USING OF SINGLE EXPONENTIAL SMOOTHING (SES) METHOD FOR SALES OF GAMIS AT RATNA JAYA SHOP

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Abstract: Toko Ratna Jaya is a business in the fashion sector that sells women's robes and is experiencing instability in its sales because Toko Ratna Jaya is unable to predict their sales for the following month. Ratna Jaya Shop currently carries out forecasting only by relying on the owner's predictions. However, this approach is less efficient and can lead to losses or increased stock costs if forecasting is inaccurate. To increase the accuracy of the estimates, the use of the Single Exponential Smoothing Method is proposed. This method smooths past values with exponential weights, placing greater emphasis on recent data. Use of data from the last 1 (one) year as reference data for recording the past for forecasting experiments for the next 1 (one) month. Experiments using different Alphas test accuracy in actual situations. The results of the experiment with an alpha of 0.2 are almost the same as the actual value in predicting the situation one month into the future with the lowest error, namely MAPE 12.05% and forecasting sales of gamis of 1,476 pcs.

Keywords: forecasting; gamis; sales; single exponential smoothing (SES); toko ratna jaya.

Abstrak: Toko Ratna Jaya adalah usaha di bidang fashion yang menjual baju gamis wanita dan sedang mengalami ketidakstabilan dalam penjualannya dikarenakan Toko Ratna Jaya tidak mampu meramalkan penjualan mereka untuk bulan berikutnya. Toko Ratna Jaya saat ini melakukan peramalan hanya dengan mengandalkan paraduga pemiliknya. Namun, pendekatan ini kurang efisien dan dapat menyebabkan kerugian atau peningkatan biaya stok jika peramalan tidak akurat. Untuk meningkatkan ketepatan perkiraan, penggunaan Metode Single Exponential Smoothing diusulkan. Metode ini menghaluskan nilai masa lalu dengan bobot eksponensial, memberikan penekanan lebih besar pada data terbaru. Penggunaan data 1 (satu) tahun terakhir sebagai data acuan pencatatan masa lalu untuk percobaan peramalan untuk 1 (satu) bulan kedepan. Eksperimen menggunakan Alpha yang berbeda menguji akurasi dalam situasi aktual. Hasil dari eksperimen dengan alpha 0,2 hampir sama dengan nilai aktual dalam meramalkan keadaan satu bulan ke depan dengan error yang paling rendah yaitu MAPE 12,05% dan peramalan penjualan gamis sebanyak 1.476 pcs.

Kata kunci: gamis; penjualan; peramalan; single exponential smoothing (ses); toko ratna jaya.

INTRODUCTION

The sale of Muslim and Muslimah clothing is a business based on sharia law. As a country with a majority Muslim population, Indonesia offers opportunities for Muslim fashion companies. Entrepreneurs who run fashion businesses based on sharia principles will benefit economically and socially as they have to behave in accordance with sharia standards such as piety, politeness, courtesy, care, and trustworthiness[1].

Forecasting one of the art and science of predicting what will happen in the future. This will involve collecting previous data, such as the previous year's sales, and using mathematical models to project future data[2]. This becomes crucial when the company has to plan future production, because without forecasting, setting the right production quantities can be a complicated challenge[3]. By applying demand prediction, risks arising in inventory control can be minimized[4].

Toko Ratna Jaya is a fashion business that sells women's gamis in the midst of a growing fashion market. Toko Ratna Jaya is located on Jl. Letjend. Suprapto, North Tanjung Balai sub-district, Kel. Tanjung Balai IV, Tanjung Balai City. Toko Ratna Jaya has been established for 20 years precisely in 2003.

Toko Ratna Jaya experienced instability in the number of gamis sold from January 2023 to January 2024. This can be seen directly in the owner's notebook where the owner will record sales per day and add them up every month. Because of the fierce business competition and the rapid exchange of gamis models, Toko Ratna Jaya has to sell the stock that has been sold, even if the stock has not been sold for a long time, Toko Ratna Jaya will sell the gamis at a price below the capital which can cause losses

to Toko Ratna Jaya. Thus, the owner of Toko Ratna Jaya must be able to estimate the exact amount of goods to be purchased based on previous sales data because this prediction greatly affects the decision about the number of goods to be provided or sold.

