FlexBIT

Politechnika Wrocławska

Hour-Ahead Load Forecasting for Flexibility Management in Energy Communities #169

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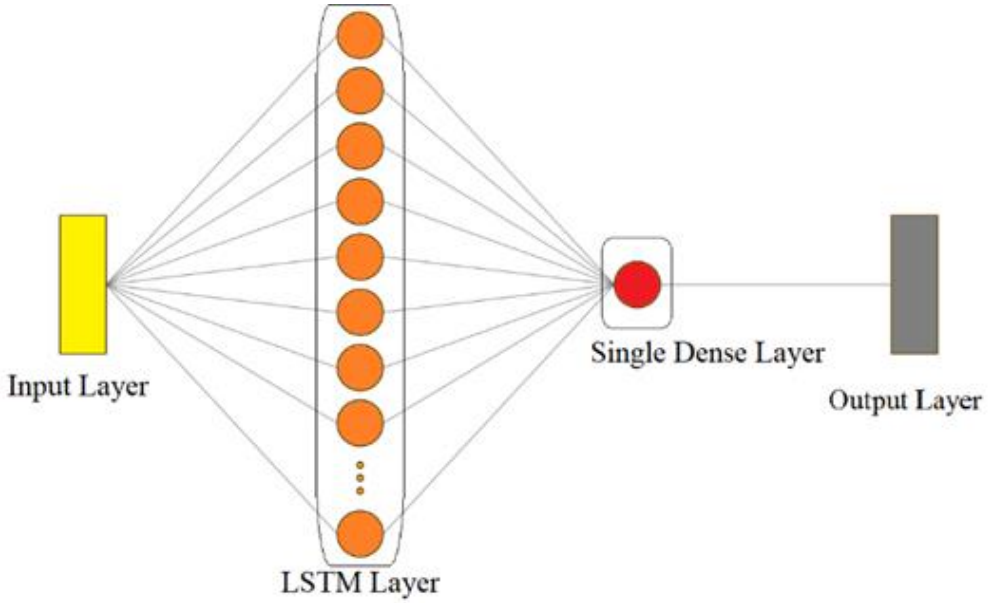
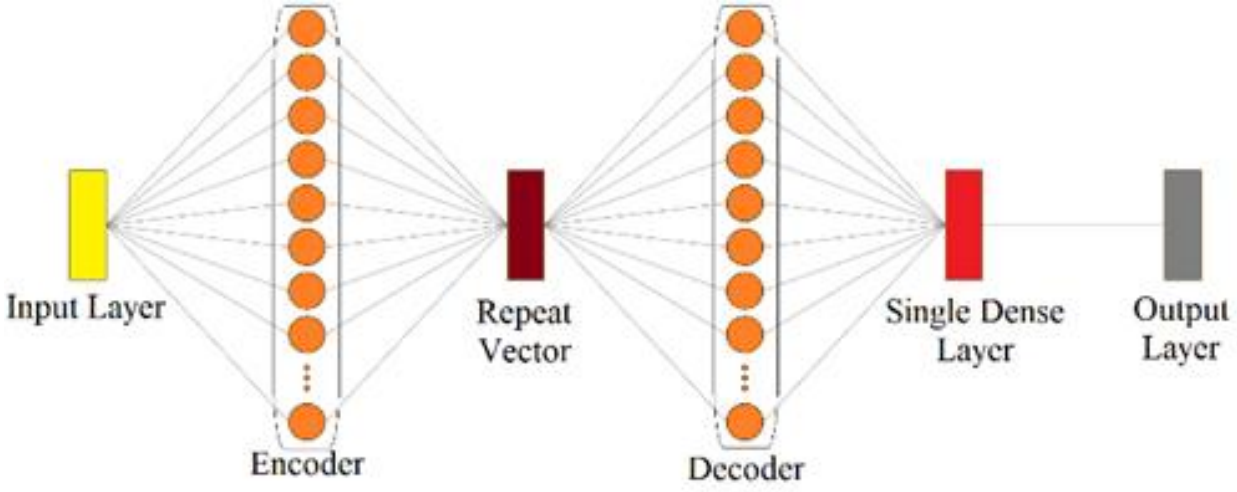
LSTM Model Architectures

