

DeviceScope: An Interactive App to Detect and Localize Appliance Patterns in Electricity Consumption Time Series

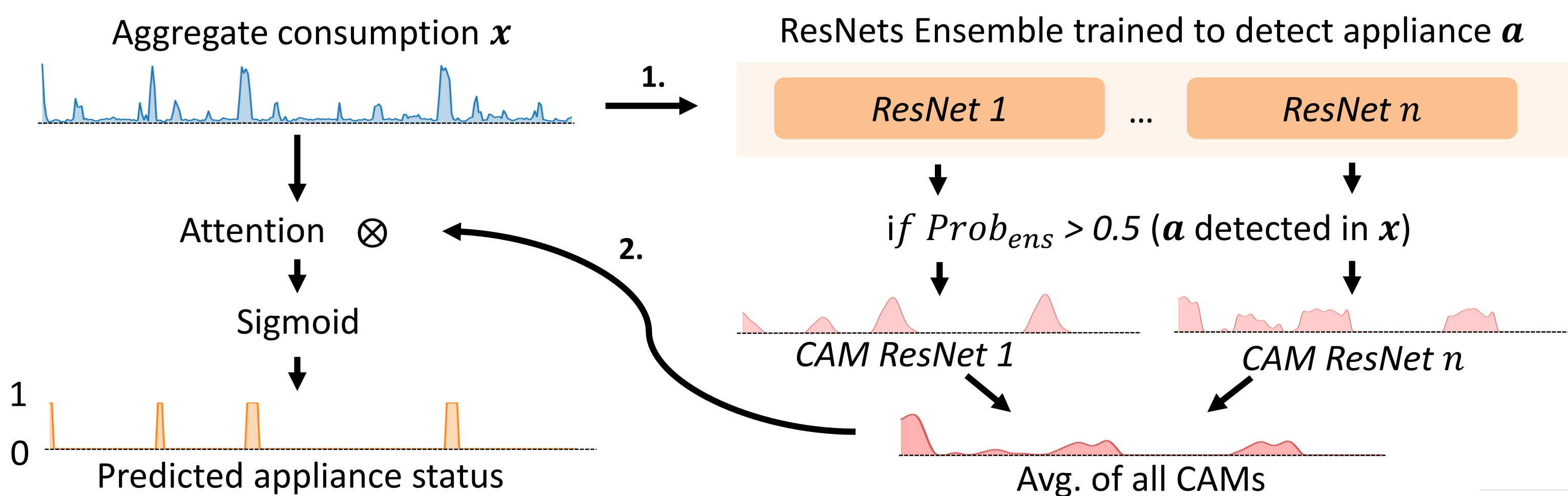
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1. Motivation

- **Appliance detection** and **typical usage pattern** analysis are key to electricity suppliers [1, 3]
- **Appliance localization** is commonly formulated as a **sequence-to-sequence task** requiring **strong labels** (one label per timestep)
- However, suppliers typically only have access to **weak labels** : binary presence indicators **per sequence** or **per households**
- Recent **explainability-driven methods** have emerged to **highlight anomalous** or **relevant regions** in time series **based on weak labels** [2]

2. CamAL

Class Activation Map based Appliance Localization



Step 2: Localization

If detected, timestamps corresponding to appliance pattern are highlighted using the explainability module

