Chapter 12
Forecasting Demand With Support Vector Regression Technique Incorporating Feature Selection in the Presence of Calendar Effect

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ABSTRACT

Reliable prediction of future demand is needed to better manage and optimize supply chains. However, a difficulty of forecasting demand arises due to the fact that heterogeneous factors may affect it. Analyzing such data by using classical time series forecasting methods will fail to capture such dependency of factors. This chapter addresses these problems by examining the use of feature selection in forecasting using support vector regression while eliminating the calendar effect using X13-ARIMA-SEATS. The approach is investigated in three different case studies.

INTRODUCTION

Demand forecasts play a crucial role in supply chain (SC) management. The future demand for a certain product is the basis for the optimization of supply chain and of replenishment systems. However, proposing a model for SC demand forecasting

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may be difficult due to the complex, dynamic, and uncertain environment. This complexity increases nowadays and different heterogeneous factors may influence the demands (Carbonneau, Vahidov, & Laframboise, 2009). In fact, it has been shown in several research works that machine learning methods are useful for supply chain since data are non-linear in relation and complex. In this paper, a special interest is given to calendar effect which is a major factor that influences the demand of different products.

The calendar effect is any effect which appears to be related to the calendar. Calendar effects are of two kinds: trading day effect and moving holiday's effect. Moving holidays are holidays which occur each year, but where the period shifts under the Gregorian calendar system. The trading day effect is caused by the fact that months may have different numbers of each day of the week from year to year.

Nowadays, there are several methods for forecasting time series. But traditional ones such as exponential smoothing (Winters, 1960) and the ARIMA (Auto-regressive moving average) approach defined by Box, Jenkins, and Reinsel (1994), are not appropriate in the case of non-linear data which includes calendar effect, see for instance Carbonneau, Laframboise, and Vahidov (2008). Therefore, we may deal with other techniques. In particular, as presented before, the machine learning techniques are from the most appropriate methods in this case.

However, statistical methods can still determine the nature of time series components. In particular, concerning the calendar effect components, the corresponding methods extend the ARIMA method to deal with the calendar effect. The X13-ARIMA-SEATS which is one of these techniques is used in our previous work (Sarhani & El Afia, 2014a) to forecast the demand of sugar in Morocco where the calendar effect is present. In the mentioned paper, we justified the choice of the X13-ARIMA-SEATS technique.

The advantage of these methods is that they can better detect the nature of the calendar effect. Indeed, the calendar effect differs from communities according to the moving holidays and the trading days of the country. For instance, moving holidays of Morocco (which is Islamic country) are different from those of China. The machine learning techniques cannot take this fact into consideration in the same manner. Therefore, machine learning techniques can be improved by adding information about the nature of calendar effect. Motivated by these facts, we have proposed in our previous paper in Sarhani and El Afia (2014b) a hybrid method with two stages which uses the X13-ARIMA-SEATS technique to eliminate the calendar component and uses the SVR method to forecast the demand.

The contribution of this paper is to carry out an investigation on the importance of using feature selection as in Sarhani and El Afia (2016) to enhance more the performance of SVR.