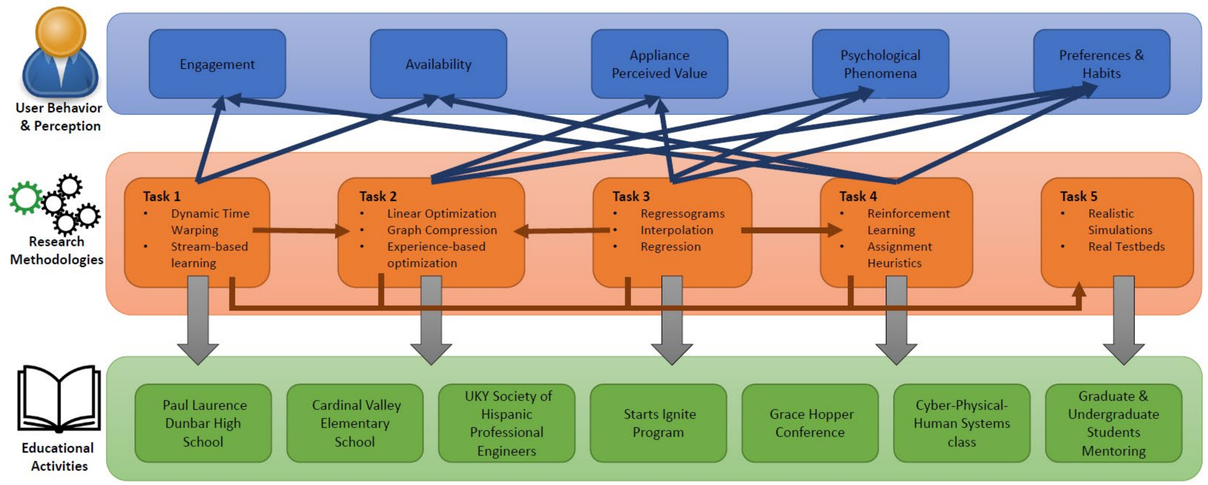
CAREER: Energy Management for Smart Residential Environments through Human-in-the-loop Algorithm Design

PI: Simone Silvestri – University of Kentucky
web: silvestri.engr.uky.edu/

Challenges:

- Residential energy consumption has been rapidly increasing (e.g., 2.6 trillion KWH in 2015)
- Complexity of human behaviors and perceptions, when interacting with energy management systems, is often overlooked
- Negative attitudes increase energy consumption and



Solutions:

- Algorithms, machine learning models, and optimization techniques that consider user behaviors, perceptions, and psychological processes
- User-Centered Active Learning for Appliance Recognition
- Perceived-Value Optimization of Energy Consumption
- User-participation Aware Energy Sharing Mechanisms
- Real testbed in collaborations with Tennessee Valley Authority (TVA) and Louisville Gas and Electric and Kentucky Utilities (LG&E-KU)

Broader Impact

- Reduce residential energy consumption
- Tools to learn and represent human behavior
- Improve the design and optimization of CPS through human in the loop

Education

- Paul Laurence Dunbar High School coding challenges and research experience
- STARS Computing Corps
IGNITE Program
- Hispanic elementary students through Society of Hispanic Professional Engineers

Publications

- Khamesi, Atieh R. and Musmeci, Riccardo and Silvestri, Simone and Baker, D. A. "Reproducibility of Survey Results: A New Method to Quantify Similarity of Human Subject Pools" IEEE Global Communications Conference (GLOBECOM) , 2020
- Kahemsi, Atieh R. and Silvestri, Simone "Reverse Auction-based Demand Response Program: A Truthful Mutually Beneficial Mechanism" IEEE International Conference on Mobile Ad-Hoc and Smart Systems (MASS) , 2020
- Shin, Eura and Khamesi, Atieh R. and Bahr, Zachary and Silvestri, Simone and Baker, D. A. "A User-Centered Active Learning Approach for Appliance Recognition" IEEE International Conference on Smart Computing (SMARTCOMP) , 2020
- Timilsina, Ashutosh and Khamesi, Atieh R. and Agate, Vincenzo and Silvestri, Simone "A Reinforcement Learning Approach for User Preference-aware Energy Sharing Systems", in IEEE Transactions on Green Communications and Networking, Special Issue on Green Internet of Things: Challenges and Future Opportunities, (to appear).

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