

An Unsupervised Training Method for Non-intrusive Appliance Load Monitoring

Oliver Parson, Siddhartha Ghosh, Mark Weal, Alex Rogers

Agents, Interaction, and Complexity Research Group

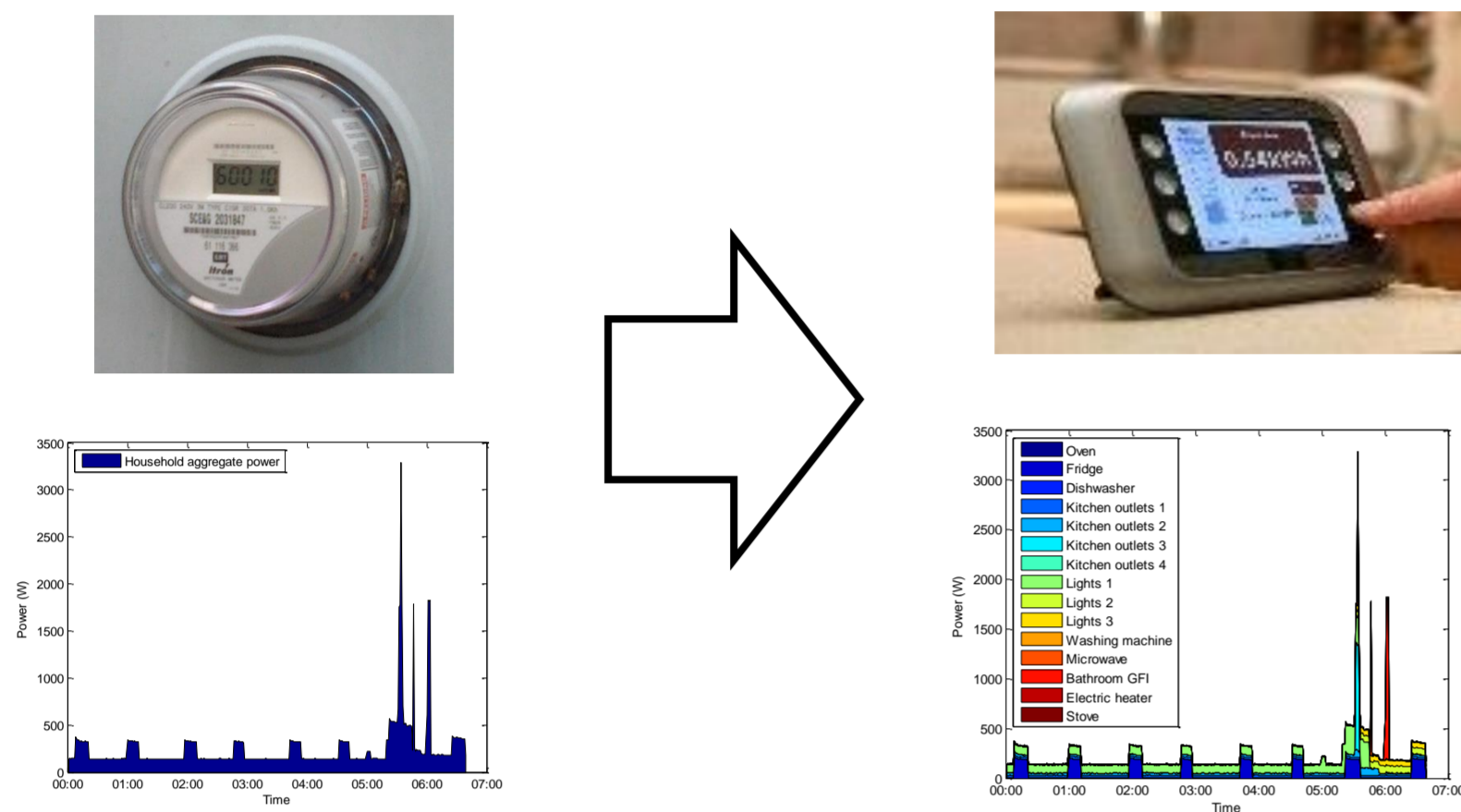
School of Electronics and Computer Science

University of Southampton

Smart Meters in the UK

Smart meters are being deployed in many countries on national scales (all houses in the UK by 2020)

In home displays have access to low resolution data from smart meters (10 second intervals in UK)



