

ADF & TransApp: A Transformer-Based Framework for Appliance Detection Using Smart Meter Consumption Series

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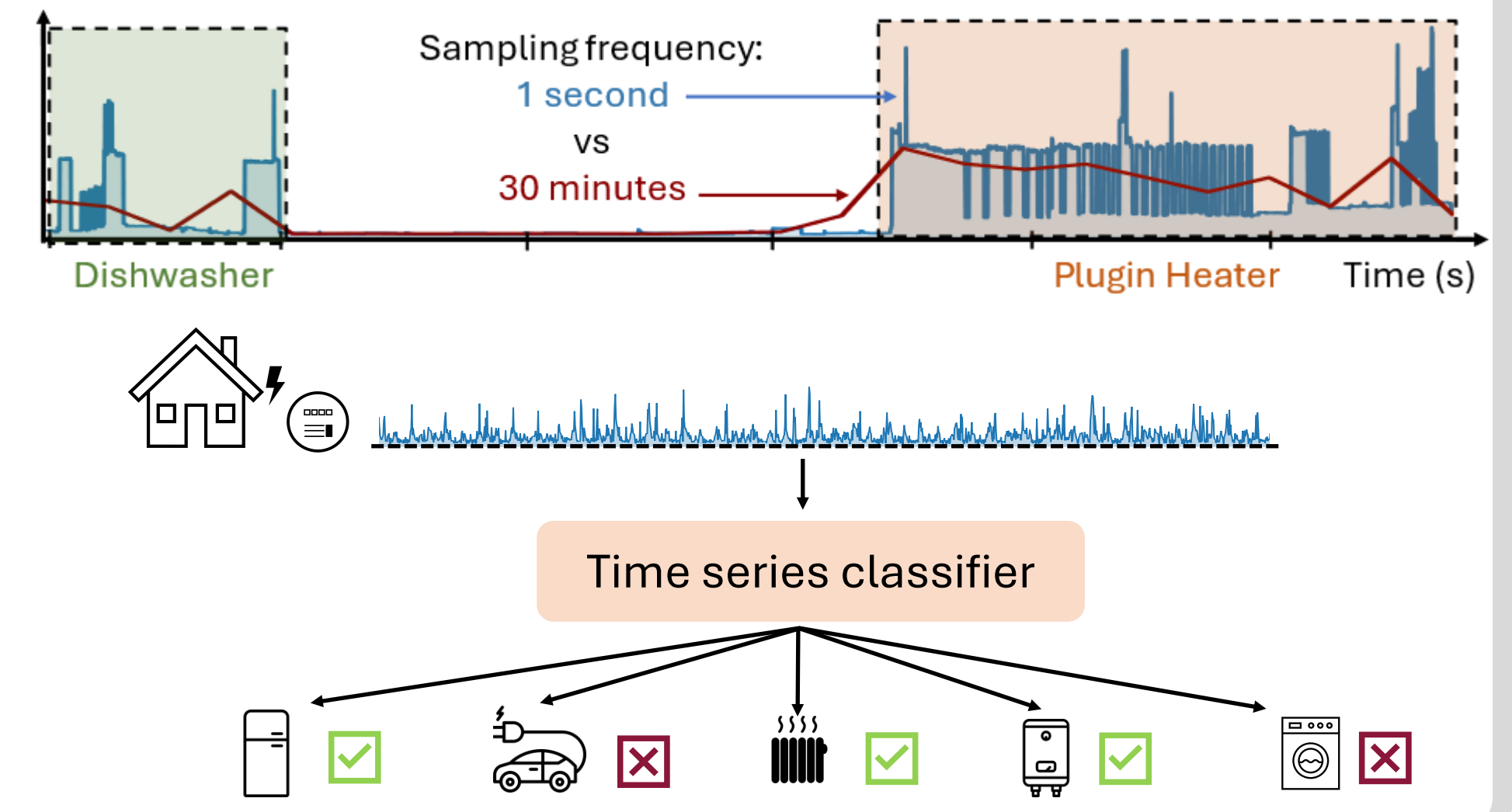
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Motivation

- **Widespread adoption** of smart meters around the world for better energy management [1,2].
- Electricity suppliers record large amounts of **time-stamped electricity consumption data**.
- Interested in **extracting information** from these data: e.g., **detecting which appliances the consumers own**.

