Forecasting of Foreign Tourists' Arrivals in Bangladesh: A Neural Network Approach

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Abstract: Forecasting of foreign tourists' arrivals in any destination country is very important for the tourism industry of that country. It has direct impact on social, cultural, educational and economic sectors of most countries. In this paper a feed-forward neural network model was used to forecast foreign tourists' arrivals in Bangladesh. Some other models like naive, simple moving average, single exponential smoothing and multiple regression model were used for comparison with neural network model. One output variable and seven input variables were used. The output of the neural network model represented the foreign tourists' arrivals in Bangladesh. Data from various sources for the previous thirty years were used. The estimated foreign tourists' arrivals were compared with the actual officially published foreign tourists' arrivals. Empirical results showed that neural network model outperformed other forecasting models. For the purpose of forecasting the next ten year's foreign tourists' arrivals by neural network model, two other methods named double moving average method and trend forecasting method were used to predict the variables. Finally next ten years foreign tourists' arrivals were forecasted by the neural network model using the predicted values of the variables from trend forecasting method as it showed higher accuracy than double moving average method.

1. Introduction

Bangladesh is a country of Asian region holding high potentiality of tourism. The country can earn a huge amount of foreign exchanges from this industry. The annual foreign earnings from tourism were 331 Million BDT in 1991, 2653.8 Million BDT in 2001 and it went to 7947 Million BDT in 2010 (Source: Special Branch, Bangladesh Police, Statistical Report, Resource Center, BPC and Bangladesh Bank). According to the statistics of the country's National Tourism Authority (NTA), a total of 3,49,837 foreign tourists visited Bangladesh in 2008, which was about 21 percent higher than that in 2007. Despite the rise in number of tourists' visits, the incomes from the tourism sector in 2008 came down to 4.60 billion BDT (about 65.7 million U.S. dollars) in 2008 from 5.27 billion BDT (about 75.3 million U.S. dollars) in 2007. Also, during the five years (2006-2010), Bangladesh received a total number of 15, 29,000

visitors and earned US$ 413.00 million (Ahmad 2013). The country is trying from the inception of this industry to attract more tourists to its destinations and to earn more foreign currency from this sector. The statistics on this sector shows that both the arrivals and earnings from tourism in Bangladesh have increased over the past.

In a developing country like Bangladesh, researchers, practitioners and policy makers have the necessity of accurate forecasting for tourism demand. Accurate forecasting is very important as it would help managers and investors make operational, tactical and strategic decisions which involves scheduling and staffing, preparation of tour brochures etc (Law & Au 1999). At present, tourism industry in Bangladesh is facing serious challenges. Bangladesh is seen by many as overcrowded and over expensive, could seriously affect the number of future international tourists' arrivals in Bangladesh. If forecasting is not properly done, there may be loss for the government or the different services for the tourism may not be satisfactory. As a result tourists' won't show their eagerness to visit Bangladesh. So an accurate forecast from neural network models could certainly help industry practitioners and official policy makers improve their planning and decision making. The objective of this research is to forecast foreign tourists' arrivals in Bangladesh using different forecasting methods and compare them to select the best method to provide prediction for the future periods. In second section of this paper, there is an overview of the previous works regarding international tourism demand forecasting. Next section describes the theoretical background of neural network and other forecasting models and shows how they work. After that, methodology, data collection and model development process is described in section four. An experiment section then follows to present the empirical results of different forecasting methods and forecasting process for the next ten years is described here. Then the empirical results are analyzed in terms of three error measurement techniques in section six. Finally, a conclusion section outlines the significance of this research and suggests future research possibilities.