Unidirectional Model



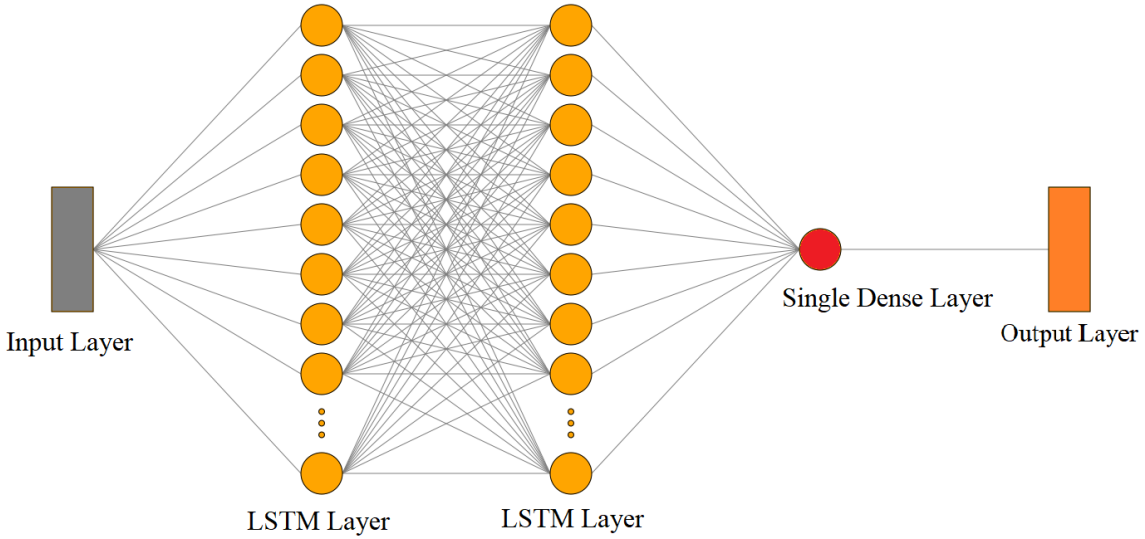
Autoencoder Model Model



LSTM Model Architectures

BiLSTM Model

Multi-layer Model

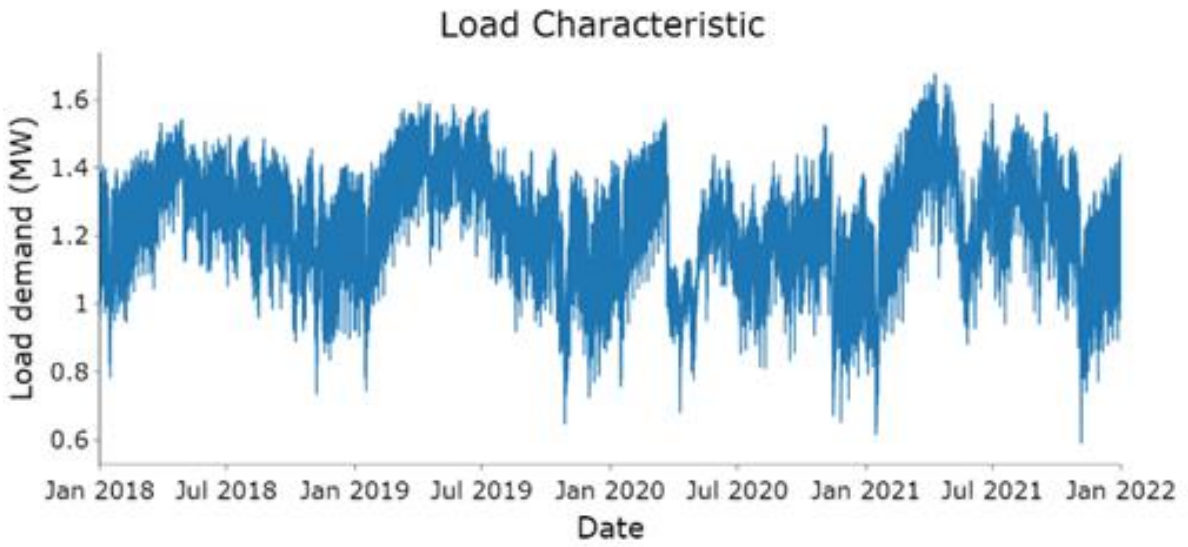


Data Description + Processing

Data description

The load demand data utilized in this study pertains to a local energy community located in a suburb in Poland. The dataset has only hourly load demand values from 01.01.2018 00:00 to 31.12.2021 23:00. The peak load demand value observed in the dataset is 1.68 MW

Load Characteristic



Data Description + Processing

Normalization

$$z_i - \min(z) / \max(z) - \min(z)$$

Sliding Window

Algorithm 1 Sliding Window Algorithm

1: **Input:** Total time series length **L**, window length **W**

2: **Output:** Array of sliding windows **S**

3: Initialize **t** = 0 for the current position in the time series, and **w_count** = 0 for the count of windows

4: Prepare an empty list **S** to hold the segments

5: while **t** + **W** <= **L** do

- **Ensure:** The end of the time series is not surpassed
- Segment the time series from position t to **t** + **W** and append to **S**
- Update **t** by adding **W** to move to the next segment
- Increment **w_count**

