J. Sains Dasar 2017 6 (2) 81 - 90

PREDICTION OF TOURIST ARRIVALS TO THE ISLAND OF BALI WITH HOLT METHOD OF WINTER AND SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (SARIMA)

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Abstract

The tourism sector is one of the contributors of foreign exchange is quite influential in improving the economy of Indonesia. The development of this sector will have a positive impact, including employment opportunities and opportunities for entrepreneurship in various industries such as adventure tourism, craft or hospitality. The beauty and natural resources owned by Indonesia become a tourist attraction for domestic and foreign tourists. One of the many tourist destination is the island of Bali. The island of Bali is not only famous for its natural, cultural diversity and arts but there are also add the value of tourism. In 2015 the increase in the number of tourist arrivals amounted to 6.24% from the previous year. In improving the quality of services, facing a surge of visitors, or prepare a strategy in attracting tourists need a prediction of arrival so that planning can be more efficient and effective. This research used Holt Winter's method and Seasonal Autoregressive Integrated Moving Average (SARIMA) method to predict tourist arrivals. Based on data of foreign tourist arrivals who visited the Bali island in January 2007 until June 2016, the result of Holt Winter's method with parameter values $\alpha=0.1$,$\beta=0.1$,$\gamma=0.3$ has an error MAPE is 6,171873. While the result of SARIMA method with (0,1,1) 〖(1,0,0)〗12 model has an error MAPE is 5,788615 and it can be concluded that SARIMA method is better.

Keywords: Foreign Tourist, Prediction, Bali Island, Holt-Winter's, SARIMA.

Introduction

Indonesia has beautiful culture and nature which became international and domestic tourist interest. Growing number of tourists visit elicit positive impact for Indonesia: increasing economic growth and provide vacancy for local community. One of the most popular tourist destinations in Indonesia is Bali. The number of international tourist arrival is increasing annually. It is noted that in 2015 there are 6.24% increase in tourist arrival compared to the previous year (Bali Government Tourism Office, 2015). To increase quality of service, anticipating surge in tourist arrival or preparing strategies to attract more tourists, a prediction of tourist arrival should be made for more efficient and effective planning. Forecasting is a method to predict future events by reflecting past events. Forecasting methods are classified into two methods: causal and time series method. Both of these methods are the most popular method and 60% of studies conducted since year 2000 used time series method. Forecasting tourist arrival was pioneered in the beginning of year 1960. [2]

Proper forecasting method to predict tourist arrival is Holt Winter's method and Seasonal Autoregressive Integrated Moving Average (SARIMA) method. Both of these methods may be used on data comprising seasonality and trend. Holt Winter's method uses three smoothing parameters: level, trend and seasonality. SARIMA method is a time series method developed by Box Jenkins which may be used in various data patterns, either stationary or non-stationary. Holt Winter's and SARIMA method have been frequently used as an alternative solution and have been used in various studies conducted in implementing this problem, including studies by Saayman (2010) about Forecasting Tourism Arrivals in South Africa and by Widiarsih [7] about comparative analysis of Holt Winter and SARIMA method in forecasting statistics of international tourist arrival at Kraton Yogyakarta.

This paper is about a study aimed to predict the number of international tourist arrival in Bali using Holt Winter and Seasonal Autoregressive Integrated Moving Average (SARIMA) also picking the best method among the two.

Holt Winter's method could be used on data pattern comprising trend and seasonality. This method uses three smoothing parameters: α , β , γ located between 0 and 1. The parameters' value could be calculated by trial and error. Holt Winter's Multiplicative equation is as follows: (Makridakis, 1999)

$$L_t = \alpha \frac{Y_t}{S_{t-s}} + (1-\alpha)(L_{t-1} + b_{t-1}) \quad (1)$$

$$b_t = \beta(L_t + L_{t-1}) + (1-\beta)b_{t-1} \quad (2)$$

$$S_t = \gamma \frac{Y_t}{L_t} + (1-\gamma)S_{t-s} \quad (3)$$

$$F_{t+m} = (L_t + b_t m)S_{t-s+m} \quad (4)$$

Whereas:

s is length of seasonality, L_t overall estimate value, b_t trend component, S_t seasonal component, F_{t+m} is the estimate for m in the next period.

