

Chapter 62

Computational Performance Analysis of Neural Network and Regression Models in Forecasting the Societal Demand for Agricultural Food Harvests

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ABSTRACT

Demand forecasting plays an important role in the field of agriculture, where a farmer can plan for the crop production according to the demand in future and make a profitable crop business. There exist a various statistical and machine learning methods for forecasting the demand, selecting the best forecasting model is desirable. In this work, a multiple linear regression (MLR) and an artificial neural network (ANN) model have been implemented for forecasting an optimum societal demand for various food crops that are commonly used in day to day life. The models are implemented using R tool, linear model and neuralnet packages for training and optimization of the MLR and ANN models. Then, the results obtained by the ANN were compared with the results obtained with MLR models. The results obtained indicated that the designed models are useful, reliable, and quite an effective tool for optimizing the effects of demand prediction in controlling the supply of food harvests to match the societal needs satisfactorily.

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1. INTRODUCTION

Demand planning plays a very strategic role in improving the performance of every business, as the planning for a whole lot of other activities depends on the accuracy and validity of this exercise (Sultana & Shathi, 2010). The field of agriculture is not an exception; demand forecasting plays an important role in this area also, where a farmer can plan for the crop production according to the demand in future. Hence, a system which could forecasts the demand for day-to-day food harvests and assists the farmers in planning the crop production accordingly may lead to beneficial farming business. The agricultural or farming system generates massive collections of data with the potential to reveal insights into optimizing costs and outcomes if analyzed with the proper tools.

Over the last few decades, statistical methods have been used largely to solve predictions and classifications problems. Some of the commonly used statistical techniques for predictions and classifications are multiple regression, logistic regression, discriminant analysis etc. Most of the researchers have been used regression models to solve the prediction problems in various scenarios. These days, neural network (NN) methods have been extensively used in prediction and classification problems. Neural network methods have become very significant models for a wide variety of applications across many disciplines where the statistical methods were being used. This has led many researchers to compare the traditional statistical methods with neural network methods in several of applications (Ali Aydın Koç, 2013). Many studies have shown the relationship between neural networks and statistical models in many disciplines.

This work is focusing on the power of modern predictive data analytics in educating the farmers towards the demand-based supply of food crops to reduce the loss and price variations. These problems have risen mainly due to the unsynchronized demand and supply of food crops (Balaji Prabhu & Dakshayini, 2018). Forecasting the needs of various food harvests may help us to build an effective analytical system in instructing the farmers for cultivating the food crops according to the actual necessity and make the agriculture as a successful business. Despite the availability of huge historical data about the crop demand, a gap between the demand for and supply of food harvests has resulted in significant loss for farmers and varied market prices causing the substantial encumbrance to the agriculture system.

The aim of this work is to find the best method for forecasting the societal demand for various food harvests by analyzing the computation performances of ANN and MLR forecasting methods. Forecasting is done using MLR and ANN forecasting models and also analyzed the computational performance in forecasting of these models using different performance parameters. A cloud-based system could be developed based on the selected model through which the developed system could effectively assist the farmers in cultivating the crops based on the forecasted demand. So that, the supply of the food harvest could be map with the demand avoiding the loss for farmers leading to sustainable farming.

The main contribution of this work is a novel ANN and MLR based high-performance computing models to forecast the demand for different food crops and select the best amongst them by comparing their performances in demand forecasting.

Rest of the paper is organized as follows; Section 2 gives a survey on ANN and MLR model, Section 3 briefs about the regression and neural network models. System architecture and methodology are explained in Section 4. Section 5 discusses the implementation and performance analysis of the models. Section 6 concludes the paper.

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