Various types of works were done to forecast foreign tourists' demand in different cities of many countries. Kuo, Chiang and Chiang (2010) forecasted tourist arrivals in Taiwan by using Artificial Neural Network (ANN) modelling. The variables were population, GDP, foreign exchange rate, tourism marketing expenses, average hotel rates and tourist arrivals. Law and Au (1999) worked on forecasting Japanese demand for travelling to Hong Kong using neural network model. Service price, average hotel rate, foreign exchange rate, population, marketing expenses and gross domestic expenditure were used as the six nodes in the input. It was suggested that a possibility of future research could be to include some qualitative exogenous variables in the neural network model, such as Government policies and weather condition in determining annual or seasonal tourist arrivals. Loganathan, Nanthakumar and Ibrahim (2010) forecasted international tourism demand in Malaysia. In this work ARIMA model or well known as Box Jenkins model were applied. Padhan (2011) worked on forecasting international tourists footfalls in India. An assortment of univariate time series forecasting models for monthly data spreeding over December 1990 to January 2010 was used to forecast international tourist footfalls in India. Lin (2011) forecasted tourism demand using time series, artificial neural networks and multivariate adaptive regression splines. Fernandes et.al (2011) forecasted tourism demand with artificial neural network (ANN) focusing on to Portuguese regions North and Centre as tourism destinations offering a large number of tourist products that goes beyond the beach, the mountains, the thermals not forgetting the rural tourism that has growing in the last years. Lin and Lee (2013) researched on tourism demand forecasting based on monthly data of tourists to Taiwan. Multivariate adaptive regression splines (MARS) artificial neural network (ANN) and support vector regression (SVR) were adopted to develop the forecast models and compare the forecast result. Cuhadar (2014) worked on modeling and forecasting inbound

tourism demand to Istanbul. It was observed that forecast by the seasonal exponential Smoothing model provided quite good result. Claveria, Monte and Torra (2015) studied about tourism demand forecasting with neural network models. Yao, Ma, Jin, Ge and Ren (2014) forecasted real time tourist arrivals using hierarchical cluster and Gaussian fitting Algorithm. Mamula (2015) examined the forecasting accuracy of different forecasting technique in modelling and forecasting international tourism demand in Croatia. Ali and Shabri (2016) worked on modeling Singapore tourist arrivals to Malaysia. Two Machine Learning Methods, Artificial Neural Network (ANN) and Support Vector Machine (SVM) were studied to predict the Singapore tourist arrival to Malaysia. It was shown that ANN model outperforms SVM based on the criteria Root Mean Squared Error (RMSE) as ANN model showed the smallest RMSE. Gnanapragasam and Cooray (2016) forecasted post war tourist arrivals to Sri Lanka using dynamic transfer modelling method. Huang and Hou (2017) applied Artificial Neural Network (ANN) combined with Genetic Algorithm (GA) to establish a prediction model of air ticket sales revenue. Yahya, Samsudin and Shabri (2017) forecasted Tourism Demand Using Hybrid Modified Empirical Mode Decomposition (EMD) and neural network. Intrinsic mode functions (IMF) produced via EMD was utilized in this new approach by reconstructing some IMFs through Trial and Error Method, which was referred in this research as decomposition.

The previous works were done in different countries using different forecasting methods. There are some prior studies on modeling and forecasting tourism demand to some tourism destinations of different countries of the world, but no research is available on forecasting foreign tourists' arrivals in Bangladesh using neural network model and this research will fill this gap.

2. Theoretical Background

A Neural Network (NN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. NNs, like people, learn by example. A NN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of NNs as well (Stergiou & Siganos n.d.).

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an expert in the category of information it has been given to analyze. A neural network consists of an input layer, an output layer, and usually one or more hidden layers. Each of these layers in neural network contains nodes and these nodes are connected to nodes at adjacent layer. Figure 1 demonstrates simplified neural network with three layers. Each node in a neural network is a processing unit that contains a weight and a summation function. A weight (w) returns a mathematical value for the relative strength of connections to transfer data from one layer to another layer; whereas a summation function (y) computes the weighted sum of all input elements entering a processing unit. In figure 1, each node in the hidden layer computes y_j (j=1, 2, 3) in the following way:

$$Y_j=\sum_{i=1}^{2} x_i w_{ij}$$

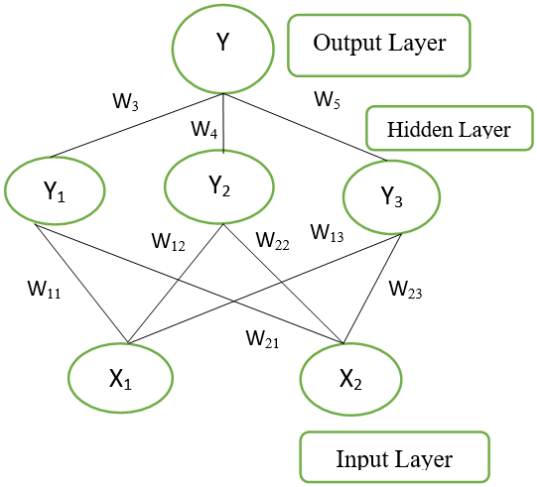
Also, a sigmoid function (y_T) in the following form is used to transform the output so that it falls into an acceptable range. This transformation is done before the output reaches the next level. The purpose of a sigmoid function is to prevent the output value from being too large, as the value of y_T must fall between 0 and 1:

$$y_T = \frac{1}{1+e^{-y}}$$

Finally, Y in node of the output layer in figure 1 is obtained by the following summation function:

$$Y = \sum_{i=1}^{3} y_{Ti} w_i$$

Figure 1: A Neural Network Model



Nodes in the input layer represent independent variables of the problem. For instance, to determine a person's credit rating, a financial institution needs information about that person's income level, education background and home ownership status as the essential input variables. The hidden layer is used to add an internal representation of handling non-linear data. The output of a neural network is the solution to a problem. To demonstrate, a numeric value from the output node is used to represent the credit rating of an individual loan applicant (Law & Au 1999).

A supervised feed-forward neural network learns from training data to discover patterns representing input and output variables. Usually, the process of learning involves the following stages.

(i) Assign random numbers to the weights.
(ii) For every element in the training set (a set of sample observations used to develop the pattern or relationship among the observations), calculate output using the summation functions embedded in the nodes.
(iii) Compare computed output with observed values
(iv) Adjust the weights and repeat steps (ii) and (iii) if the result from step (iii) is not less than a threshold value.
(v) Repeat the above steps for other elements in the training set.

The simplest model for forecasting tourists' demand is the naive model or random walk model, where the current value will be the future value. It means best forecast of next months' value is this month's value. This model is suitable when the data follows random process. A simple moving average is a method of computing a specified number of the most recent data values in a series. In most cases, this method is applied to forecast for only one period into the future. Basically three different smoothing models are widely applied in different areas. Those are namely simple exponential smoothing model, Holt's linear exponential smoothing model, Holt's-Winter's multiplicative seasonal model. The essence of the simple exponential smoothing model is that the weights assign to each observation exponentially decreases over time. Regression means dependence and involves estimating the value of dependent variable Y, from an independent variable X. In simple regression, only one independent variable is used, whereas in multiple regression two or more independent variables are involved.

3. Methodology

The methodology of forecasting foreign tourists' arrivals in Bangladesh is given below which starts from the selection of the independent variables and ends with the forecast of tourists' arrivals in Bangladesh.

1. Selection of the independent variables which affect the foreign tourists' arrivals.

2. Collection of data of independent and dependent variables from different related Sources.

3. Building a neural network model and input data for training and testing to achieve the output.

4. Forecasting of foreign tourists' arrivals by naive, simple moving average, single exponential smoothing and multiple regression model.

5. Measurement of MAPE, Normalized Correlation Coefficient (r) and Acceptable Output Percentage (Z) for every forecasting method.

6. Comparing the forecasts of neural network model with the outputs of other forecasting methods.

7. Selecting best method to forecast the independent and dependent variable for the future periods.

8. Using the forecasted variables from the best method in the neural network model.

9. Forecasting the foreign tourists' arrivals for the next ten years by neural network model.

Secondary Sources of data were used in this work. The selection of data for the neural network was based on data availability, the reliability of the data sources and measurability of variables in the modeling Process. Table 1, containing relevant data for forecasting foreign tourists' arrivals in Bangladesh in the period 1987-2016, was set up from the sources of Bangladesh Parjatan Corporation, Bangladesh Tourism Board, Bangladesh Bank, Different hotels and motels of Bangladesh, Bangladesh Meteorological Department and the website of worldbank.