Initializing Process:

Initializing current smoothing constant:

$$L_s = \frac{1}{s}\left[Y_1 + Y_2 + Y_3 + \ldots + Y_s\right]$$

Initializingtrend:

$$b_s = \frac{1}{s}\left[\frac{Y_{s+1} - Y_1}{s} + \frac{Y_{s+2} - Y_2}{s} + \ldots + \frac{Y_{s+s} - Y_s}{s}\right]$$

Initializing seasonality index :

$$S_1 = \frac{Y_1}{L_s},\quad S_2 = \frac{Y_2}{L_s},\ \ldots,\quad S_s = \frac{Y_s}{L_s}$$

Autoregressive Integrated Moving Average (ARIMA)

ARIMA is good for calculating short term forecasting (Ekananda, 2014). Makridakis (1999) stated that steps in ARIMA method are model identification, parameter estimation, diagnostic tests and forecasting. ARIMA model are represented as (p,d,q) in general.

ARIMA model with order (p,d,q)

$$\phi_p(\mathrm{B})(1-\mathrm{B})^d X_t = \theta_0 + \theta_q(\mathrm{B})e_t \quad (5)$$

Seasonal Autoregressive Integrated Moving Average (SARIMA)

Seasonal ARIMA or SARIMA have a common form of $(p,d,q)(P,D,Q)^S$ and is written as follows

$$\phi_p(\mathrm{B})\Phi_p(\mathrm{B}^S)(1-\mathrm{B})^d(1-\mathrm{B}^S)^D X_t = \theta_q(\mathrm{B})\Theta_Q(\mathrm{B}^S)e_t \quad (6)$$

e_t : error

X_t : Observed value at time of t (t = 1,2,...,n)

$(1-\mathrm{B})^d$: Mathematical operation of non-seasonal differencing

$(1-\mathrm{B}^S)^D$: Mathematical operation of seasonal differencing

$\phi_p(\mathrm{B})$: Autoregressive operator = $(1-\phi_1\mathrm{B}-\phi_2\mathrm{B}^2-\ldots-\phi_p\mathrm{B}^p)$

$\Phi_P(\mathrm{B}^S)$: Seasonal autoregressive operator = $(1-\Phi_1\mathrm{B}^S-\Phi_2\mathrm{B}^{2S}-\ldots-\Phi_P\mathrm{B}^{PS})$

$\theta_q(\mathrm{B})$: Moving average operator = $(1+\theta_1\mathrm{B}+\theta_2\mathrm{B}^2+\ldots+\theta_q\mathrm{B}^q)$

$\Theta_Q(\mathrm{B}^S)$: Seasonal moving average operator = $(1+\Theta_1\mathrm{B}^S+\Theta_2\mathrm{B}^{2S}+\ldots+\Theta_Q\mathrm{B}^{QS})$

(Ibrahim, 2016)

Data And Methods

Based on the previous elaborations, Bali was one of the top tourist destinations for international tourists. Prediction of tourist arrival was important to understand the dynamics of tourism sector in Bali. Table 1 showed data of international tourist arrival per January 2007-June 2016. Data were used to calculate the prediction of international tourist arrival during July 2016-December 2016. It could be seen clearly from Figure 1 that there were trend and seasonality pattern from the data.

Table 1. Data of International Tourist Arrival in Bali Island during January 2007- June 2016

Tahun	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agu	Sep	Okt	Nov	Des
2007	109.875	118.483	119.458	125.393	129.039	145.500	164.972	167.031	152.804	146.385	142.124	147.467
2008	139.872	155.153	153.929	147.515	159.877	170.994	183.122	187.584	181.033	180.944	142.014	166.855
2009	164.643	139.370	161.169	179.879	181.983	190.617	224.636	222.441	208.185	210.935	163.531	182.556
2010	168.923	187.781	194.482	178.549	196.719	219.574	247.778	236.080	229.573	223.643	194.152	215.804
2011	202.660	201.320	201.833	221.014	204.489	240.154	278.041	250.835	251.737	241.232	216.384	246.880
2012	248.289	219.475	227.846	219.984	215.868	238.296	258.781	254.020	243.722	255.709	241.985	268.044
2013	232.935	241.868	252.210	242.369	247.972	275.667	297.878	309.219	305.629	266.562	307.276	299.013
2014	279.257	275.795	276.573	280.096	286.033	330.396	361.066	336.763	354.762	341.651	296.876	347.370
2015	301.748	338.991	305.272	313.763	295.973	359.702	382.683	303.621	389.060	369.447	270.935	370.640
2016	350.592	375.744	364.113	380.614	394.557	405.835						

