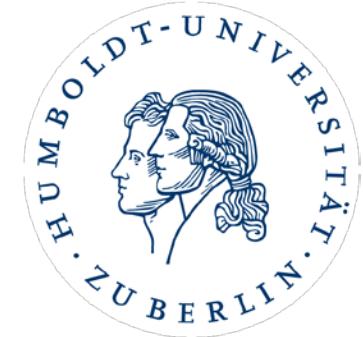




NEURAL INFORMATION
PROCESSING SYSTEMS



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



Intentions



Actions



Explainability



Trust

Transparency

Acceptance

Persuasiveness

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 \leftrightarrow Factors supporting the prediction
"device will be used" **"device will not be used"**



A horizontal timeline with a red background. On the left, there are icons for a house, a document, a list, a gear, and an information sign. Below the timeline, several factors are listed in boxes: Dew point (pink), Temperature (pink), Wind direction (pink), Wind speed (pink), User availability in the last 2 days (pink), Dishwasher usage 1 day ago (pink), and Dishwasher usage 2 days ago (pink). To the right of the timeline, there are two sets of text: "Factors supporting the prediction" and "Factors supporting the prediction" with arrows between them, followed by the text "device will be used" and "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 \leftrightarrow Factors supporting the prediction
"user will be available" **"user will not be available"**



A horizontal timeline with a red background. On the left, there are icons for a house, a document, a list, a gear, and an information sign. Below the timeline, several factors are listed in boxes: Dew point (pink), User availability in the last 72 hours (pink), Relative humidity (pink), Wind speed (pink), Hour = 12 (pink), User availability in the last 24 hours (pink), and User availability in the last 48 hours (blue). To the right of the timeline, there are two sets of text: "Factors supporting the prediction" and "Factors supporting the prediction" with arrows between them, followed by the text "user will be available" and "user will not be available".

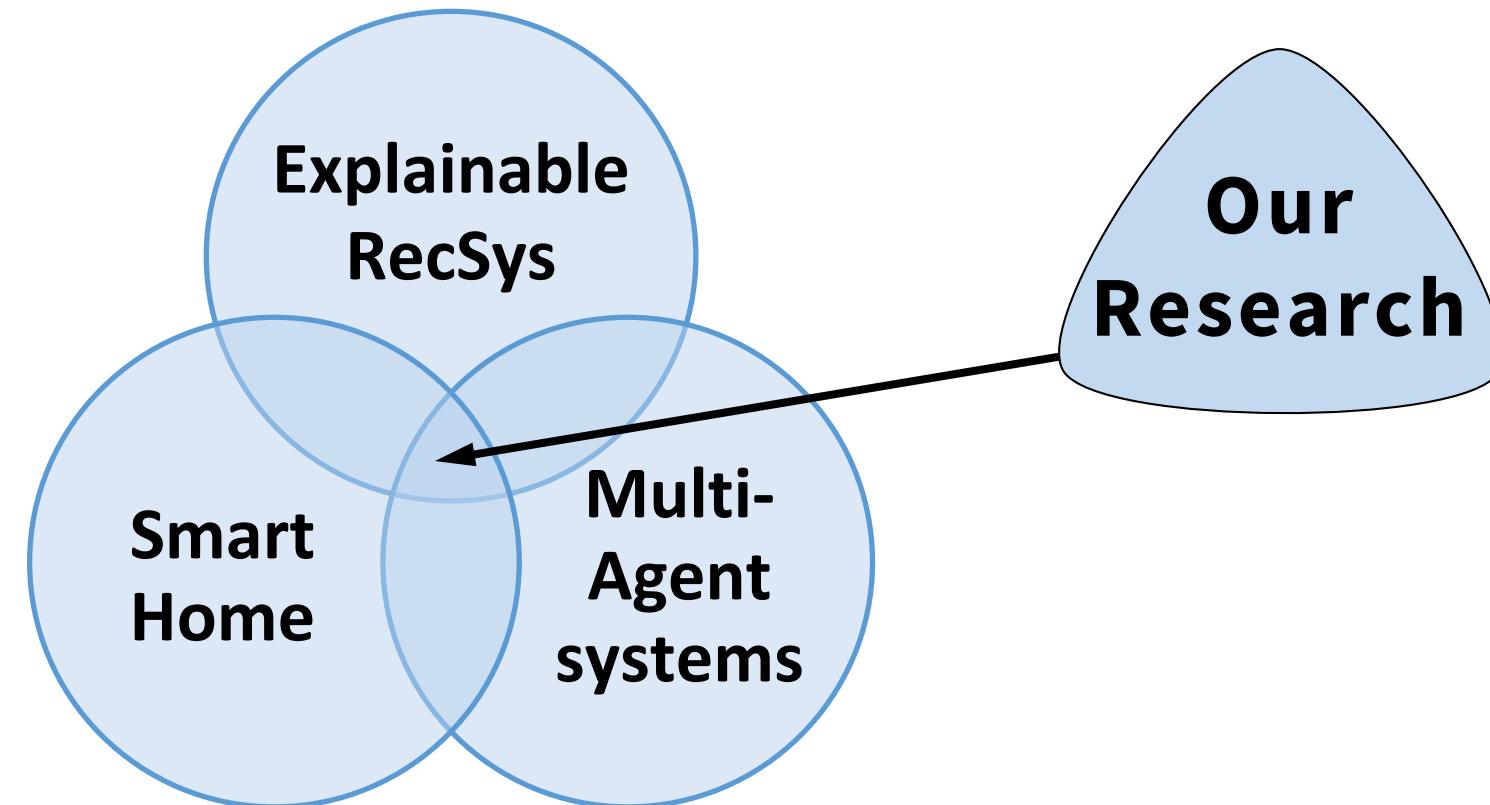
There is no recommendation for the devices: Tumble Dryer and Washing Machine. Reason: the probabilities of user availability and/or device usage are not high enough.