In this research, all monetary values were measured in US$. Foreign tourists' demand for travelling to Bangladesh, measured by the number of foreign tourists' arrivals, can be stated as

$$Y=f\ (AHR, TME, FTE, CI, Currency, AT, POP)$$

Where Y is the number of foreign tourists' arrivals in Bangladesh. AHR is the average hotel rate in Bangladesh, TME is the tourism marketing expenses to promote Bangladesh's tourism industry

Table 1: Data of different input and output variables to forecast foreign tourists' arrivals

Year	AHR (US$)	TME (US$)	FTE (US$)	CI (US$)	Currency (Tk/U	AT (°C)	POP (Persons)	Tourists Arrivals (Persons)
2016	82.121	35644.	1631646	192188.0	78.47	26.31	597134658	643094
2015	82,90	35355.	1458500	732443.8	77.95	25.01	595916414	604394
2014	79.3	34969.	1580800	2767903.	77.64	24.74	589623084	325000
2013	76.96	34084.	1215836	761843.7	78.1	24.69	583308155	278780
2012	70.45	21871.	1009532	1533410.	81.86	24.76	577038706	588193
2011	75.66	34497.	8363587	2451786.	74.15	24.94	570820430	593667
2010	69.95	36008.	7986992	934673.3	69.65	25.38	564745311	303386
2009	70.56	35617.	8346234	1358632.	69.04	26.08	558518203	267107
2008	71.16	35131.	8954081	619533.5	68.6	26.12	552282421	467322
2007	73.34	34325.	7645114	653404.9	68.87	25.41	545972918	289110
2006	71.02	33613.	8023574	406563.0	68.93	25.41	539712659	200311
2005	74.39	35146.	6985683	186538.1	64.33	25.91	533429609	207662
2004	74.66	37069.	6667047	302470.1	59.51	25.5	527150535	271270
2003	75.06	37007.	5692175	171969.0	58.15	25.44	520874363	244509
2002	73.12	36258.	5722231	552772.5	57.89	25.33	514604577	207246
2001	75.65	37135.	4755061	1299767.	55.81	25.41	508302996	207199
2000	78.36	38319.	5038358	711162.2	52.14	24.84	501938694	199211
1999	83.32	39702.	4994703	548991.6	49.09	25.67	495499505	172781
1998	82.63	40737.	5232999	1765393.	46.91	25.52	488968817	171961
1997	86.53	42492.	6246069	1011619.	43.89	24.84	482319976	182420
1996	85.76	43742.	3360134	658052.1	41.79	25.3	475578426	165887
1995	87.54	44265.	2371400	372393	40.28	25.4	468794558	156231
1994	83.76	43471.	1888584	659040.0	40.21	25.04	134192772	140122
1993	83.02	43113.	1502148	1048774.	39.57	24.73	131972342	126785
1992	79.02	42926.	8449294	1283697.	38.95	24.8	129724737	110475
1991	83.52	44808.	9057377	478142.0	36.6	24.93	441196690	113242
1990	82.93	46253.	8761932	868238.3	34.57	25.37	434081173	115369
1989	87.88	48590.	9163310	1348775.	32.27	25.35	426896352	128064
1988	83.47	48219.	9138040	881657.7	31.73	25.72	419690521	120782
1987	84.87	48465.	9204200	405654.2	30.95	25.61	412497791	106765

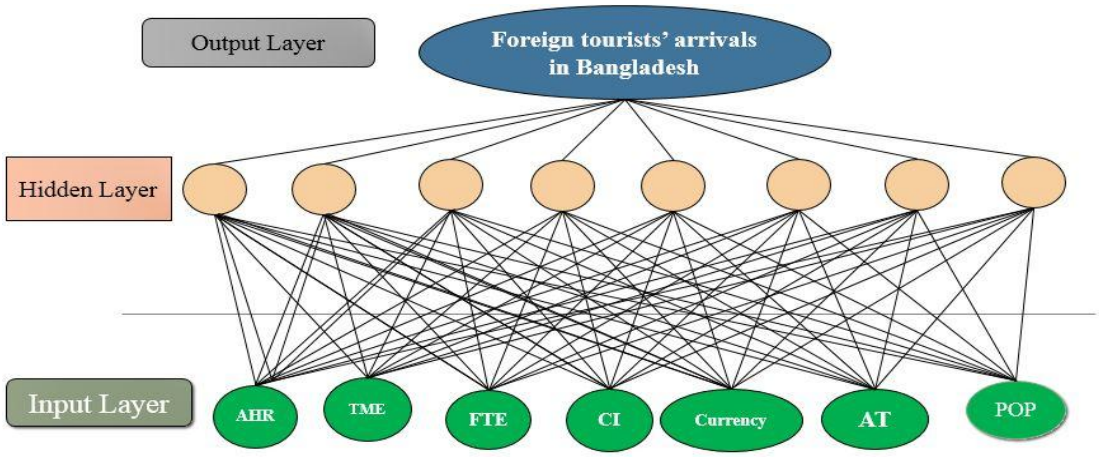
FTE is the foreign tourist's expenditure, CI is the capital investment for tourism in the destination country, Currency is the dollar exchange rate or foreign exchange rate, AT is the