Figure 1. International Tourist Arrival in Bali Island (Source : Bali Government Tourism Office)

Using the monthly arrival data, calculation of three smoothing parameters by trial and error was done to determine trend and seasonality smoothing using Holt Winter's method (Makridakis, 1999). Meanwhile, the initial step to forecast using SARIMA method was by identifying model from data stationary test in terms of mean and variance. Should data were not stationary in the variance, then variance stability transformation was done, while non-stationary data in the mean underwent differencing process. After the data were stationary, a temporary model was made by identifying Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plot to determine the order of the model. The next step was estimating parameters: AR, MA, seasonal and non-seasonal and conducting significance test of the parameters. Another assumption which should be fulfilled was the existing error should undergo white noise process, i.e. error was not autocorrelated and normally distributed. The test which could be used to determine autocorrelation was Ljung-Box test and Kolmogorov-Smirnov test to determine normality. If there were some models which fulfilled all assumptions, selection was done to select the best model based on residual (error) AIC (Akaike's Information Criterion), Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). (Lestari and Wahyuningsih, 2012)

Result And Discussion

Holt Winter's Method

In general, Holt Winter's method had three smoothing constants (valued between 0 to 1). Trial and error was done to achieve optimum parameter. Table 2 below showed process of finding values of α, β and γ, which was determined by selecting the least MAPE value. Hence, the parameters used in this study were $\alpha = 0.1 , \beta = 0.1 , \gamma = 0.3$

Table 2 Selection Process from Parameter α, β and γ Value

No	α	β	γ	MAPE
1	0.1	0.1	0.1	7.018829
2	0.3	0.1	0.1	7.384176
3	0.5	0.1	0.1	7.580133
4	0.7	0.1	0.1	7.975131
5	0.9	0.1	0.1	8.541087
7	0.1	0.3	0.1	7.508636
8	0.1	0.5	0.1	7.904706
9	0.1	0.7	0.1	8.347971
10	0.1	0.9	0.1	8.645456
11	0.1	0.1	0.3	6.171873
12	0.1	0.1	0.5	6.254192
13	0.1	0.1	0.7	6.55192
14	0.1	0.1	0.9	6.925053
15	0.1	0.3	0.3	6.617456
16	0.3	0.3	0.3	6.745072
17	0.5	0.3	0.3	7.285565
18	0.7	0.3	0.3	8.064216
19	0.9	0.3	0.3	9.064871
20	0.3	0.1	0.3	6.337714
21	0.3	0.5	0.3	7.12549
22	0.3	0.7	0.3	8.251126
23	0.3	0.9	0.3	10.63063
23	0.3	0.3	0.1	8.050824
24	0.3	0.3	0.5	6.860116
25	0.3	0.3	0.7	7.780988
26	0.3	0.3	0.9	9.355067
27	0.3	0.5	0.5	7.81693
28	0.5	0.5	0.5	8.019158
29	0.7	0.5	0.5	8.362255
30	0.9	0.5	0.5	9.52849
31	0.5	0.1	0.5	6.393344
32	0.5	0.3	0.5	6.978395
33	0.5	0.7	0.5	8.778024
34	0.5	0.9	0.5	9.040438
35	0.5	0.5	0.1	9.056739
36	0.5	0.5	0.3	8.144727
37	0.5	0.5	0.7	8.286761
38	0.5	0.5	0.9	8.50618
39	0.7	0.7	0.7	9.048502
40	0.9	0.9	0.9	10.96552

Calculation process of Holt Winter's exponential smoothing using parameters $\alpha = 0.1$, $\beta = 0.1$, $\gamma = 0.3$ was as shown below:

For forecasting the 13th period:

$$L_{13} = 0.1\frac{Y_{13}}{S_1} + (1-0.1)(L_{12} + b_{12}) = 144.717,6$$

$$b_{13} = \beta(L_{13} + L_{12}) + (1-\beta)b_{12} = 2.444,587$$

$$S_{13} = \gamma\frac{Y_{13}}{L_{13}} + (1-\gamma)S_1 = 0,8431064$$

$$F_{13} = (L_{12} + b_{12}m)S_1 = 111.523,3$$

Calculation result for other periods could be seen from Table 3 below.