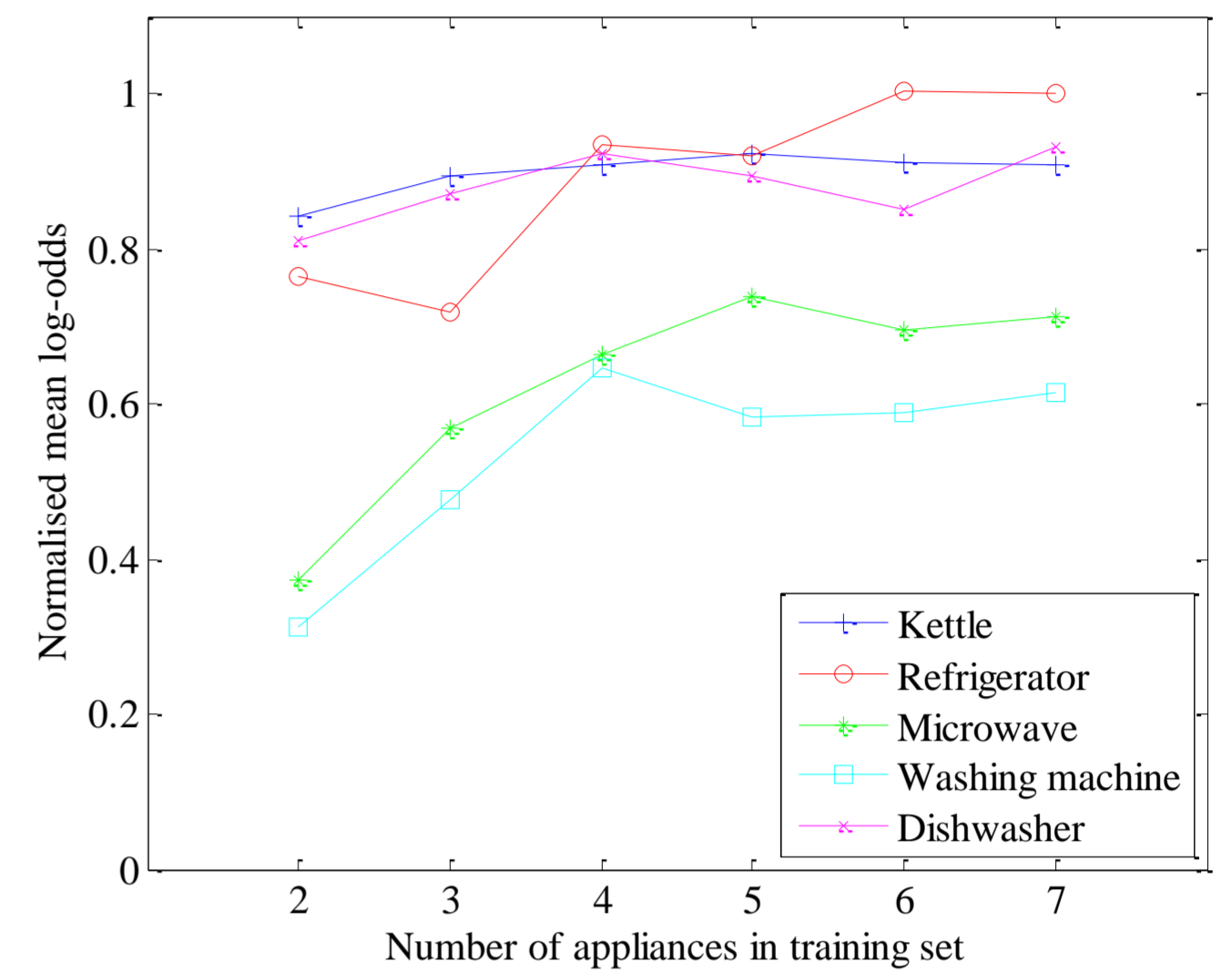
Aim: Provide disaggregated feedback of the energy usage of individual appliances to the household occupants to empower them to optimise their energy use

Generalising Appliances using Sub-metered Data

We learn general appliance models from existing appliance data sets

We use cross validation to evaluate how well models generalise to new appliances

We show that general models can be built from only 5 or 6 appliance instances



Existing Approaches Are Unrealistic

Existing approaches require a costly process to be carried out in all households in which disaggregation is performed.