average temperature which is the mean temperature of a year of the destination country, POP is the population of the origin countries. Previous studies have suggested that the exogenous variables in econometric forecasting models for international tourism demand comprise mainly: the population and income of the origin country, the cost of living of the destination country, currency, foreign exchange rate, marketing expenditure on promotional activities in the destination country (Lim 1997). In this research, due to data unavailability, AHR was used as a proxy for the cost of living of tourists in Bangladesh. TME was used as a proxy for marketing expenses to promote Bangladesh's tourism industry. Tourism marketing expense includes massive advertisement through various media, personal selling, sales promotion, publicity etc. Foreign tourist's expenditure is the earnings from the tourists' and capital investment is the capital invested from the government or from private sector. Currency indicates the foreign exchange rate or dollar exchange rate which is another important variable of the input layer in the neural network model. It is reasonable to believe that weather conditions play an important role in determining annual or seasonal tourists' arrivals, leading to notable change in demand for tourism (Law & Au 1999). Average temperature affects the foreign tourists' arrivals in Bangladesh, that's why in the winter season there are the highest number of foreign tourists' arrivals in Bangladesh and in the summer season tourists' arrivals is the lowest. Population indicates the summation of all the countries population from which tourists' are coming to Bangladesh.

This research establishes a neural network to model foreign tourists' arrivals in Bangladesh. Figure 3 shows the neural network with a hidden layer of eight nodes which was used in this research to determine the number of foreign tourists' arrivals in Bangladesh.

This adopts the data of table 1 for network training and testing. Among the thirty sample entries, all sample entries were randomly selected to form the training set, while ten of them were used for accuracy testing (validation). The seven nodes in the input layer are Average hotel Rate (AHR), Tourism marketing Expenses (TME), Foreign Tourist's Expenditure (FTE), Capital Investment (CI), Currency, Average Temperature (AT) and Population of the origin countries (POP). The output variable used in this research was Y, representing the number of foreign tourists' arrivals in Bangladesh in a given year. A program was developed using MATLAB R2016a for the neural network model. There were seven input nodes (independent variables) and one output node (dependent variable). Empirical findings are presented in the next section.

Figure 3: A demand neural network model for travelling by foreign tourists' to Bangladesh.



4. Results

Results from other Forecasting models-

Three other time series forecasting models and multiple regression model were used to forecast the foreign tourists' arrivals in Bangladesh. Three time series models are naive, simple moving average (3) and single exponential smoothing (0.2). These are common models in tourism demand forecasting. When using these models, no assumptions about the dependence relationship are made and these are easy to implement. These models generate relatively accurate forecasts for international tourism demand when annual data are used. Mathematically naive model can be expressed as,

$$Yt+1=Yt$$

Where Yt is actual value and Yt+1 is the forecasted .

value for the next year. The formula to compute the Simple Moving Average (SMA) is as follows.

$$Mt= 1/n\{Dt-(n-1) +Dt-(n-2) +----------+Dt-2+Dt-1+Dt\}$$

Where Mt is the simple moving average at the end of period t (It is to be used as a forecast for period t+1), Dt is the actual demand in period t, n is the number of periods included in each average. n was taken three years in this research. Single exponential smoothing method were used in this research to forecast for the foreign tourists' arrivals for the year 2007-2016. All the calculations were done by the Minitab17 software. The smoothing constant (α) were 0.2 in this forecasting procedure. Widely adopted in international tourists' arrivals demand forecasting, multiple regression models attempt to identify the relevant variables and estimate the relationship between the independent variables and dependent variable in terms of parameters. The model for multiple linear regression is shown below:

$$Y=a+b1X1+b2X2+b3X3+biXi+----------+bnXn$$

Where, Y=Dependent variable, Xi= ith independent variable, a= Intercept, bi =Slope of the independent variable Xi. The equation for curvilinear regression is shown below.