Step 1: Detection

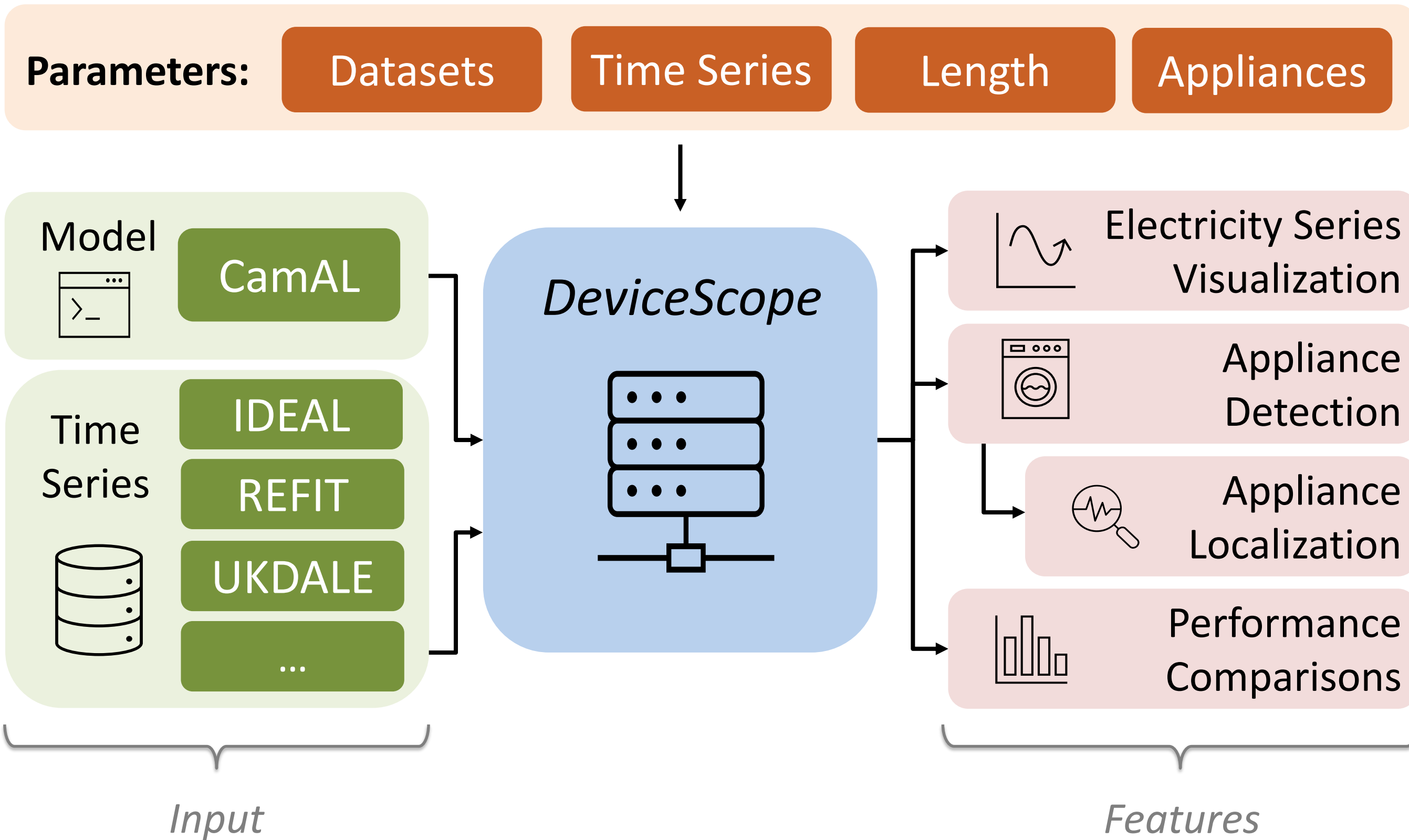
An ensemble of ResNets detects appliance presence in the input consumption series

3. DeviceScope

Stand-alone webapp developed on Streamlit with 3 main features:

1. **Visualizing** electricity consumption time series
2. **Detecting** and **localizing** appliance usage patterns
3. **Benchmarking** the performance of *CamAL* against baselines (weakly and strongly supervised ones)

Input/Features summary



Playground



(A) Playground frame

Benchmark



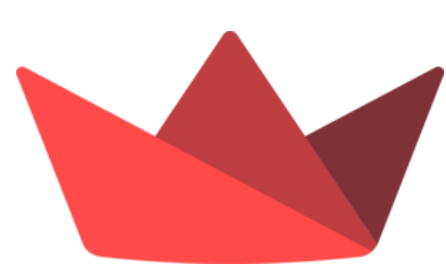
(B) Benchmark frame

Bibliography

- [1] Appliance Detection Using Very Low-Frequency Smart Meter Time Series, A. Petralia, P. Boniol, P. Charpentier, and T. Palpanas, ACM e-Energy, 2023.
- [2] dCAM: Dimension-wise Class Activation Map for Explaining Multivariate Data Series Classification, P. Boniol, M. Meftah, E. Remy and T. Palpanas, SIGMOD, 2022.
- [3] Few Labels are all you need: A Weakly Supervised Framework for Appliance Localization in Smart-Meter Series, A. Petralia, P. Boniol, P. Charpentier, and T. Palpanas, ICDE, 2025.



DeviceScope
Webapp



Github
repository