Research with the title "Comparison of SES and DES Methods in Predicting New Learners at SMA Negeri 1 Tual" states that the SES method is better than the DES method because it has the smallest MAPE value.[5], and research with the title "Application of the Single Exponential Smoothing Method for Sales Forecasting Analysis" states that the SES method is quite easy to use for sequential forecasting and can be used for forecasting as far as the next 1 to 3 months.[6]. Research with the title "Single Exponential Smoothing: A Forecasting Method for Measles Vaccine Needs" states that with the SES method, it can predict or forecast the number or stock of incoming and outgoing goods in the company, and can predict the number of new students, as well as fish sales stock. [7].

Research with the title "Comparison of Single Exponential Smoothing and Moving Average Methods on Forecasting Sales of Cooking Oil Products at Pt Tunas Baru Lampung" states that forecasting with the Single Exponential Smoothing (SES) method is more accurate than the Single Moving Av-erage (SMA) method because the SES method has a smaller error value. [8].

The research with the title "Forecasting Implementation in Inaura Hair Care Sales With Single Exponential Smoothing Method" states that the single exponential smoothing method has been applied effectively, using an α value of 0.2. The results show excellent forecasting ability, with a MAPE of 0.04, MAD of 21, and MSE of 432, which falls into

the Excellent Forecasting Ability category. The results show excellent forecasting ability, with a MAPE of 0.04, MAD of 21, and MSE of 432, which falls into the Excellent Forecasting Ability category [9].

Some of the previous research that has been explained states that the Single Exponential Smoothing method is very helpful in producing the right decision for forecasting with the best level of accuracy. This supports this research, but this research uses an information system so that this forecasting system can make it easier for Toko Ratna Jaya to do forecasting without doing manual calculations and this system can also help Toko Ratna Jaya reduce losses caused by stockouts.

The stages of preparing quantitative forecasting are choosing at least two forecasting techniques that are considered the most suitable, calculating the parameters of the forecasting function, choosing the best method where the method has the smallest error and verifying the forecast.[10]. There are three types of forecasting based on horizon such as long-term forecasting, medium-term forecasting and short-term forecasting [11].

This research aims to predict future sales of gamis for Ratna Jaya shop, Design a forecasting system for gamis sales at Ratna Jaya Shop and apply the Single Exponen-tial Smoothing (SES) method to the forecasting system created.

From the background of the existing problems, a solution is needed in the form of a forecasting system that is able to predict future sales of gamis, which will later become a reference in the process of restocking goods. Therefore, the single exponential smoothing method is used to forecast the number of gamis sales, especially when the data shows trends and seasonal patterns. By applying this method in the information system, it is hoped that forecasting can be done with a minimal error rate and close to the actual value, so that Toko Ratna Jaya can estimate the number of gamis for the next period and avoid losses.

METHOD

This research uses the Single Exponential Smoothing (SES) method by collecting information or data and investigating the data that has been obtained. The research method provides an overview of the research design which includes[12].

Literature Study
Collecting references in the form of books, journals, and research materials relevant to the topic of forecasting using the SES method.

Collecting Data
Collected through interviews and observations to observe and analyze the gamis sales process at Toko Ratna Jaya Tanjung Balai, which will be processed using the web based Single Exponential Smoothing method.

Table 1. Data Penjualan Gamis

No	Period	Sold (Pcs)
1	Januari 2023	1.300
2	Februari 2023	1.190
3	Maret 2023	2.457
4	April 2023	1.840
5	Mei 2023	1.540
6	Juni 2023	1.513
7	Juli 2023	1.764
8	Agustus 2023	1.524
9	September 2023	1.520
10	Oktober 2023	1.622
11	November 2023	1.390
12	Desember 2023	1.300
13	Januari 2024	1.400

In table 1. the gamis sales data of Toko Ratna Jaya Tanjung balai from January 2023 to January 2024 will forecast gamis sales one month ahead (February).

System Planning

Create a system design with the aim of making a more structured and efficient system according to needs, so as to produce a system that can predict well.

System Implementation

At this stage, implementation aims to achieve the previously designed goals. In the context of this research, implementation refers to the application of all prediction system designs.

