Lim & Zohren, 2021

STATS 631, Winter 2026

Impact

Lim, B., & Zohren, S. (2021). Time-series forecasting with deep learning: a survey. *Philosophical Transactions of the Royal Society A*, 379(2194), 20200209. (https://doi.org/10.1098/rsta.2020.0209).

- cited 2500 times
- Philosophical Transactions A (impact factor: 4.3)
- This is a review paper

Insights

- CNN is like an AR model: finite number of lags of previous data.
- RNN is like an SSM

The M4 Forecasting Competition

- Hyndman R. (2020). A brief history of forecasting competitions. Int. J. Forecast. 36, 7–14. (doi:10.1016/j.ijforecast.2019.03.015)
- Makridakis, S., Spiliotis, E., & Assimakopoulos, V. (2020). The M4 Competition: 100,000 time series and 61 forecasting methods. International Journal of Forecasting, 36, 54-74. (https://doi.org/10.1016/j.ijforecast.2019.04.014)
- **The clear winner of the M4 forecasting competition**. Smyl, S. (2020). A hybrid method of exponential smoothing and recurrent neural networks for time series forecasting. International Journal of Forecasting, 36, 75–85. (https://doi.org/10.1016/j.ijforecast.2019.03.017)

Smyl (2020) and LSTM

- Uses a combination of exponential smoothing and long short-term memory (LSTM) recurrent neural net (RNN) methods.
- LSTM was state-of-the-art from 2015-2020: Google translate, Apple's Siri, Amazon's Alexa, Facebook translate, OpenAI, DeepMind.
- Achieved prominence by winning a handwriting recognition competition in 2009 (https://en.wikipedia.org/wiki/Long_short-term_memory).
- LSTM Largely addresses the vanishing gradient problem; can have the exploding gradient problem

Forecasting and science

- How is forecasting related and unrelated to developing useful understanding?