- User-defined neighborhoods
 - Generate by online mapping tool
 - Third-party shapefiles
- Compute energy consumption statistics
 - segmented based on neighborhoods
 - Measures: sum, mean, percentile, ...
- Visualization:
 - change over time

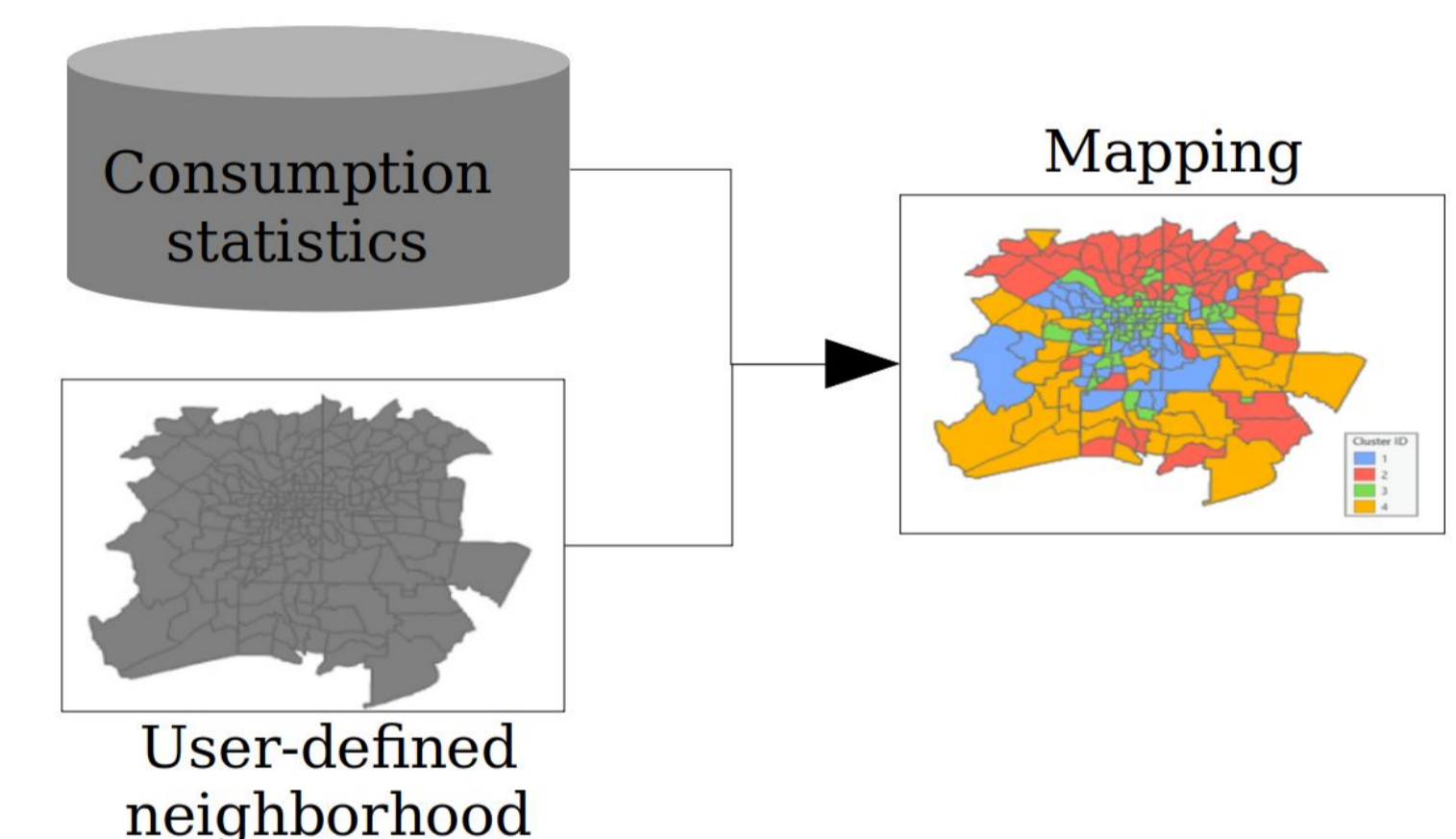
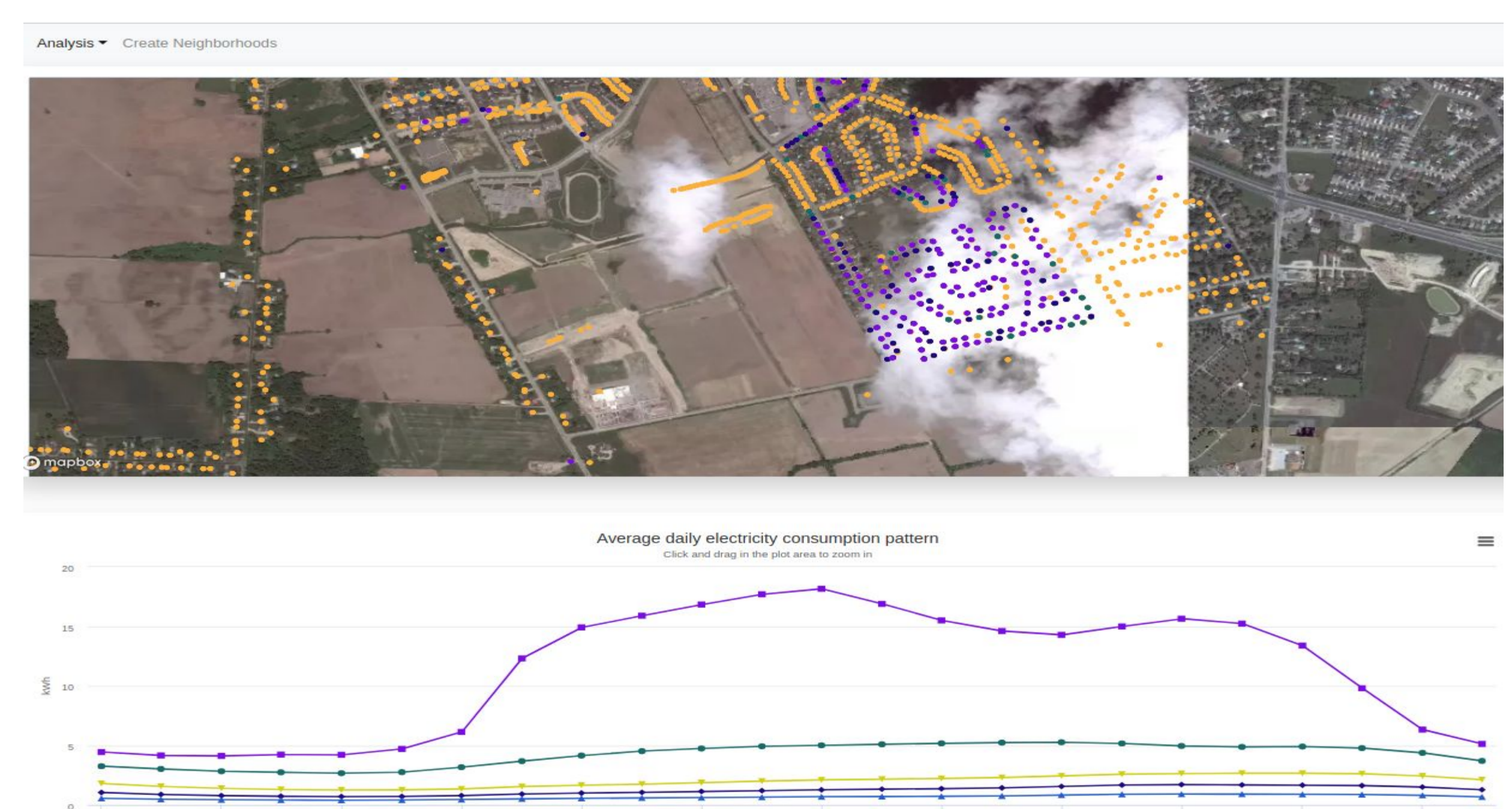


Figure 4 GIS-neighborhood clustering

2.3 Segmentation based on scio-demographic factors

- Compute energy consumption statistics segmented based on scio-demographic factors:
 - Measures: sum, mean, percentile, ...
- Segmented by:
 - a) household characteristics: size, type, age, ..
 - b) dwelling characteristics: area, type, year, ..

VISUALIZATION



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