A Weighted Window Approach to Neural Network Time Series Forecasting

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ABSTRACT

In this chapter, we propose a neural network based weighted window approach to time series forecasting. We compare the weighted window approach with two commonly used methods of rolling and moving windows in modeling time series. Seven economic data sets are used to compare the performance of these three data windowing methods on observed forecast errors. We find that the proposed approach can improve forecasting performance over traditional approaches.
INTRODUCTION

Forecasting is an important part of decision making. The success of decision making is dependent, to a large extent, on the quality of forecasts. There are two major approaches to quantitative forecasting. Causal Methods model the relationship between a set of predictor variables and the value of the criterion variable to be forecast. Time Series Methods, on the other hand, use past or lagged values of the same criterion variable as a surrogate for all the underlying causal factors and model the relationship between these past observations and the future value. Each approach has its advantages and disadvantages as discussed in Bowerman and O’Connell (1993). This chapter will focus on the time series forecasting methods.

A time series is a chronological sequence of observations taken at periodic points in time. Many models exist for the task of time series forecasting. Some of these models include:

- Naive or random walk: use the most recent observation as forecast.
- Moving average: use the average of a fixed number of past data points as forecast.
- Exponential smoothing: a weighted moving average approach that weights more heavily the recent values than the past values.
- Autoregression (AR): a linear regression technique that estimates the relationship among observations in a time series.
- Autoregressive integrated moving average (ARIMA): a versatile linear system that models the relationship among time series observations and random shocks (Box & Jenkins, 1976).
- Threshold autoregressive: a specialized nonlinear AR model (Tong & Lim, 1980).
- Autoregressive conditional heteroscedastic (ARCH): a parametric nonlinear model for nonconstant conditional variance (Engle, 1982).
- Artificial neural networks (ANNs): adaptive models based upon biological neural systems capable of representing nonlinear relationships.

These models represent some of the most popularly used linear and nonlinear approaches to practical time series forecasting. The first five models are linear while the rest are nonlinear. It is important to note that most of these models are parametric in nature. That is, the model form is assumed before the model is built from data. Among other things, the assumed model form specifies how many lagged observations of the variables are used as inputs to the function.
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