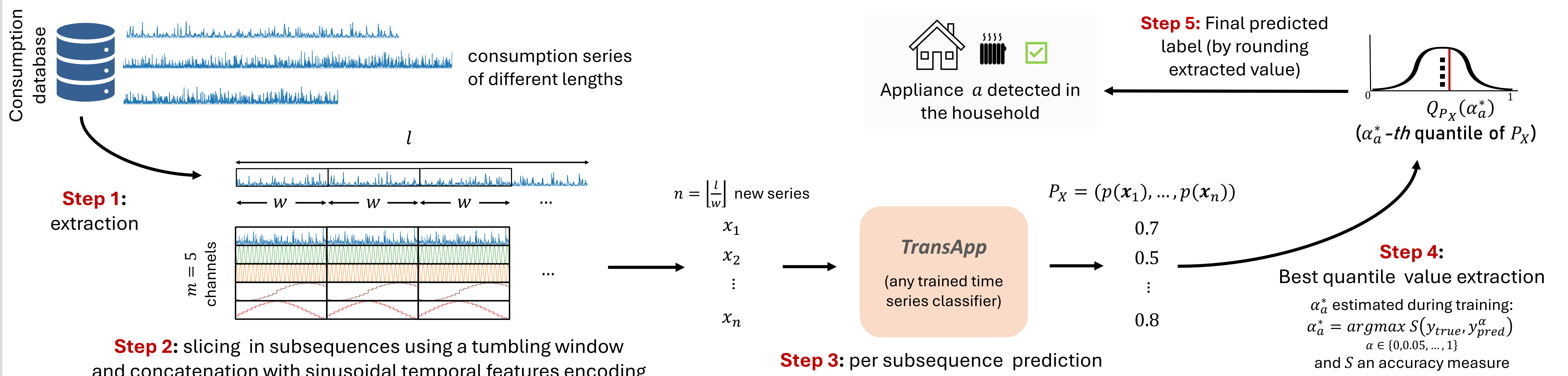
Challenges

- Smart meters record data at a **very low frequency**, resulting in a loss of information.
- **Appliance Detection as a time series classification problem** [3]:
 1. Consumption series of long and variable length.
 2. Few labeled data available.
 3. Large amount of non-labeled data.