$$Y=a+b1X+b2X2+b3X3$$

In this research, at first a regression equation was found from the input and output variable and after that a program was developed to find out the output from that equation. Table 2 shows the empirical findings of the different forecasting models. In table 2, every forecasting method shows output for the year 2007-2016. Accuracy measurement of different forecasting models is based on mean absolute percentage error (MAPE), acceptable output percentage (Z) (within a ±15% range) and normalized correlation coefficient (r). Mean Absolute Percentage Error (MAPE) is the mean value of percent deviations of the forecast demands from the actual demands. The formula to measure MAPE is

$$\text{MAPE}=\frac{\sum_{i=1}^{n}|Xi-Yi|/Yi}{n}*100\%.$$

Acceptable output percentage (Z) is used as a relative measurement for acceptance level. As a reference point for optimal experimental outcome Z is set for ±15%. The formula to measure Z is

$$\text{Z}=\frac{\sum_{i=1}^{n}J}{n}*100\%\ for\ \begin{cases} j=1\ if\ \frac{|\text{Xi}-\text{Yi}|}{\text{Yi}}\ldots\leq 0.15 \\ j=0\ otherwise, \end{cases}$$

Normalized correlation coefficient measures the closeness of the observed and the estimated value. The formula is

$$\text{r}=\frac{\sum_{i=1}^{n}(Xi*Yi)}{\sqrt{\sum_{i=1}^{n}\{(Yi)*(Yi)\}*\sum_{i=1}^{n}\{(Xi)*(Xi)\}}}$$

Where Xi=Forecasted number of tourists' arrivals in several years, Yi= Actual number of tourists' arrivals in several years, n=Total number of years. Values of MAPE, Z and r for different forecasting models are presented in Table 3.

Forecast for Next Ten Years-

When using the neural network model to forecast for the future periods, it is necessary to forecast the independent variables of the input layer and the output variable for the future periods. Three time series forecasting models and multiple regression model cannot forecast for the future periods of many years. For this reason, two other forecasting models, double moving average and trend forecasting methods were used to forecast the independent and dependent variables for the next ten years. Double moving average method is applicable to trend data pattern. In this research, forecasting of foreign tourists' arrivals in Bangladesh using double moving average method was performed by taking three years moving average. After calculating the simple moving average, double moving average was calculated. Trend forecasting was done using the Minitab17 software.

Table 2: Experimental results of forecasting foreign tourists' arrivals for travelling to Bangladesh

Year	Actual number of visitors	Neural Network	Naive	Moving Average	Exponential smoothing	Multiple Regression
2007	289110	290394	200311	226414	223104	352429
2008	467322	461613	289110	232361	271947	323442
2009	267107	255515	467322	318914	270979	335636
2010	303386	353860	267107	341180	277461	262001
2011	593667	593784	303386	345938	340702	463375
2012	588193	580153	593667	388053	390200	504537
2013	278780	286909	588193	495082	367916	418621
2014	325000	331133	278780	486880	359333	434294
2015	604394	603806	325000	397324	408345	492173
2016	643094	833999	604394	402725	455295	544671

Table 3: An accuracy comparison in sample for different forecasting models

Forecasting Model	MAPE	Z	r
Neural Network	5.86	80	0.9936
Naive	38.30	40	0.9159
Multiple Regression	24.58	20	0.9759
Exponential	25.51	30	0.9712
Moving Average	37.86	10	0.9240

For the better accuracy, error measurement of both the forecasting method named double moving average method and trend forecasting method were done to select the best method. Table 4 shows the forecasted number of foreign tourists' arrivals by double moving average and trend forecasting methods.

Table 4: Double moving average method and trend Forecasting method output for tourists' arrivals

Year	Double	Trend
2007	262780	339896
2008	230469	354978
2009	438282	370060
2010	428570	385142
2011	367126	400224
2012	447379	415306
2013	665864	430388
2014	547296	445470
2015	272448	460551
2016	350223	475633

Table 5 shows MAPE for the double moving average and trend forecasting method. From the table it is seen that MAPE for double moving average is 53.50% and for trend forecasting is 31.04% which is lower than double moving average.

