

Explainable Multi-Agent Recommendation System for Energy-Efficient Decision Support in Smart Homes

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Motivation

Why Energy-Efficient Decision Support for Smart Homes?

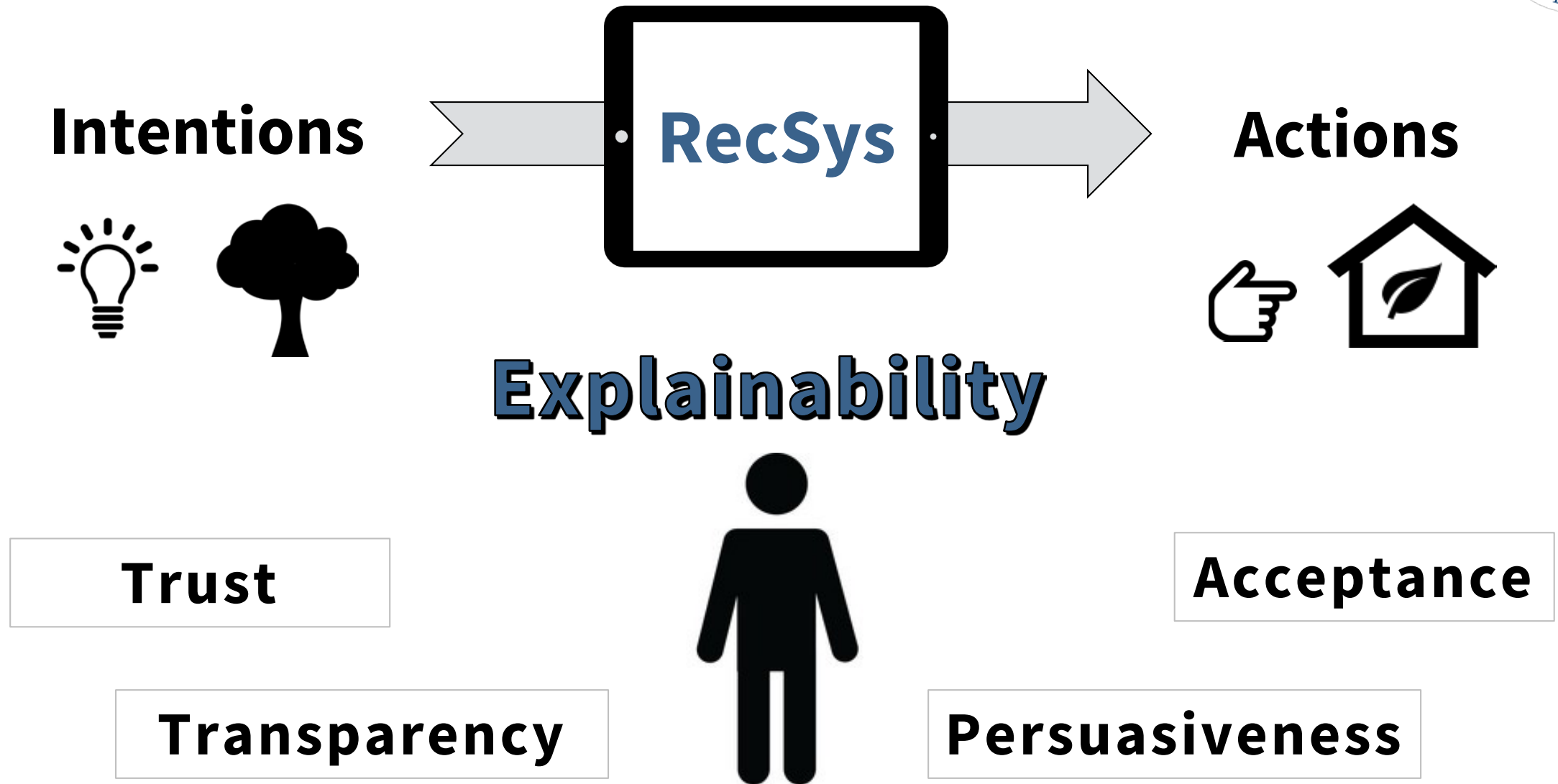
■ Status Quo

- ca. 30% of the total CO₂ emissions emerge from building sector (incl. electricity and heat)
- 70% thereof come from private households
- Gas shortages and volatile energy prices

■ Goals of Energy-Efficient Smart Home

- Reduce/shift energy consumption
- Reduce electricity costs
- Reduce CO₂ emissions
- Reduce volatility in the energy demand (i.e., through load shifting to off-peak hours)
- Increase the use of renewable energy (i.e., through load shifting to hours when more green energy is generated)

Motivation Challenges



Motivation

Recommendation



You have a recommendation for the following device: **Dishwasher**. If you launch the device tomorrow at **12:00 a.m.**, you would save 8.73% of costs compared to the predicted start at 10 a.m. This recommendation is based on your past availability and usage of the device.