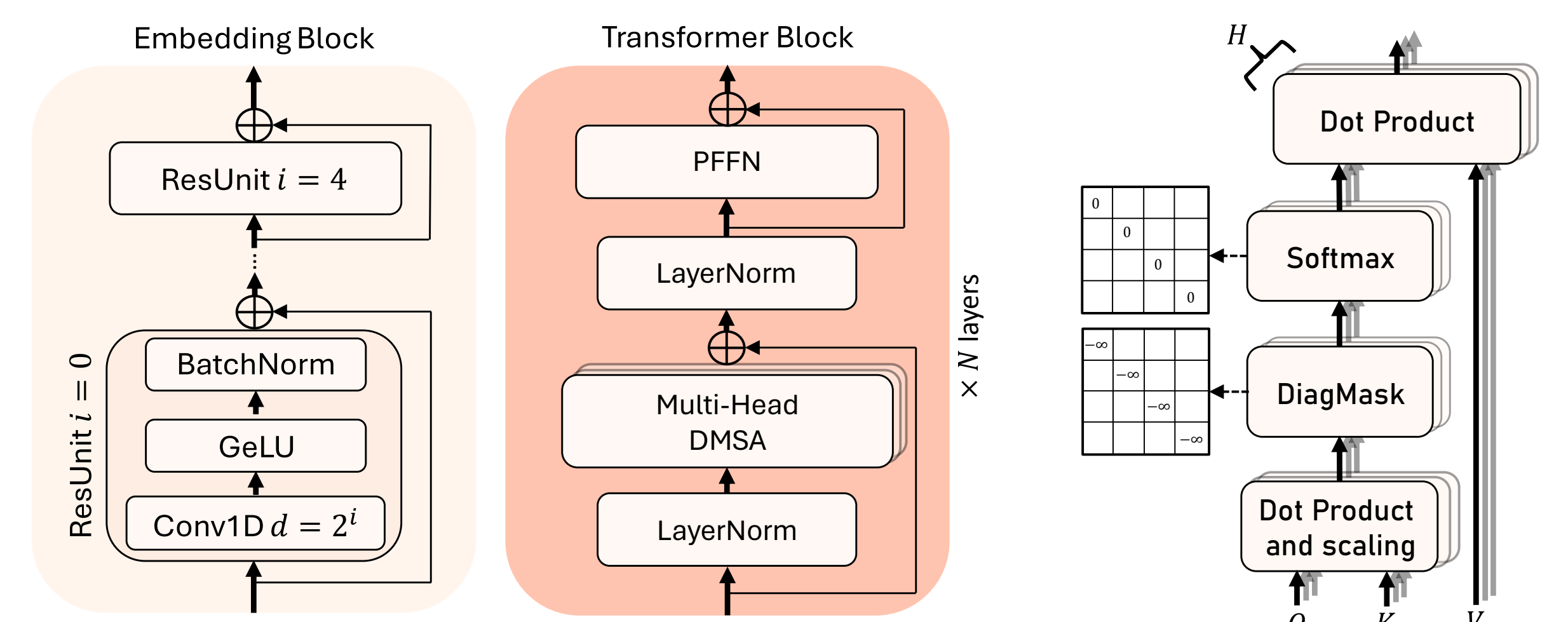
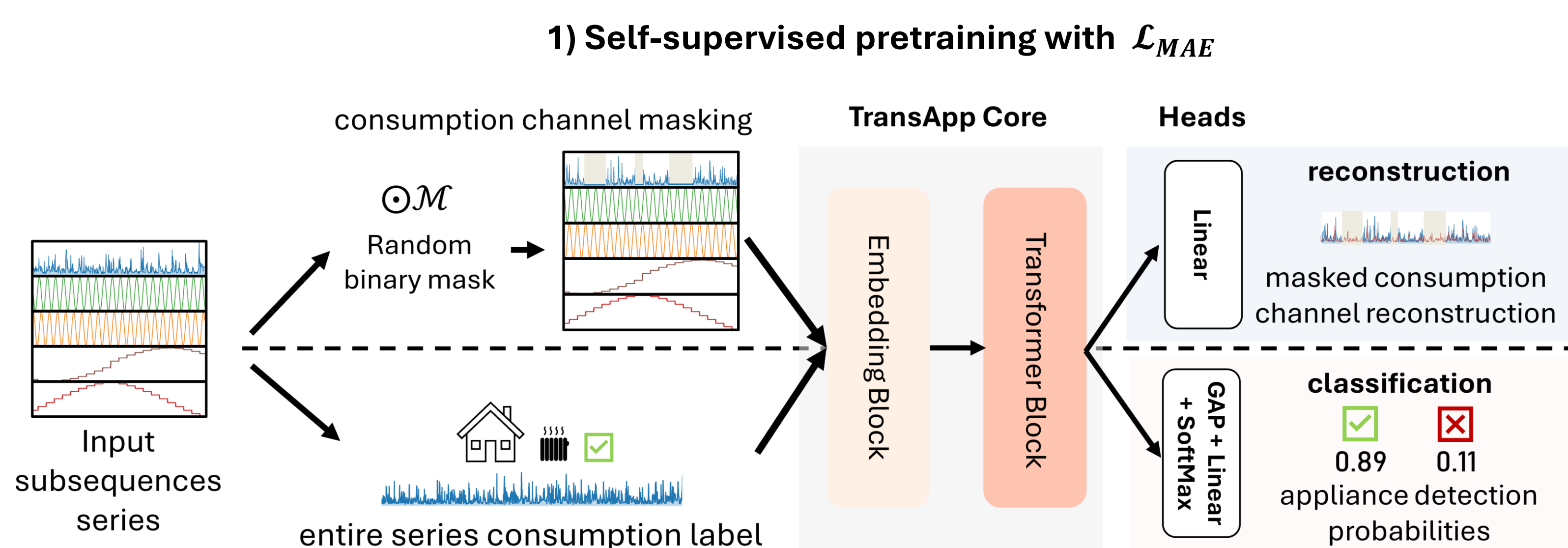


