The Akahappa Case Study

The Akahappa Company specializes in ready-to-eat meals. The company operates a three-tier supply chain with a factory, warehouses, and retailers. Akahappa delivers directly to the warehouses of its two largest distributors. The sales department records sales on a daily basis, which are then used by the operations department for developing forecasts used for planning purposes.

Since many consumers will switch to the competitor's brands if product is out-of-stock, underforecasting results in lost sales. On the other hand, overforecasting results in excess inventory, which becomes obsolete and has to be destroyed because of the perishable characteristics of the products. Therefore, producing an accurate forecast is very important.

The company has decided to develop new forecasting models for curry, which is one of the most valuable product categories of the company. The company produces two kinds of curry: green thai curry and vegetable korma curry. The warehouse records sales on a daily basis but only days with sales are reported. You are given 9 years of sales data.

You are given two sets of data: the historical demand data of green thai curry (D_{A}) and korma curry (D_{B}). Carry out steps 1 to 6.

1. Develop neural network models for forecasting the demand of each individual product, i.e. use D_{A} for green thai curry and D_{B} for vegetable korma curry. In either case, use 85% of the data for training and the rest for testing. Use a single hidden layer. Vary the number of neurons in the hidden layer using 3, 5, 7, and 9 neurons (for each architecture, record the Akaike Information Criteria). Let the predictions of each model be F_{A} and F_{B}, respectively.

    1.1 Make a table that shows the Akaike Information Criteria for each number of neurons for product-level model F_{A}.

    1.2 Report the best number of neurons in the hidden layer of the product-level model F_{A}.

    1.3 Repeat 1.1 and 1.2 for F_{B}.

2. **Approach 1.** Use the results of the product-level models in Step 1 to calculate a forecast for the curry category. In other words, the forecast of the curry category is equal to forecast with F_{A} + forecast with F_{B}.

3. **Approach 2.** Develop an ***aggregate*** neural network model for the curry category, using the total demand given by D_{A} + D_{B} as input data. Use 85% of the data for training and the rest for testing. Use a single hidden layer. Vary the number of neurons in the hidden layer using 3, 5, 7, and 9 neurons, to train four ANN models (for each architecture, record the Akaike Information Criteria).

    3.1 Make a table that shows the Akaike Information Criteria for each number of neurons for the aggregate model.

    3.2 Report the best number of neurons in the hidden layer for the aggregate model.

4. Use scatter plots to compare predicted against actual values for approaches 1 and 2.

5. Report the precision of approaches 1 and 2 in terms of Root Mean Squared Error and determination coefficient r^2.

6. Write a paper in which you briefly explain: data understanding, data preparation, modeling, and evaluation steps according to the CRISP methodology. Include a table listing the **activities carried out by each team member**. Limit the length of the paper to a maximum of four pages. Include an Excel or Python file with the calculations of Step 5. Also, include the Jupyter Notebooks that you used to generate the models.

Note: Remember that the data preparation requires the identification, removal, and replacement of outliers. If such a preparation is needed document the approach that you followed.

The following references provide information for the detection and processing of outliers:

Hampel filter

https://medium.com/wwblog/clean-up-your-time-series-data-with-a-hampel-filter-58b0bb3ebb04

Outlier identification and replacement

https://www.pluralsight.com/guides/cleaning-up-data-from-outliers

Outlier detection in Python

https://towardsdatascience.com/practical-implementation-of-outlier-detection-in-python-90680453b3ce