Time Series Forecasting using LSTM - Long Short-Term Memory Recurrent Neural Networks

Abid Hossain
Department of Computer Science and Engineering
BRAC University
Dhaka, Bangladesh
abid.hossain@g.bracu.ac.bd

Tanjim Hussain Sajin
Department of Computer Science and Engineering
BRAC University
Dhaka, Bangladesh
tanjim.hussain.sajin@g.bracu.ac.bd

Md Hazibuzzaman Bhuiyan
Department of Computer Science and Engineering
BRAC University
Dhaka, Bangladesh
md.hasibuzzaman.bhuiyan@g.bracu.ac.bd

***Abstract*—Due to its wide range of application areas and significant influence, economic time series forecasting is without a doubt the most popular form of computer science for finance scientists from both academic and the finance industry. Researchers in machine learning (ML) developed a variety of models, and a huge number of research studies have been written as a result. As a result, there are numerous surveys that address ML for economic time series forecasting research. Deep Learning (DL) models have recently started to appear in the field, and their performance is noticeably better than that of their classic ML counterparts. Even while creating models for economic time series forecasting studies is receiving more attention, there aren't many review papers that are just concerned with DL for finance. Therefore, the purpose of this research is to present a thorough literature analysis on DL studies for the implementation of financial time series forecasting. We divided the research into groups based on the DL models they used, including such Convolutional Neural Networks (CNNs), Deep Belief Networks (DBNs), and Long-Short Term Memory, in addition to the forecasting implementation areas they were meant for, such as index, currency, and commodities forecasting (LSTM). We also made an effort to predict the field's future by noting potential challenges and opportunities, so that any interested scholars may take advantage.**

***Index Terms*—deep learning, finance, computational intelligence, machine learning, time series forecasting, CNN, LSTM, RNN**

I. Introduction

The successful prediction of economic and financial time series has long piqued the curiosity of the financial sector. Numerous studies with comparatively superior performances than traditional time series forecasting methods have been reported that were built on ML models. The extensive use of automated algorithmic trading systems and the rising desire for higher yields, however, keep pushing practitioners and researchers to keep looking for more effective models. As a result, the literature on economics and computer science is constantly receiving new papers and applications.

In recent years, DL has begun to emerge as the most effective predictor class in the ML domain across a variety of application domains. Economic time series forecasting is no different, therefore more and more researchers believe utilizing various DL approaches have been presented in the relevant conferences and publications during the past few years. To the best of the researcher, no reviews have been done in the literature for DL, despite the presence of a sizable number of survey studies addressing financial time series forecasting and trading strategies utilizing conventional soft computing approaches. Therefore, we made the decision to engage on a thorough study that would concentrate on DL applications of financial time series forecasting. Our goal was to provide a current overview of academic and industrial opinions on the developed DL models, but we also wanted to identify the key elements that made each model stand out so that academics and practitioners wouldn't end up making poor decisions while developing their systems. By suggesting potential future directions, we also hoped to anticipate where the economy is headed.