Proposed Approach

The Appliance Detection Framework (ADF)

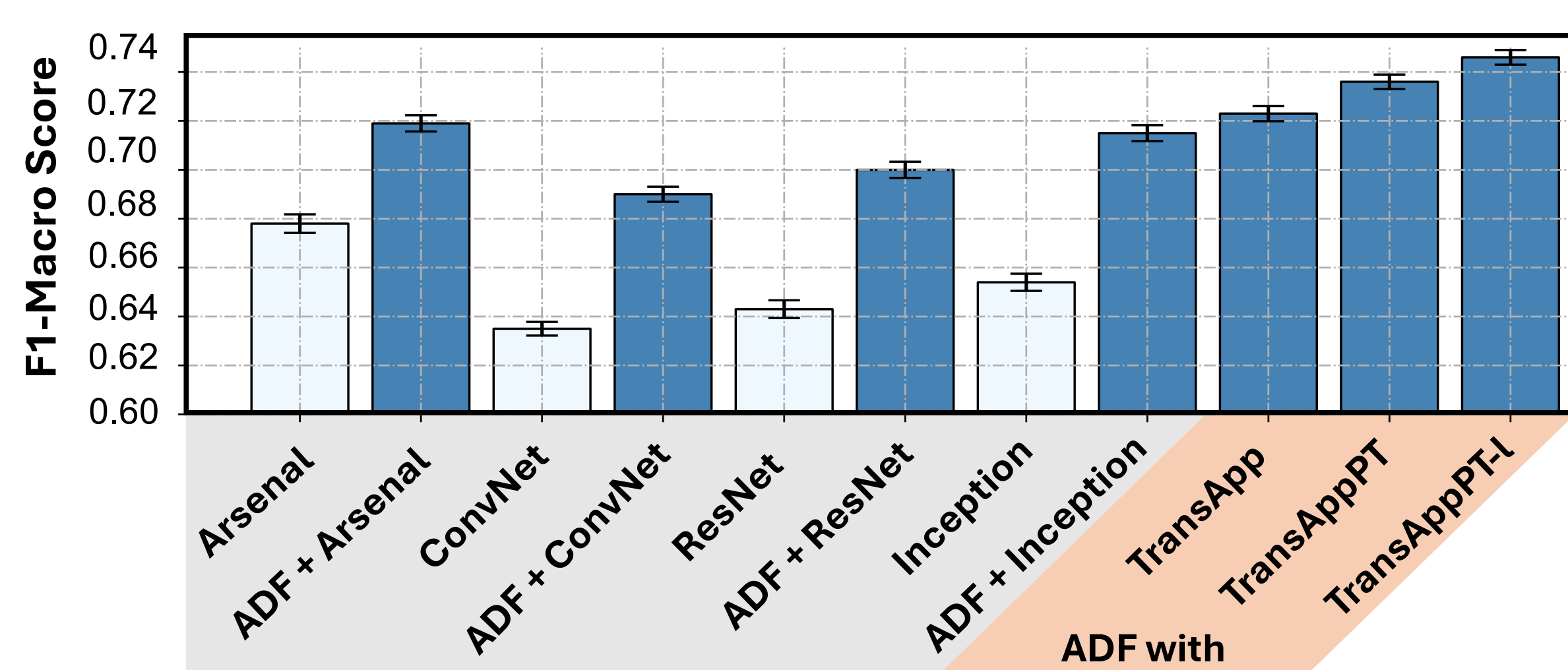


TransApp architecture

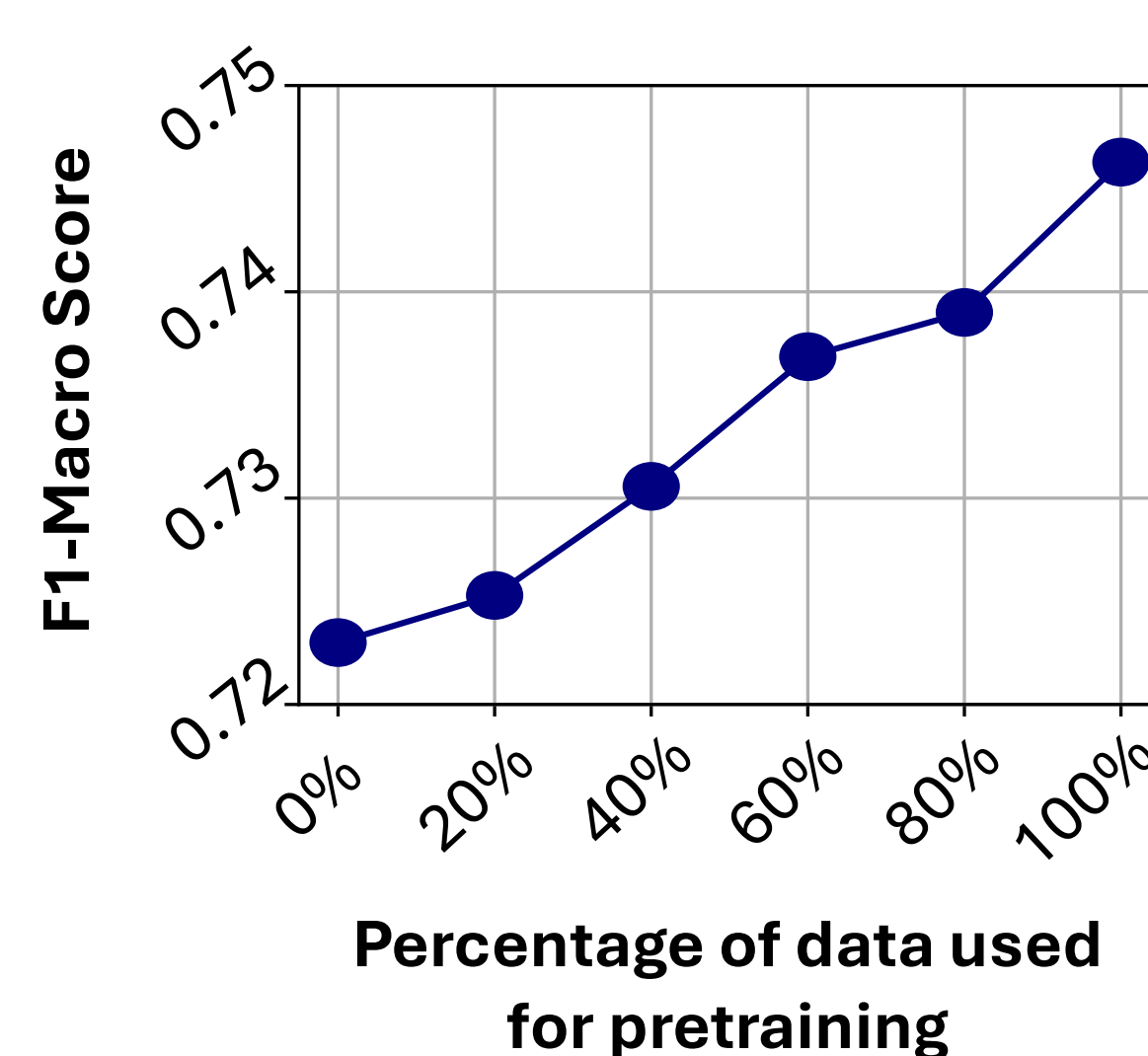


Detail of the two blocks used in the TransApp Core

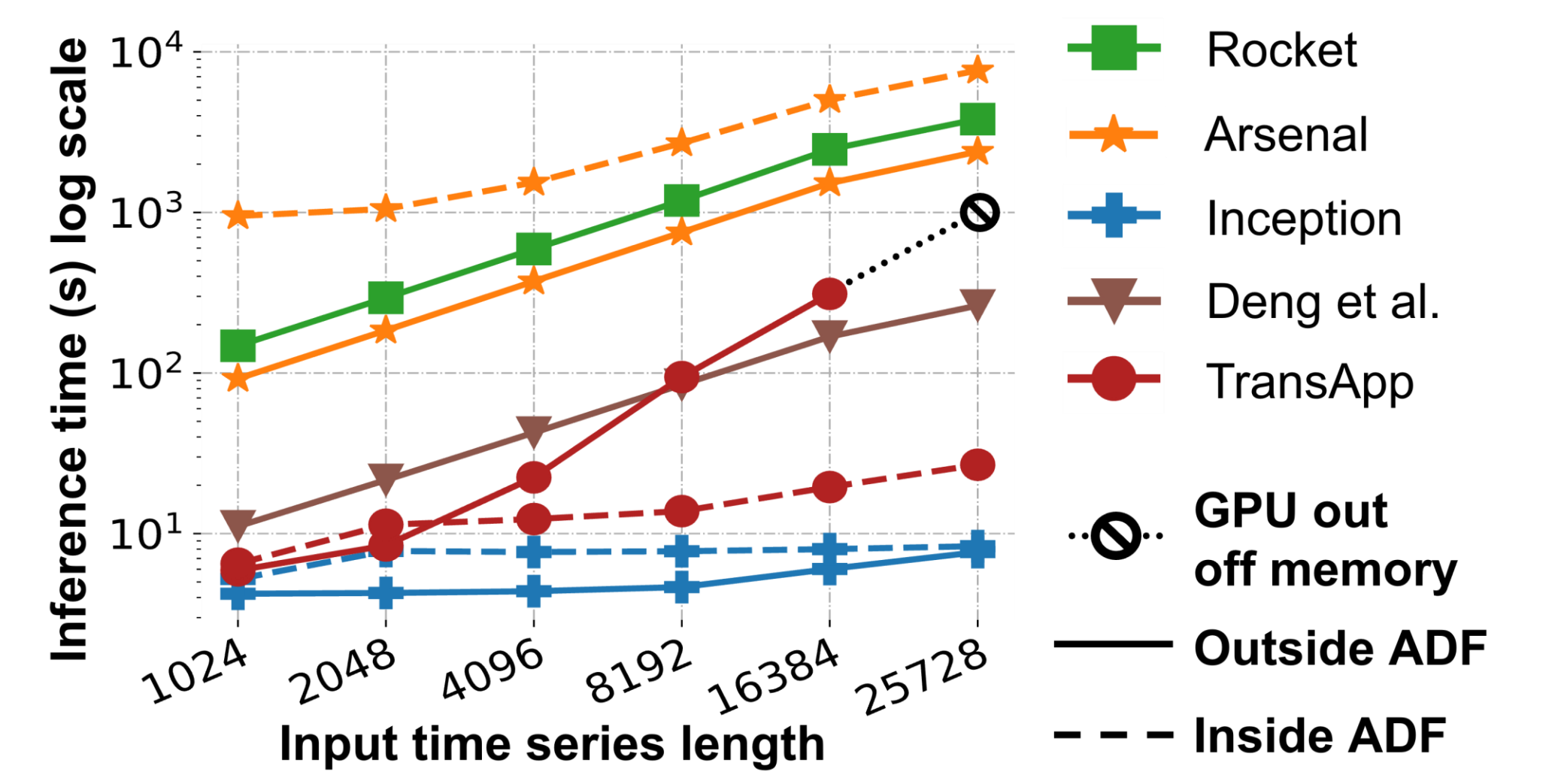
Experimental Evaluation



Average results over 7 different appliance detection case (EDF dataset)



- Pretraining improves TransApp detection quality



Running time to predict 1K instances (CER dataset [4])

- TransApp scales to long consumption series (thanks to ADF)

Bibliography

- [1] Gouri R. Barai, Sridhar Krishnan, and Bala Venkatesh. 2015. Smart metering and functionalities of smart meters in smart grid. In 2015 IEEE Electrical Power and Energy Conference (EPEC). 2015.
- [2] Stanislav Chren, Bruno Rossi, and Tomáš Pitner. 2016. Smart grids deployments within EU projects: The role of smart meters. In 2016 Smart Cities Symposium Prague (SCSP).
- [3] Adrien Petralia, Philippe Charpentier, Paul Boniol, and Themis Palpanas. 2023. Appliance Detection Using Very Low-Frequency Smart Meter Time Series. In ACM International Conference on Future Energy Systems (e-Energy). 2023.
- [4] CER Smart Metering Project - Electricity Customer Behaviour Trial, 2009-2010.

Github repository