Table 3. Forecasting Value using Holt Winter's Method

alpha=	**0.1**	**beta=**	**0.1**	**Gamma=**	**0.3**
Month	Arrival Data	Lt	Bt	St	Ft
Jan-07	109875			0.790216064	
Feb-07	118483			0.852124414	
Mar-07	119458			0.85913657	
Apr-07	125393			0.901820823	
May-07	129039			0.928042691	
Jun-07	145500			1.046429464	
Jul-07	164972			1.186471213	
Aug-07	167031			1.201279449	
Sep-07	152804			1.098959504	
Oct-07	146385			1.052794344	
Nov-07	142124			1.022149424	

Dec-07	147467	139044.25	2085.8403	1.06057604	
Jan-08	139872	144717.56	2444.5869	0.843106389	111523.26
Feb-08	155153	150653.72	2793.7442	0.90544661	125400.46
Mar-08	153929	156019.42	3050.9405	0.897376054	131832.32
Apr-08	147515	159520.79	3095.9831	0.908696096	143452.97
May-08	159877	163582.43	3192.5486	0.942834359	150915.31
Jun-08	170994	166438.19	3158.8698	1.040712342	174518.25
Jul-08	183122	168071.52	3006.3163	1.157394262	201222.03
Aug-08	187584	169585.41	2857.073	1.172735487	205512.29
Sep-08	181033	171671.36	2779.961	1.085631354	189507.3
Oct-08	180944	174193.21	2754.15	1.048582422	183661.36
Nov-08	142014	173146.29	2374.0427	0.961563582	180866.64
Dec-08	166855	173700.79	2192.0882	1.030579817	186152.66
Jan-09	164643	177831.73	2385.9735	0.867925247	148296.41
Feb-09	139370	177588.33	2123.0369	0.869250389	163177.51
Mar-09	161169	179700.26	2121.9261	0.897226282	161268.68
Apr-09	179879	183435.26	2283.2329	0.93027117	165221.11
May-09	181983	186448.34	2356.2174	0.952799216	175101.77
Jun-09	190617	188240.11	2299.7731	1.032286712	196491.23
Jul-09	224636	190894.67	2335.2513	1.163202088	220529.77
Aug-09	222441	192874.63	2299.7226	1.166902804	226607.58
Sep-09	208185	194833.32	2265.619	1.080500574	211887.4
Oct-09	210935	197505.25	2306.2502	1.054406778	206674.48
Nov-09	163531	196837.13	2008.8132	0.922332548	192131.46
Dec-09	182556	196675.26	1791.745	0.999868961	204926.61
Jan-10	168923	198083.15	1753.3601	0.863384168	172254.52
Feb-10	187781	201455.5	1915.2586	0.888111719	173707.97
Mar-10	194482	204709.6	2049.1424	0.913069951	182469.59
Apr-10	178549	205276.09	1900.8771	0.912129615	192341.69
May-10	196719	207105.69	1893.7503	0.951913954	197398.05
Jun-10	219574	209370.14	1930.8199	1.037221492	215747.35
Jul-10	247778	211472.24	1947.9475	1.165745759	245785.72
Aug-10	236080	212309.5	1836.879	1.150420428	249040.61
Sep-10	229573	213978.65	1820.1064	1.078213818	231385.28
Oct-10	223643	215429.2	1783.1503	1.049523031	227539.67
Nov-10	194152	216541.22	1716.0376	0.914614365	200342.02
Dec-10	215804	218014.76	1691.7879	0.996866147	218228.66
Jan-11	202660	221208.64	1841.9973	0.879213513	189691.16
Feb-11	201320	223413.9	1878.3228	0.892010538	198093.89
Mar-11	201833	224867.87	1835.8884	0.908417753	205707.56
Apr-11	221014	228263.93	1991.9056	0.928962373	206783.22
May-11	204489	228712.13	1837.535	0.934566462	219183.75

