I.E. Livieris, E. Pintelas, S. Stavroyiannis and P. Pintelas. A novel validation framework to enhance deep learning models in time-series forecasting
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Neural Computing and Applications
, 2020.

Abstract - Time-series analysis and forecasting is generally considered as one of the most challenging problems in data mining. During the last decade, powerful deep learning methodologies have been efficiently applied for time-series forecasting; however, they cannot guarantee the development of reliable prediction models. In this work, we introduce a novel framework for supporting deep learning in enhancing accurate, efficient and reliable time-series models. The major novelty of our proposed methodology is that it ensures a time-series to be ``suitable'' for fitting a deep learning model by performing a series transformations in order to satisfy the stationarity property.
The enforcement of stationarity is performed by the application of Augmented Dickey-Fuller test and transformations based on first differences or returns, without the loss of any embedded information. The reliability of the deep learning model's predictions is guaranteed by rejecting the hypothesis of autocorrelation in the model's errors, which is demonstrated by autocorrelation function plots and Ljung-Box Q-test. Our numerical experiments were performed utilizing time-series from three real-world
application domains (financial market, energy sector, cryptocurrency area), which incorporate most of global research interest. The performance of all forecasting models were compared on both problems of forecasting time-series price (regression) and time-series directional movements (classification). Additionally, the reliability of the models' forecasts was evaluated by examining the existence of autocorrelation in the errors. Our numerical experiments indicate that our proposed methodology considerably improves the forecasting performance of a deep learning model, in terms of efficiency, accuracy and reliability.