Related Literature

Explainable Recommendation Systems

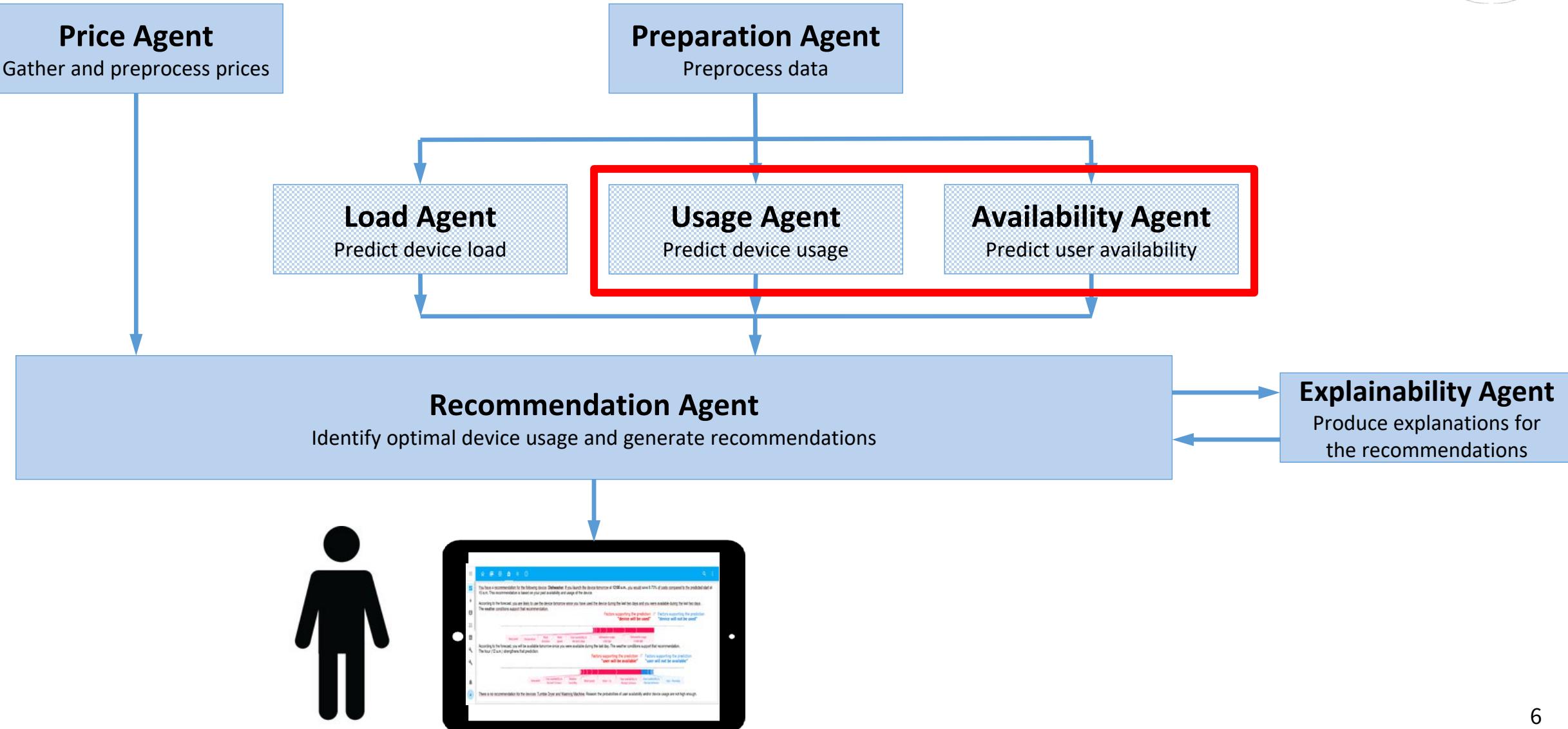
- Explainability in RecSys in other domains (Zhang & Chen, 2020)
- Most existing approaches are not applicable for Smart Home area

- 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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