Jun-11	240154	230648.29	1847.3972	1.038418945	239131.07
Jul-11	278041	233097.03	1907.5316	1.173865712	271030.86
Aug-11	250835	233307.88	1737.8627	1.127831633	270354.05
Sep-11	251737	234888.76	1722.1649	1.076268251	253429.56
Oct-11	241232	235934.75	1654.5474	1.041401777	248328.61
Nov-11	216384	237488.86	1644.504	0.913570031	217302.58
Dec-11	246880	239985.64	1729.7315	1.006424766	238383.96
Jan-12	248289	245783.73	2136.5675	0.91850735	212519.42
Feb-12	219475	247732.8	2117.8175	0.890187683	221147.52
Mar-12	227846	249947.19	2127.4746	0.909365396	226968.74
Apr-12	219984	250547.81	1974.7894	0.913677278	234167.88
May-12	215868	250368.54	1759.383	0.912856819	235999.15
Jun-12	238296	249863.09	1532.9002	1.013005145	261814.41
Jul-12	258781	248301.59	1223.4599	1.134367307	295105.14
Aug-12	254020	247095.41	980.49591	1.097889329	281422.24
Sep-12	243722	245913.41	764.24665	1.050714379	266996.22
Oct-12	255709	246564.2	752.90086	1.040107918	256890.55
Nov-12	241985	249073.24	928.51418	0.930961489	225941.49
Dec-12	268044	251634.86	1091.8254	1.02406037	251607.95
Jan-13	232935	252814.19	1100.5753	0.919365662	232131.32
Feb-13	241868	255693.74	1278.4726	0.906909938	226031.79
Mar-13	252210	259009.71	1482.2232	0.928679957	233681.63
Apr-13	242369	260969.51	1529.98	0.918191706	238005.56
May-13	247972	263413.93	1621.4243	0.921413086	239624.44
Jun-13	275667	265744.61	1692.3502	1.020305021	268482.18
Jul-13	297878	266952.66	1643.9201	1.128810849	303371.75
Aug-13	309219	269901.78	1774.4404	1.112224224	294889.32
Sep-13	305629	273596.34	1966.4515	1.070624072	285454.11
Oct-13	266562	273634.81	1773.6539	1.020321255	286615.04
Nov-13	307276	280873.92	2320.1998	0.979872965	256394.67
Dec-13	299013	284073.48	2408.1353	1.032619362	290007.88
Jan-14	279257	288208.42	2580.8157	0.934238313	263381.36
Feb-14	275795	292120.72	2713.964	0.918070892	263719.65
Mar-14	276573	295132.52	2743.7476	0.93121036	273807.06
Apr-14	280096	298593.81	2815.5026	0.924149267	273507.51
May-14	286033	302311.25	2905.6957	0.928835364	277722.49
Jun-14	330396	307077.33	3091.7344	1.03699475	311414.38
Jul-14	361066	311138.56	3188.6842	1.138307662	350122.21
Aug-14	336763	313172.86	3073.2454	1.101154835	349602.38
Sep-14	354762	317757.49	3224.3845	1.084373404	338580.69
Oct-14	341651	322368.34	3363.0307	1.032169561	327504.63
Nov-14	296876	323455.63	3135.4566	0.961258886	319175.37
Dec-14	347370	327571.67	3233.5152	1.040965457	337244.28

Jan-15	301748	330023.5	3155.3458	0.928263654	309050.88
Feb-15	338991	336785.23	3515.9847	0.94461447	305881.8
Mar-15	305272	339053.37	3391.2007	0.921956937	316892.02
Apr-15	313763	342151.67	3361.9099	0.922013186	316469.9
May-15	295973	342827.18	3093.27	0.909183766	320925.23
Jun-15	359702	346015.37	3102.7619	1.03776282	358717.69
Jul-15	382683	347824.91	2973.4398	1.12688057	397403.84
Aug-15	303621	343291.47	2222.7524	1.036140637	386283.3
Sep-15	389060	346841.59	2355.4887	1.09557812	374666.44
Oct-15	369447	350070.62	2442.8426	1.039123671	360430.59
Nov-15	270935	345447.55	1736.2515	0.908171644	338856.7
Dec-15	370640	348070.83	1824.9543	1.048128043	361406.34
Jan-16	350592	352674.78	2102.8545	0.948012854	324795.54
Feb-16	375744	359077.37	2532.8279	0.975154672	335128.09
Mar-16	364113	364942.67	2866.0752	0.944687825	333389.03
Apr-16	380614	372308.63	3316.0632	0.952101558	339124.52
May-16	391027	381070.8	3860.6739	0.944266707	341511.87
Jun-16	405835	385545.05	3922.0312	1.042221977	399467.57
Juli-16					438,882
Aug-16					443,302
Sep-16					447,722
Oct-16					452,141
Nov-16					456,561
Dec-16					460,981

By using Holt Winter's method, it was obtained that the prediction for July 2016 was 438,882 arrivals, August 2016 was 443,302 arrivals, September 2016 was 447,722 arrivals, October 2016 was 452,141 arrivals, November 2016 was 456,561 arrivals, December 2016 was 460,981 arrivals and MAPE error was 6.171873 .

