Chapter 5
Tourism Time Series Forecast

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ABSTRACT

In this chapter four combinations of input features and the feedforward, cascade forward and recurrent architectures are compared for the task of forecast tourism time series. The input features of the ANNs consist in the combination of the previous 12 months, the index time modeled by two nodes used to the year and month and one input with the daily hours of sunshine (insolation duration). The index time features associated to the previous twelve values of the time series proved its relevance in this forecast task. The insolation variable can improved results with some architectures, namely the cascade forward architecture. Finally, the experimented ANN models/architectures produced a mean absolute percentage error between 4 and 6%, proving the ability of the ANN models based to forecast this time series. Besides, the feedforward architecture behaved better considering validation and test sets, with 4.2% percentage error in test set.

1. INTRODUCTION

Several studies have been published in the field of tourism in recent years. The forecast of tourism demand has an important role to play in the planning, decision-making and controlling of the tourism sector (Witt & Witt, 1995; Wong, 2002; Fernandes, 2005; Yu & Schwartz, 2006).

Tourism has been seen as an important sector in the Portuguese economy. Decision makers should adopt policies that ensure its profitability and sustainability, (Dolgner & Costa, 2010). It has a strategic importance for the Portuguese economy because of its ability to create wealth and employment. This sector shows competitive advantages as few other, (Ministério da Economia e da Inovação, 2006).

According to the World Tourism Organization (WTO), Portugal will achieve 18.3 million foreign visitors in 2020. The population of Portugal is about 10 million. Tourism is at present one of Portugal's

most important activities. Apart from its impact on the balance of payments and Gross Domestic Product (GDP), and its role on employment generation, investment and revenue, it is also recognized as an "engine" for development and other economic activities, (World Tourism Organization, 2011).

The incomes of the foreign tourism can be seen as exportations which increases the importance of this activity because it contributes to the equilibrium of the import/export balance. Additionally, if the Portuguese tourism marketing convinces the Portuguese people to spend their vacancies inside the country it will reduce the exportations, therefore reinforcing again the import/export balance equilibrium.

The Northern region of Portugal is a very particular region that offers an interesting alternative to the so called 'mass tourism', focusing on the provision of a wide variety of tourism products that range from the beach, mountains, thermal/health spas, gastronomy and rural tourism, which has had a significant increase in recent years, (Fernandes, 2005).

In this respect, and given the substantial growth of this sector in the North of Portugal, the development of models is needed to make reliable forecasts of tourism demand. These forecasting models assume an important role for the process of planning and decision-making both within the public and private sectors.

Currently there are a wide range of methods that have emerged in response to most situations, displaying different characteristics and methodologies ranging from the simplest linear regression model to more complex approaches. The Box-Jenkins forecasting models belong to the family of algebraic models known as ARIMA models, which make it possible to make forecasts based on a given stationary time series. The methodology considers that a real time series amounts to a probable realization of a stochastic process. The aim of this analysis is to identify the model that best depicts the underlying unknown stochastic process and a good representation of its realization, i.e. of the real-time series. The ANN methodology also has had countless applications in the most diverse areas of knowledge and has been used in the field of forecasting as an alternative to classical models.

The authors already have used ANN models to predict the tourism demand in Portugal (Machado, Teixeira & Fernandes, 2010) and other in several regions of Portugal such the North region (Fernandes & Teixeira, 2007) and (Teixeira & Fernandes, 2011), Center region (Fernandes, Teixeira, Ferreira & Azevedo, 2008) and the Madeira Island (Teixeira & Fernandes, 2010).

Some different inputs have been experimented along time. The mostly used consists in using only the previous twelve values (months). Anyhow, the Tourism demand registered an increasing during last years and the ANN prediction improved when a time index has added in the input (Fernandes & Teixeira, 2009). Other studies (Teixeira & Fernandes, 2011) pointed out the influence of the weather in the tourism demand, at least for the short periods of unplanned vacation. Therefore the variable named insolation duration was used in the input of the ANN with improved results.

In the present paper the research questions concerns with the comparison of the combination of inputs, considering the previous twelve months, the time index and the insolation duration variable along the choice of the best architecture for the ANN dedicated to the prediction of the time series "Monthly Number of Guest Nights in the Hotels of the North Region of Portugal". In general ANN's applications the feedforward architecture performs better than others. In authors previous studies (Fernandes, 2005) the feedforward architecture has been used with success. Alternative architecture can improve the prediction? How the other architectures behave with this type of prediction? Which will be the best combination of inputs and architecture?

The aim of current research consists of the search and highlights the best architecture of the Artificial Neural Networks methodology and its input combination as an alternative to the classical models such as the Box-Jenkins methodology or the linear regression models for analysing tourism demand. The ANN

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