Either:

- Sub-metered data required to be collected from all appliances
- Manual labelling of appliances after an unsupervised approach has disaggregated loads



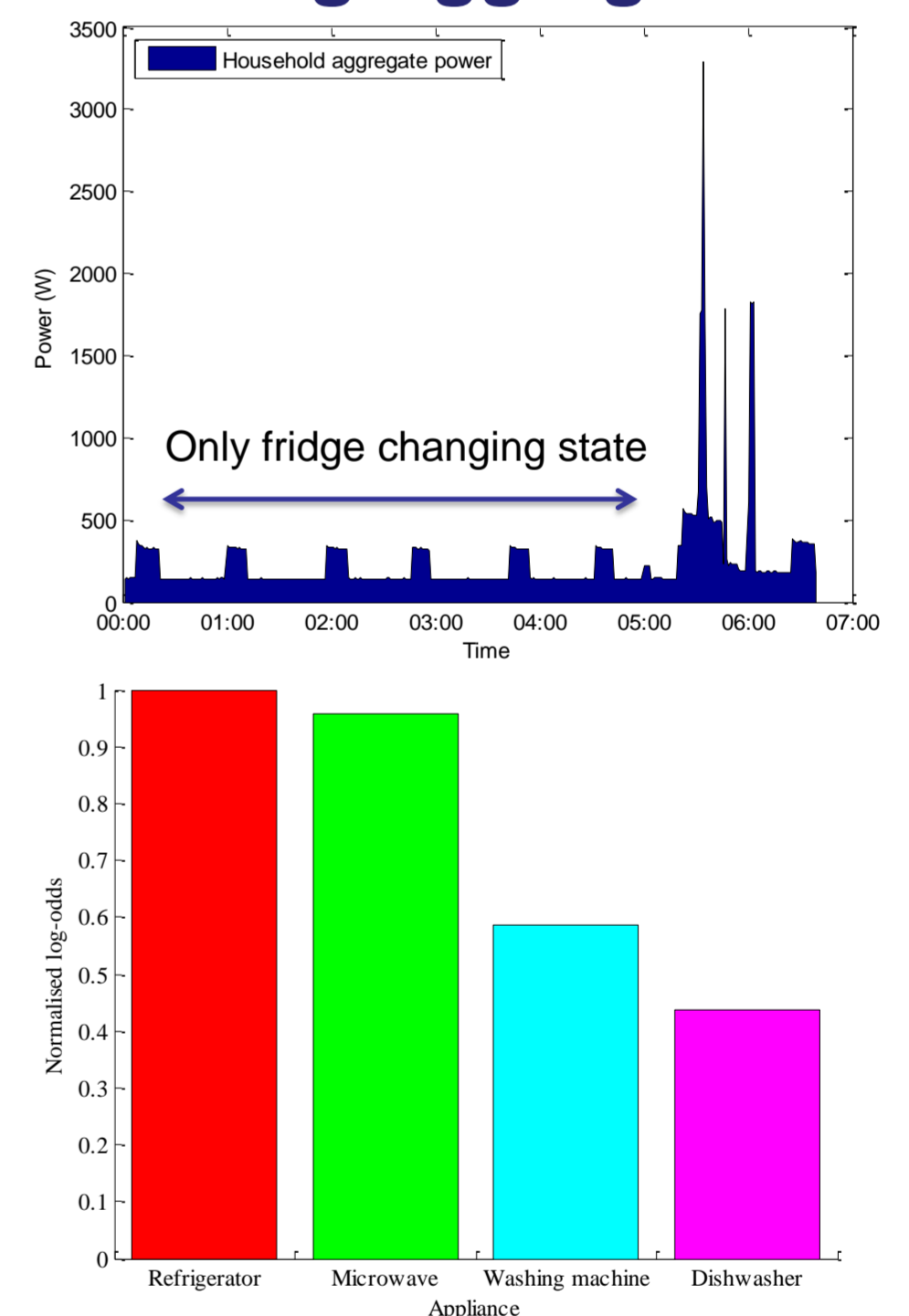
However, training approaches perform poorly when sub-metered data is unavailable