6: **end while**

7: **return S**

Results

Normalization

$$MAE = 1/N * \sum_{i=1}^{N} |e_i|$$

$$RMSE = \sqrt{MSE} = \sqrt{1/N * \sum_{i=1}^{N} e_i^2}$$

$$MBE = 1/N * \sum_{i=1}^{N} e_i$$

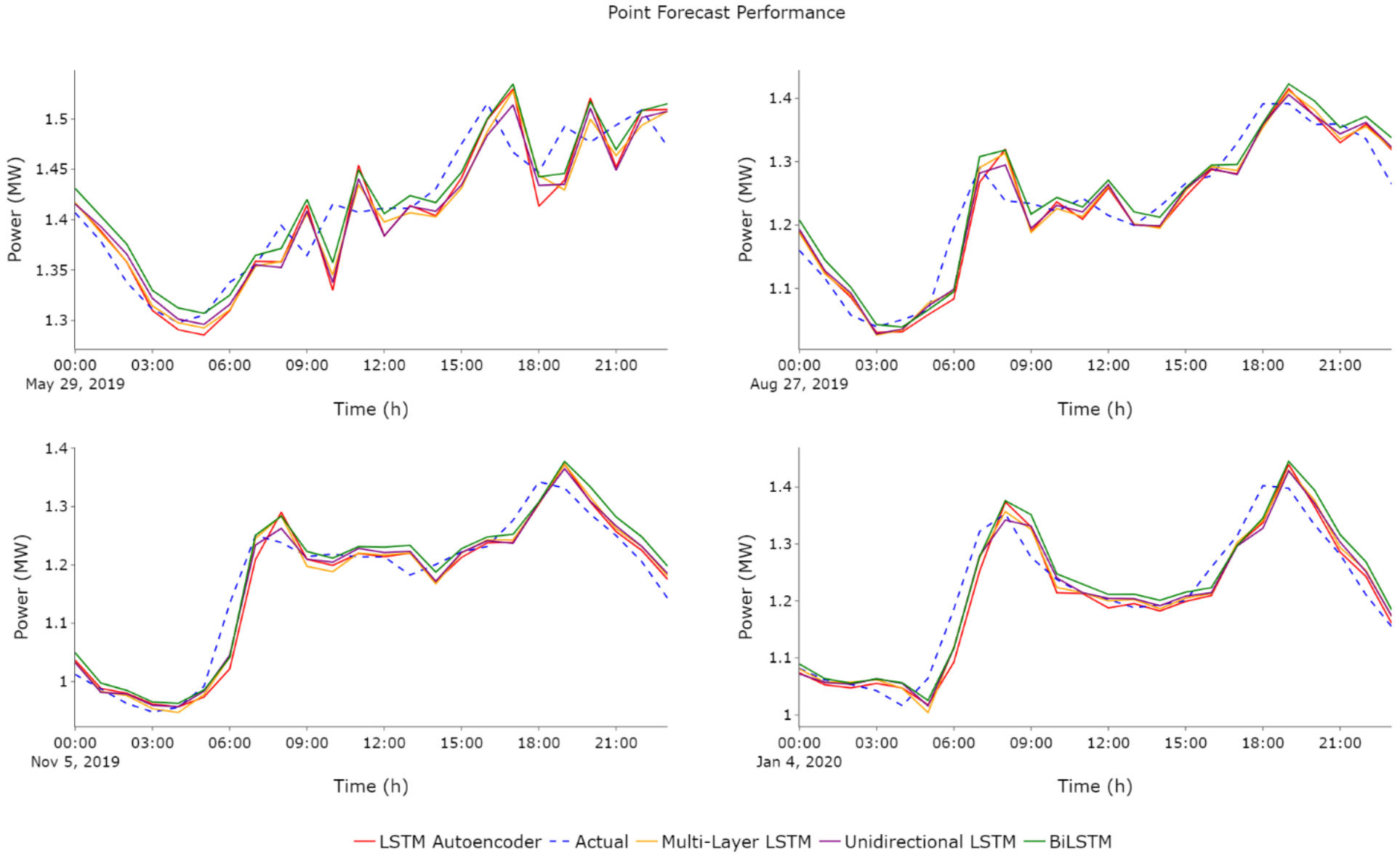
$$e_i = y_{i(forecast)} - y_{i(actual)}$$

Evaluation Metrics

TABLE I. EVALUATION METRICS

Architecture	Performance of investigated LSTM architectures		
	RMSE(MW)	*MAE(MW)*	*MBE(MW)*
Multi-layer LSTM	0.032	0.025	0.001
Unidirectional LSTM	0.031	0.024	0.001
Autoencoder LSTM	0.034	0.026	0.001
Bidirectional LSTM	0.034	0.027	0.012

Results


Point Forecast Performance
Power (MW)
Time (h)
May 29, 2019
Aug 27, 2019
Nov 5, 2019
Jan 4, 2020
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
LSTM Autoencoder
Actual
Multi-Layer LSTM
Unidirectional LSTM
BiLSTM

THANK YOU

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