SARIMA Method
Model Identification

On time series analysis, the assumptions that must be fulfilled were data stationary in mean and variance. Stationary test in variance could be conducted by Box-Cox transformation and the lambda value obtained was 0.337, hence transformation was done by changing the values into logarithms. Time series analysis required the data to be stationary; hence first differencing was done to non-seasonal lag which could be seen on the ACF and PACF plot as follows.

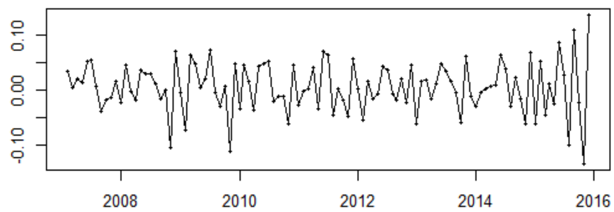

Figure 2. Data plot result from non-seasonal lag 1 differencing

Since the data was already stationary, the next step was finding the temporary model by looking at ACF and PACF plot.

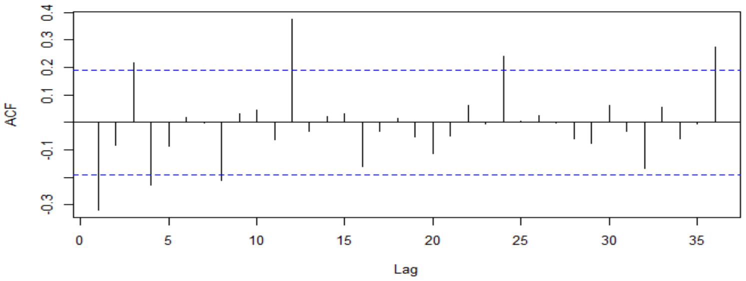

Figure 3 (a). ACF plot result from non-seasonal lag 1 differencing

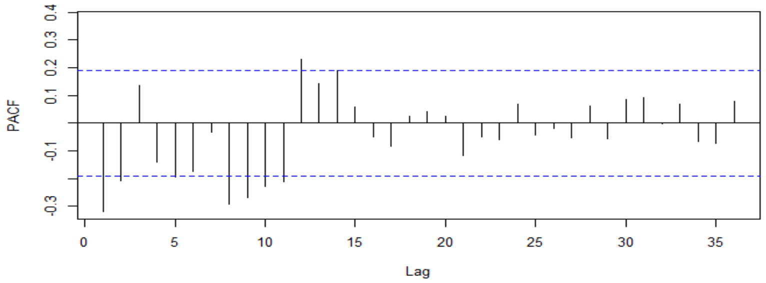

Figure 3 (b). PACF plot result from non-seasonal lag 1 differencing

Based on Figure 3 (a) and (b), a temporary model was established as follows:

Table 4. SARIMA model based on ACF and PACF

No	SARIMA Model
1	$(0,1,1)(0,0,1)^{12}$
2	$(0,1,1)(0,0,2)^{12}$
3	$(0,1,1)(1,0,0)^{12}$
4	$(0,1,3)(0,0,1)^{12}$
5	$(0,1,3)(0,0,2)^{12}$
6	$(0,1,3)(1,0,0)^{12}$
7	$(1,1,0)(0,0,1)^{12}$
8	$(1,1,0)(0,0,2)^{12}$
9	$(1,1,0)(1,0,0)^{12}$
10	$(2,1,0)(0,0,1)^{12}$
11	$(2,1,0)(0,0,2)^{12}$
12	$(2,1,0)(1,0,0)^{12}$

Table 5. AIC, RMSE and MAPE error

	AIC	RMSE	MAPE
$(0,1,1)(0,0,2)^{12}$	2426.95	48535.83	11.689400
$(0,1,1)(1,0,0)^{12}$	2413.64	46722.70	11.414930
$(1,1,0)(0,0,2)^{12}$	2442.29	50428.53	12.448746
$(1,1,0)(1,0,0)^{12}$	2433.81	53465.09	13.385149
$(2,1,0)(0,0,2)^{12}$	2424.94	51580.47	12.401560
$(2,1,0)(1,0,0)^{12}$	2410.81	52558.01	12.929056