According to the forecast, you are likely to use the device tomorrow since you have used the device during the last two days and you were available during the last two days . The weather conditions support that recommendation.

Factors supporting the prediction
"device will be used" ↔ Factors supporting the prediction
"device will not be used"



According to the forecast, you will be available tomorrow since you were available during the last day. The weather conditions support that recommendation. The hour (12 a.m.) strengthens that prediction.

Factors supporting the prediction
"user will be available" ↔ Factors supporting the prediction
"user will not be available"

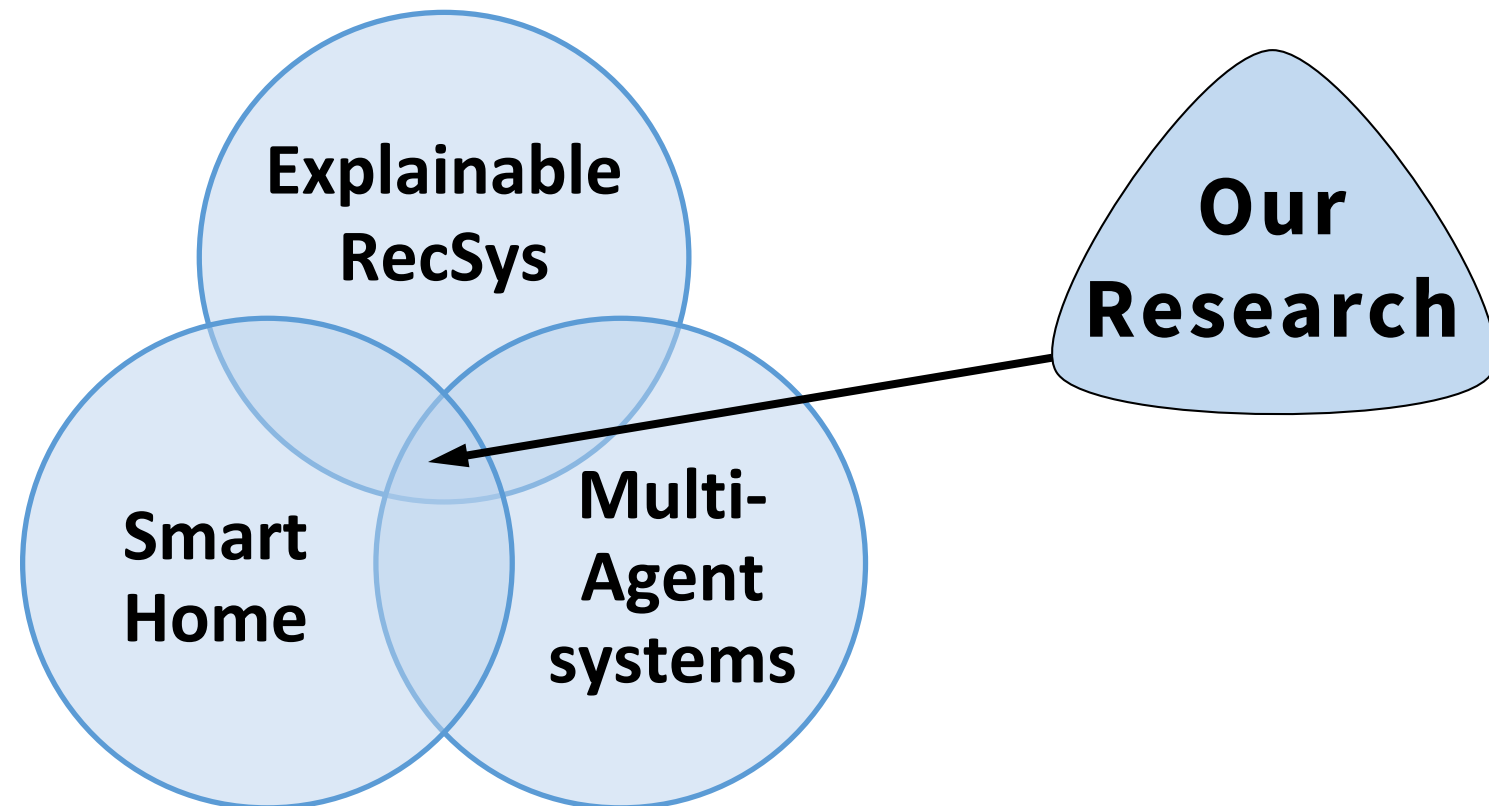


There is no recommendation for the devices: Tumble Dryer and Washing Machine. Reason: the probabilities of user availability and/or device usage are not high enough.