The formula of the Single Exponential Smoothing (SES) method is as follows:

$$F_t = a\,X_{t-1} + (1-a)F_{t-1} \qquad (1)$$

Description:
α : Parameter value of $0<\alpha<1$
X_{t-1} : Actual value at time(t-1)
F_{t-1} : Forcasting value at time(t-1)
F_t : Forecasting value at time t

The accuracy of a forecast can be measured by several measures, among others[13]: Mean Squere Error (MSE)

Mean square of the difference in value between the estimated value and the actual value.

$$MSE = \sum \frac{e^2 t}{n} \qquad (2)$$

Mean Absolute Deviation (MAD)
$$MAD = \sum \frac{|A_t - F_t|}{n} \qquad (3)$$

Mean Absolute Percentage Error (MAPE)

The average of the absolute percent difference between the actual value and the forecast value.

$$MAPE = \sum \frac{|PE_t|}{n} \qquad (4)$$

RESULT AND DISCUSSION

Process Analysis

The process of calculating data using the Single Exponential Smoothing method, which will result in forecasting the sales of gamis for the next month. To measure the error value of each alpha can be seen from the MAPE (Mean Absolute Percentage Er-ror) value, where the lower the MAPE value, the more accurate the prediction is.

Tabel 2. Calculation with alpha 0.1

Peri-od	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,1	119,00	0,9	1.300,0
3	2.457	0,1	245,70	0,9	1.289,0
4	1.840	0,1	184,00	0,9	1.405,8
5	1.540	0,1	154,00	0,9	1.449,2
6	1.513	0,1	151,30	0,9	1.458,3
7	1.764	0,1	176,40	0,9	1.463,7
8	1.524	0,1	152,40	0,9	1.493,7
9	1.520	0,1	152,00	0,9	1.496,8
10	1.622	0,1	162,20	0,9	1.499,2
11	1.390	0,1	139,00	0,9	1.511,4
12	1.300	0,1	130,00	0,9	1.499,2
13	1.400	0,1	140,00	0,9	1.479,3
14	-	-	-	-	**1.471,4**

Tabel 3. Calculation with alpha 0.2

Peri-od	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	
2	1.190	0,2	238,00	0,8	1.300,0
3	2.457	0,2	491,40	0,8	1.278,0
4	1.840	0,2	368,00	0,8	1.513,8
5	1.540	0,2	308,00	0,8	1.579,0
6	1.513	0,2	302,60	0,8	1.571,2
7	1.764	0,2	352,80	0,8	1.559,5
8	1.524	0,2	304,80	0,8	1.600,4
9	1.520	0,2	304,00	0,8	1.585,1
10	1.622	0,2	324,40	0,8	1.572,1
11	1.390	0,2	278,00	0,8	1.582,1
12	1.300	0,2	260,00	0,8	1.543,6
13	1.400	0,2	280,00	0,8	1.494,9
14	-	-	-	-	**1.475,9**

Forecasting Error Value Using Alpha 0.2

$$MAD = \frac{\sum |Yt - Ft|}{n}$$

$$= \frac{2.639,14}{12}$$

$$= 219,93$$

$$MSE = \frac{\sum |Yt - Ft|^2}{n}$$

$$= \frac{1.673.136,33}{12}$$

$$= 139.428,03$$

$$MAPE = \frac{\sum |Yt - Ft| / |Yt| * 100\%}{n}$$

$$= \frac{1,45 * 100\%}{12}$$

$$= 12,05\%$$

Tabel 4. Calculation with alpha 0.3

Period	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,3	357,00	0,7	1.300,00
3	2.457	0,3	737,10	0,7	1.267,00
4	1.840	0,3	552,00	0,7	1.624,00
5	1.540	0,3	462,00	0,7	1.688,80
6	1.513	0,3	453,90	0,7	1.644,16
7	1.764	0,3	529,20	0,7	1.604,81
8	1.524	0,3	457,20	0,7	1.652,57
9	1.520	0,3	456,00	0,7	1.614,00
10	1.622	0,3	486,60	0,7	1.585,80
11	1.390	0,3	417,00	0,7	1.596,66
12	1.300	0,3	390,00	0,7	1.534,66
13	1.400	0,3	420,00	0,7	1.464,26
14	-	-	-	-	**1.444,98**