Tuning General Models using Aggregate Data

We tune general models using appliance signatures extracted from aggregate data

We use model comparison to evaluate how well tuned models match appliance data

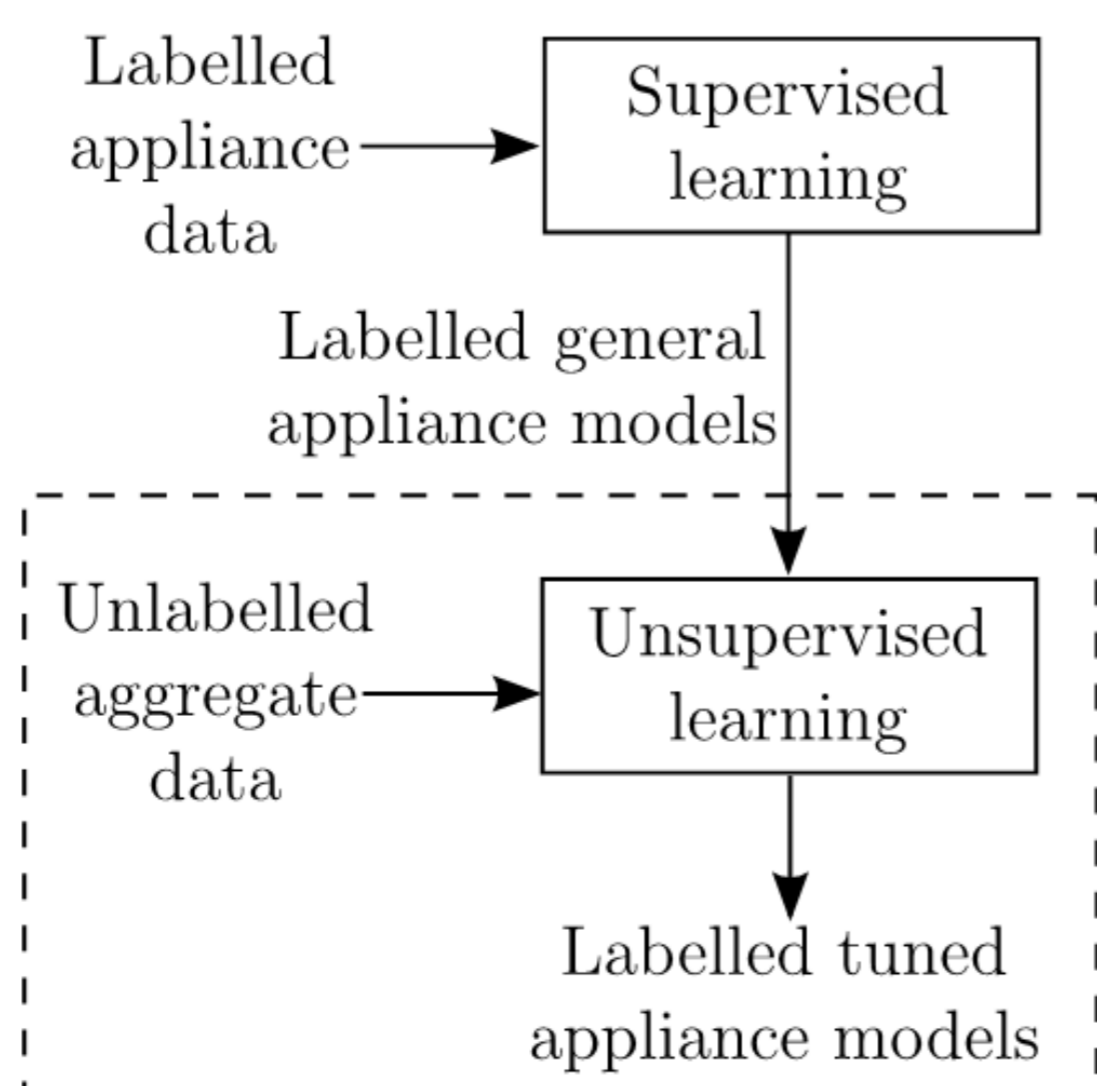
We show that tuned models outperform general models, and can perform comparably to sub-metered models



Our Approach: Tune General Appliance Models

We construct general models of appliances from sub-metering many appliances of the same type

We tune such general models using only aggregate data from the household in which disaggregation is performed



Large-scale Deployment

We deployed our approach to 117 homes in Colden Common village:

Our approach was able to identify actionable energy saving suggestions to the household occupants

Furthermore, our approach could quantify the savings should the suggestion be realised