Table 5: Relative MAPE between Double Moving Average and Trend Forecasting.

Year	Double	Trend
2007	9.11	17.57
2008	50.68	24.04
2009	64.08	38.54
2010	41.26	26.95
2011	38.16	32.58
2012	23.94	29.39
2013	138.85	54.38
2014	68.40	37.07
2015	54.92	23.80
2016	45.54	26.04
MAPE	53.50	31.04

As trend forecasting gives higher forecasting accuracy, it was used to predict the different independent variables of the input layer and the output variable. By using the independent and dependent variables predicted by trend forecasting method, the next ten years foreign tourists' arrivals in Bangladesh was forecasted using neural network model. Table 6 shows the neural network output of foreign tourists' arrivals in Bangladesh from the year 2017 to 2026.

Table 6: Forecasting of foreign tourists' arrivals in Bangladesh for next ten years using NN model.

Year	Neural network
2017	572851
2018	606310
2019	640533
2020	675219
2021	710019
2022	744543
2023	778378
2024	811120
2025	842384
2026	871838

5. Discussion

Experimental results in table 3 reveal that the number of foreign tourists' arrivals estimated by a neural network is very close to the actual values. In other words the forecasting output from a neural network is accurate, with a relatively small amount of error. The low MAPE indicates that the deviations between the discrepancies between the predicted values derived by the neural network and the actual values are very small. From the results it is shown that neural network model gives the lowest MAPE with 5.86%. From table 3, it is seen that multiple Regression Model gives the second lowest MAPE with a value of 24.58% and exponential smoothing method, simple moving average method and naive forecasting model give MAPE of 25.51%, 37.86% and 38.30%. As discussed earlier, Z indicates the acceptable output percentage. Within

a 15% discrepancy range, a neural network succeeds in achieving 80% of output in the acceptable range. It is seen that naive forecasting model gives an acceptable output percentage of 40 and multiple regression model, exponential smoothing method and simple moving average method give 20%, 30% and 10% of output in the acceptable range. As discussed earlier, r indicates the normalized correlation coefficient. The normalized correlation coefficient for the neural network is the highest with the value of almost 1. This demonstrates the close relationship between the estimated results and the actual tourism data. It is seen from the table 3 that naive forecasting method shows a normalized correlation coefficient of 0.9159 and multiple regression model, exponential smoothing method and simple moving average method gives normalized correlation coefficient of 0.9759, 0.9712 and 0.9240. As indicated in table 3, neural network model outperforms the multiple regression Model, naive Model, simple moving average method and exponential smoothing method in forecasting accuracy. Forecasting accuracy is based on MAPE, Acceptable output range (Z) and Normalized Correlation coefficient (r).

6. Conclusions

Practitioners and policy makers may confidently apply neural network model to forecast foreign tourists' arrivals in Bangladesh. Experimental results demonstrated that the forecasting error is less for neural network model than that of multiple regression, naive, moving average and exponential smoothing which indicates the feasibility of applying a neural network model to practical international tourism demand forecasting. Neural network model shows MAPE of 5.86% which is the lowest among all the forecasting models. Else neural network model gives 80% output in the acceptable range while other forecasting models give less than 40% output in the acceptable range. Normalized correlation coefficient for neural network model is 0.9936, which is the highest value among all the normalized correlation coefficient values for other forecasting models. Foreign tourists' arrivals for the future ten years were forecasted using neural network model. For the prediction of the independent and dependent variables to use in the neural network model, trend forecasting was used as it shows lowest MAPE with a value of 31.04% while double moving average shows MAPE of 53.50%. As exogenous variables like government policies and weather conditions can be used for tourism demand forecasting, weather condition is used in this thesis work. Government policies and business transactions can be included as exogenous variable in the neural network model to forecast foreign tourists' arrivals for travelling to Bangladesh. Finally due to the unavailability of seasonal data for most of the variables, only annual data were used in the research. Another potential area for future research could be to build a neural network model for tourism demand forecasting using seasonal data. Some of the previous works state that sometimes SARIMA model gives better output than NN model. So SARIMA model can be used to forecast foreign tourists' arrivals in Bangladesh.

7. References

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