Tabel 5. Calculation with alpha 0.4

Period	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,4	476,00	0,6	1.300,00
3	2.457	0,4	982,80	0,6	1.256,00
4	1.840	0,4	736,00	0,6	1.736,40
5	1.540	0,4	616,00	0,6	1.777,82
6	1.513	0,4	605,20	0,6	1.682,70
7	1.764	0,4	705,60	0,6	1.614,82
8	1.524	0,4	609,60	0,6	1.674,49
9	1.520	0,4	608,00	0,6	1.614,30
10	1.622	0,4	648,80	0,6	1.576,58
11	1.390	0,4	556,00	0,6	1.594,75
12	1.300	0,4	520,00	0,6	1.512,85
13	1.400	0,4	560,00	0,6	1.427,71
14	-	-	-	-	**1.416,63**

Tabel 6. Calculation with alpha 0.5

Period	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,5	595,00	0,5	1.300,00
3	2.457	0,5	1.228,50	0,5	1.245,00
4	1.840	0,5	920,00	0,5	1.851,00
5	1.540	0,5	770,00	0,5	1.845,50
6	1.513	0,5	756,50	0,5	1.692,75
7	1.764	0,5	882,00	0,5	1.602,88
8	1.524	0,5	762,00	0,5	1.683,44
9	1.520	0,5	760,00	0,5	1.603,72
10	1.622	0,5	811,00	0,5	1.561,86
11	1.390	0,5	695,00	0,5	1.591,93
12	1.300	0,5	650,00	0,5	1.490.96
13	1.400	0,5	700,00	0,5	1.395,48
14	-	-	-		**1.397,74**

Tabel 7. Calculation with alpha 0.6

Period	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,6	714,00	0,4	1.300,00
3	2.457	0,6	1.474,20	0,4	1.234,00
4	1.840	0,6	1.104,00	0,4	1.967,80
5	1.540	0,6	924,00	0,4	1.891,12
6	1.513	0,6	907,80	0,4	1.680,45
7	1.764	0,6	1.058,40	0,4	1.679,98
8	1.524	0,6	914,40	0,4	1.690,39
9	1.520	0,6	912,00	0,4	1.590,56
10	1.622	0,6	973,20	0,4	1.548,22
11	1.390	0,6	834,00	0,4	1.592,49
12	1.300	0,6	780,00	0,4	1.471,00
13	1.400	0,6	840,00	0,4	1.368,40
14	-	-	-	-	**1.387,36**

Tabel 8. Calculation with alpha 0.7

Periode	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,7	833,00	0,3	1.300,00
3	2.457	0,7	1.719,90	0,3	1.223,00
4	1.840	0,7	1.288,00	0,3	2.086,80
5	1.540	0,7	1.078,00	0,3	1.914,04
6	1.513	0,7	1.059,10	0,3	1.652,21
7	1.764	0,7	1.234,80	0,3	1.554,76
8	1.524	0,7	1.066,80	0,3	1.701,23
9	1.520	0,7	1.064,00	0,3	1.577,17
10	1.622	0,7	1.135,40	0,3	1.537,15
11	1.390	0,7	973,00	0,3	1.596,55
12	1.300	0,7	910,00	0,3	1.451,96
13	1.400	0,7	980,00	0,3	1.345,59
14	-	-	-	-	**1.383,68**

Tabel 9. Calculation with alpha 0.8

Pe-riod	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,8	952,00	0,2	1.300,0
3	2.457	0,8	1.965,60	0,2	1.212,0
4	1.840	0,8	1.472,00	0,2	2.208,8
5	1.540	0,8	1.232,00	0,2	1.913,6
6	1.513	0,8	1.210,40	0,2	1.614,7
7	1.764	0,8	1.411,20	0,2	1.533,3
8	1.524	0,8	1.219,20	0,2	1.717,8
9	1.520	0,8	1.216,00	0,2	1.562,7
10	1.622	0,8	1.297,60	0,2	1.528,5
11	1.390	0,8	1.112,00	0,2	1.603,3
12	1.300	0,8	1.040,00	0,2	1.432,6
13	1.400	0,8	1.120,00	0,2	1.326,5
14	-	-	-	-	**1.358,3**