Parameters of models acquired from ACF and PACF plot were then estimated using MLE method with help from R 3.2.3 software. Significance test was conducted afterwards and significant model was obtained, i.e. SARIMA $(0,1,1)(0,0,1)^{12}$, SARIMA $(0,1,1)(0,0,2)^{12}$, SARIMA $(0,1,1)(1,0,0)^{12}$, SARIMA $(1,1,0)(0,0,1)^{12}$, SARIMA $(1,1,0)(0,0,2)^{12}$, SARIMA $(1,1,0)(1,0,0)^{12}$, SARIMA $(2,1,0)(0,0,1)^{12}$, SARIMA $(2,1,0)(0,0,2)^{12}$ and SARIMA $(2,1,0)(1,0,0)^{12}$.

Diagnostic Test

The next assumption to fulfill was that error should undergo white noise process. A sequence was noted white noise if error was not autocorrelated and normally distributed. Temporary models whose error underwent white noise process were SARIMA$(0,1,1)(0,0,2)^{12}$, SARIMA $(0,1,1)(1,0,0)^{12}$, SARIMA$(1,1,0)(0,0,2)^{12}$, SARIMA$(1,1,0)(1,0,0)^{12}$, SARIMA$(2,1,0)(0,0,2)^{12}$, SARIMA$(2,1,0)(1,0,0)^{12}$.

Forecasting

Appropriate models were evaluated by reviewing AIC, RMSE and MAPE errors.

However, among all six models shown in Table 5, the model with the smallest error was SARIMA$(0,1,1)(1,0,0)^{12}$ hence this model was used to predict arrivals for the next six periods. The model could be written systematically as shown below

$$(1-\theta_1 B)(1-B)X_t = (1-\Phi_1 B^{12})e_t$$

$$(1-B-\theta_1 B+\theta_1 B^2)X_t = (1-\Phi_1 B^{12})e_t$$

$$X_t - X_{t-1} - \theta_1 X_{t-1} + \theta_1 X_{t-2} = e_t - \Phi_1 e_{t-12}$$

$$X_t = X_{t-1} + \theta_1 X_{t-1} - \theta_1 X_{t-2} + e_t - \Phi_1 e_{t-12}$$

Since θ_1, Φ_1 were significant, the equation became:

$$X_t = X_{t-1} - 0.7577X_{t-1} + 0.7577X_{t-2} + e_t - 0.7546e_{t-12}$$

Hence, an arrival prediction was presented as shown below:

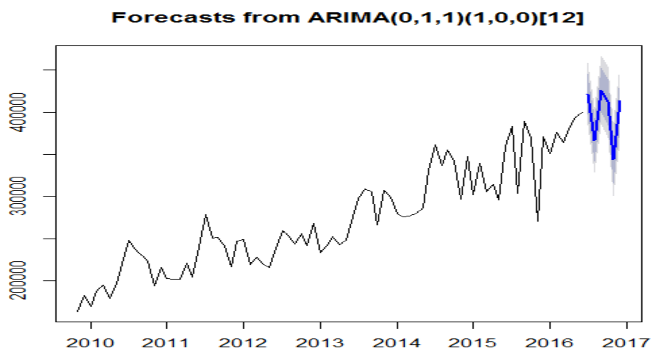

Figure 4. Forecasting result using SARIMA

Table 6. Arrival prediction using SARIMA

Time	Arrival Prediction	Time	Arrival Prediction
Jul-16	424.125	Nov-16	346.310
Aug-16	369.071	Des-16	415.739
Sep-16	428.565		
Oct-16	414.908		

Based on Table 6, the prediction of international tourist arrival using SARIMA method in July 2016 was 424,125 arrivals, August 2016 was 369,071 arrivals, September 2016 was 428,565 arrivals, October 2016 was 414,908 arrivals, November 2016 was 346,310 arrivals, December 2016 was 415,739 arrivals with MAPE error of 5.788615.

Conclusion

Result from Holt Winter's method with smoothing parameter value of $\alpha = 0.1$, $\beta = 0.1$, $\gamma = 0.3$ gave MAPE error of 6.171873. Meanwhile prediction result using SARIMA model $(0,1,1)(1,0,0)^{12}$ produced MAPE error of 5.788615, hence it could be concluded that SARIMA method was better since it has smaller error

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