Collaborative Sensing: An Approach for Immediately Scalable Sensing in Buildings

- Kamin Whitehouse and Hongning Wang
- University of Virginia
- {whitehouse,hw5x}@virginia.edu

- CPS-1646501
- Poster info: #170, 2:15pm-3:45pm, Nov. 21, 2019

Description

Improve the scalability of smart building applications via ***Collaborative Sensing***

T2: Active sensing by interactive online learning

T3: Scalable sensing by transfer learning

T1: Collaborative sensing by latent factor learning

	January	June	Heater	A/C	Washer	Latent Factors
Home 1	5000 kWh	6500 kWh	1.5 kWh	3.0 kWh	4.7 kWh	(1.2, 0.3, 0.5)
Home 2	6700 kWh	7800 kWh	?	?	?	(0.2, 0.3, 0.5)
Home 3	4950 kWh	5500 kWh	?	?	?	(0.2, 8.3, 0.5)
...	...	...	...	...	...	
Home N	4500 kWh	3900 kWh	?	?	6.3 kWh	(9.2, 0.3, 0.5)
Latent Factors	(1.2, 0.7, 0.5)	(0.2, 2.3, 0.9)	(0.6, 0.4, 0.5)	(0.2, 0.1, 0.7)	(0.2, 0.6, 0.5)	

Research goals:

- Estimating the energy breakdown of non-instrumented buildings
- Deploying minimal sensor infrastructure
- Immediate scalability by improving the similarity between buildings

Findings

- A sparse sensing basis can be used to represent sensor data from a broad range of buildings both within and across geo-regions
- Uncertainty in sensing basis estimation provides informative signal in active sensing
- Our solutions are applicable beyond energy breakdown

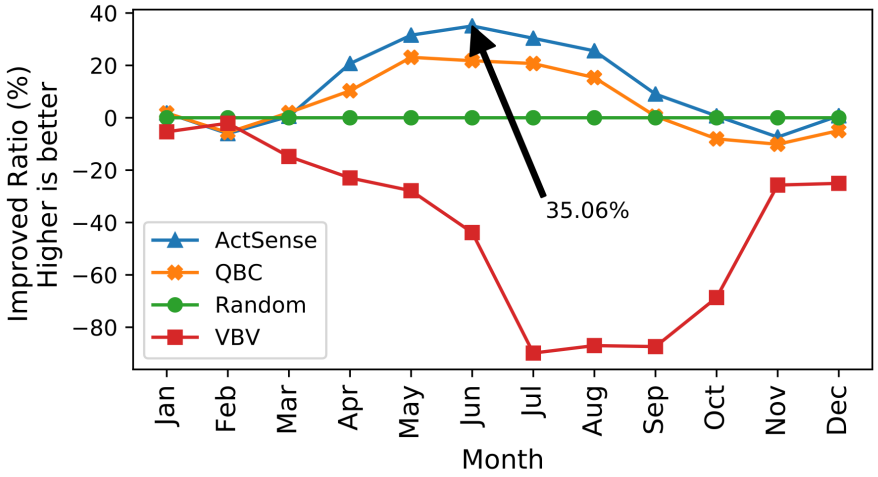

Figure 1: Active sensing improves energy breakdown accuracy.

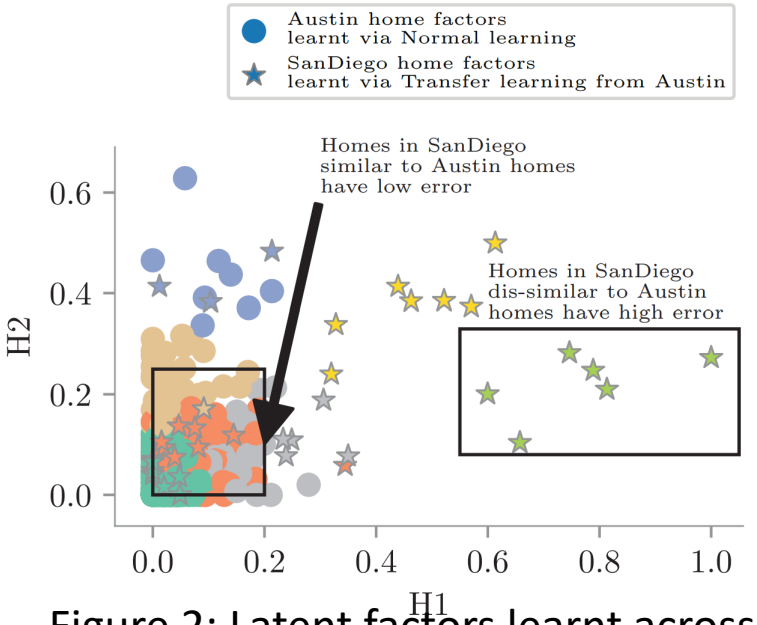

Figure 2: Latent factors learnt across regions capture the homogeneity in energy use.

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