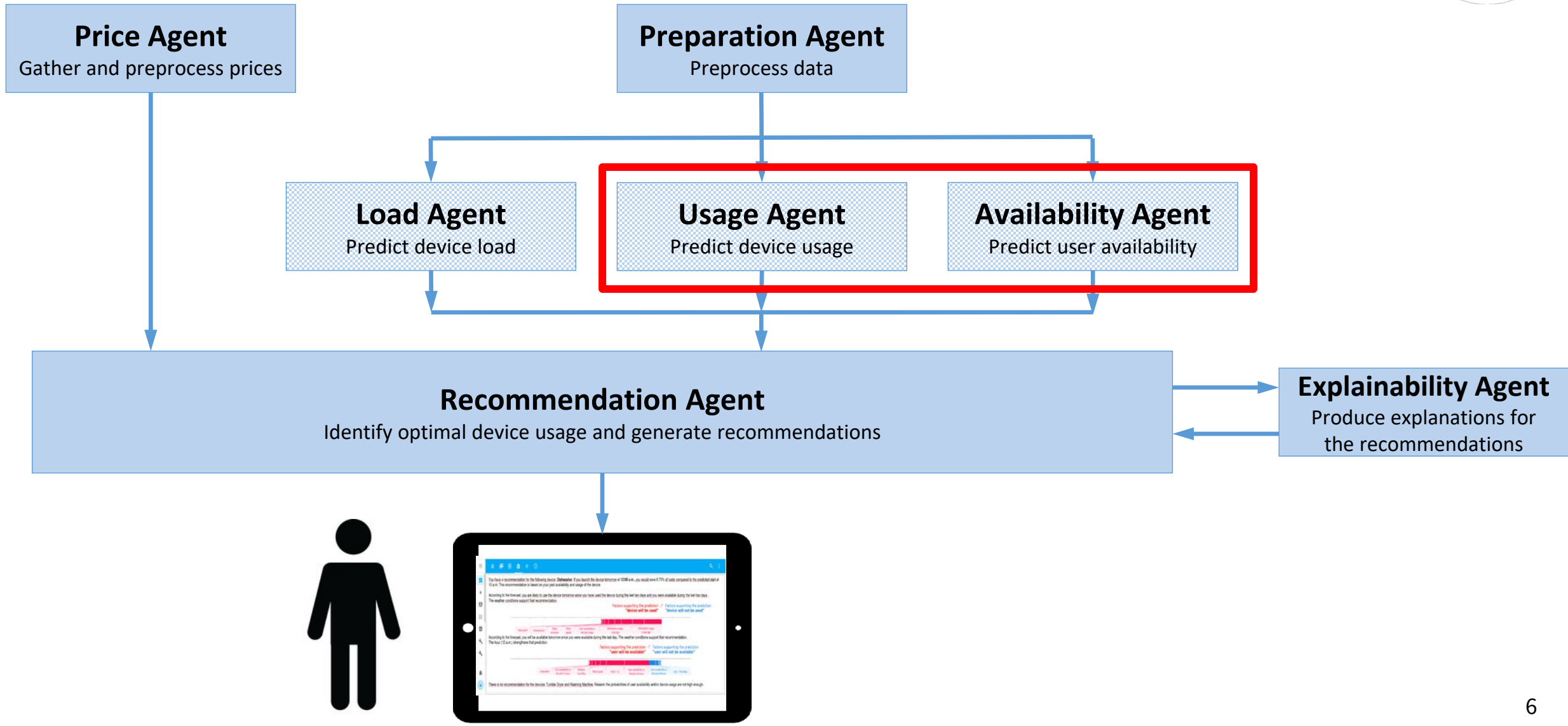
Related Literature

Explainable Recommendation Systems

- **Explainability in RecSys in other domains (Zhang & Chen, 2020)**
- **Most existing approaches are not applicable for Smart Home area**
 - Data availability
 - Data structure
 - Data privacy



Recommendation System Architecture



Thank you for your attention!



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■ More on research

- arXiv: <https://arxiv.org/abs/2205.02704>
- GitHub: https://github.com/AlonaZharova/Explainable_multi-agent_RecSys



■ Contact

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References



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