Tabel 10. Calculation with alpha 0.9

Pe-riod	Yt	α	α*Yt	1-α	Ft
1	1.300	-	-	-	-
2	1.190	0,9	1.071,00	0,1	1.300,00
3	2.457	0,9	2.211,30	0,1	1.201,00
4	1.840	0,9	1.656,00	0,1	2.331,40
5	1.540	0,9	1.386,00	0,1	1.889,14
6	1.513	0,9	1.361,70	0,1	1.574,91
7	1.764	0,9	1.587,60	0,1	1.519,19
8	1.524	0,9	1.371,60	0,1	1.739,52
9	1.520	0,9	1.368,00	0,1	1.545,55
10	1.622	0,9	1.459,80	0,1	1.522,56
11	1.390	0,9	1.251,00	0,1	1.612,06
12	1.300	0,9	1.170,00	0,1	1.412,21
13	1.400	0,9	1.260,00	0,1	1.311,22
14	-	-	-	-	**1.391,12**

So, the results of gamis forecasting at Toko Ratna Jaya Tanjung Balai using the single exponential smoothing method in the next period using alpha of 0.2 with the smallest MAPE error rate of 12.05% is 1,476 pcs, with the Good forecasting ability category.

Interface Implementation

The interface implementation of using the Single Exponential Smoothing (SES) method for gamis sales forecasting at Toko Ratna Jaya is as follows:

Home Menu

The home menu can display the amount of sales data and the latest forecast after a successful login.
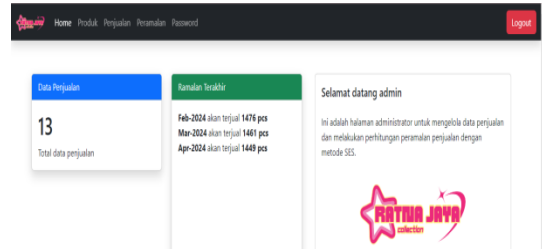

Image 1. Home Menu

Sales Menu View

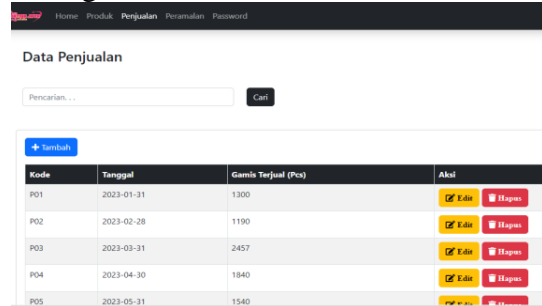Sales menu Form That Is Used To Manage Sales Data.

Image 2. Sales Menu

Forcasting Menu View

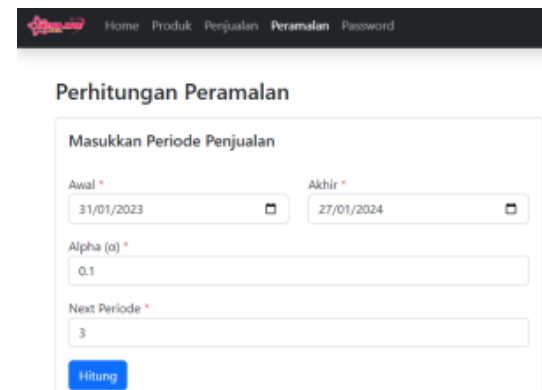The forecasting menu functions to forecast sales by entering the sales period.

Image 3. Forcasting menu

Forecasting Result Display

The calculation result form will

appear after forecasting and contains information such as forecasting results, MSE, MAD and MAPE.

Image 4. Forcasting Result Desplay

CONCLUSION

The forecasting system created has succeeded in forecasting the sales of gamis at Toko Ratna Jaya for the next one month period. By using the single exponential smoothing (SES) method, the gamis sales forecast for February 2024 is 1,476 pcs with α 0.2 and an error rate of 12.05% (MAPE). The test results using this method are able to provide decisions for Toko Ratna Jaya Tanjung Balai to achieve the desired sales target.

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