

ABSTRAK

PERBANDINGAN METODE *EXPONENTIAL SMOOTHING HOLT-WINTERS* MENGGUNAKAN MODEL *ADDITIVE* DAN *MULTIPLICATIVE* PADA PERAMALAN DATA PENUMPANG KERETA API JABODETABEK

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Peramalan adalah perkiraan masa depan berdasarkan nilai variabel di masa lalu selama beberapa periode. Ada banyak jenis peramalan, salah satunya yaitu metode *exponential smoothing Holt-Winters* yang merupakan gabungan dari metode *Holt* dan *Winters*, dimana nilai *trend* pada metode *Holt* digabungkan dengan nilai musiman pada metode *Winters*, sehingga metode *Holt-Winters* dapat menangani faktor musiman dan *trend* yang muncul secara sekaligus pada sebuah data *time series*. Pada penelitian ini dilakukan untuk membandingkan metode *exponential smoothing Holt-Winters* menggunakan model *additive* dan model *multiplicative* pada peramalan data penumpang kereta api Jabodetabek. Penelitian ini dilakukan bertahap, yaitu dengan melakukan uji asumsi pada data, yang terdiri dari uji *trend* dengan uji Mann-Kendall dan uji musiman dengan uji rata-rata sederhana, melakukan peramalan dengan mencari model *triple exponential smoothing Holt-Winters* dengan pola musiman *additive* dan *multiplicative*, menentukan model berdasarkan nilai RMSE, MAE, dan MAPE, dan peramalan berdasarkan model dengan parameter terbaik. Metode *exponential smoothing Holt-Winters* model *additive* dengan parameter terbaik yakni $\alpha = 0,9258726$, $\beta = 0$, dan $\gamma = 1$ memiliki nilai MAE = 977,4832, RMSE = 1745,577, dan MAPE = 7,858255. Metode *exponential smoothing Holt-Winters* model *multiplicative* dengan parameter terbaik yakni $\alpha = 0,9258726$, $\beta = 0,0000$, dan $\gamma = 0,90097$ memiliki nilai MAE = 1067,569, RMSE = 1868,439, dan MAPE = 8,395545. Dari nilai MAE, RMSE dan MAPE metode *exponential smoothing Holt-Winters* model *additive* dengan parameter tersebut jauh lebih baik digunakan dalam meramalkan data jumlah penumpang kereta api Jabodetabek tahun 2024 dikarenakan memiliki nilai galat lebih kecil jika dibandingkan dengan metode *exponential smoothing Holt-Winters* model *multiplicative* dengan parameter terbaiknya.

Kata kunci: peramalan, *exponential smoothing Holt-Winters*, *additive*, kereta api, *multiplicative*

ABSTRACT

COMPARISON OF HOLT-WINTERS EXPONENTIAL SMOOTHING METHODS USING ADDITIVE AND MULTIPLICATIVE MODELS FOR FORECASTING JABODETABEK RAIL PASSENGER DATA

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Forecasting is an estimate of the future based on past values of variables over some period. There are many types of forecasting, one of which is the Holt-Winters exponential smoothing method which is a combination of the Holt and Winters methods, where the trend values in the Holt method are combined with seasonal values in the Winters method, so that the Holt-Winters method can handle seasonal factors and emerging trends simultaneously on a time series data. This research was conducted to compare the Holt-Winters exponential smoothing method using an additive model and a multiplicative model in forecasting Jabodetabek train passenger data. This research was carried out in stages, namely by testing assumptions on the data, which consisted of trend testing with the Mann-Kendall test and seasonal testing with a simple average test, forecasting by looking for the Holt-Winters triple exponential smoothing model with additive and multiplicative seasonal patterns, determining the model based on RMSE, MAE, and MAPE values, and forecasting based on the model with the best parameters. The Holt-Winters additive model exponential smoothing method with the best parameters, namely $\alpha = 0.9258726$, $\beta = 0$, and $\gamma = 1$ has MAE = 977.4832, RMSE = 1745.577, and MAPE = 7.858255. Holt-Winters exponential smoothing method, multiplicative model with the best parameters, namely $\alpha = 0.9258726$, $\beta = 0.0000$, and $\gamma = 0.90097$, has MAE = 1067.569, RMSE = 1868.439, and MAPE = 8.395545. From the MAE, RMSE and MAPE values, the Holt-Winters additive model exponential smoothing method with these parameters is much better used in predicting data on the number of Jabodetabek train passengers in 2024 because it has a smaller error value when compared to the Holt-Winters multiplicative model exponential smoothing method with its best parameters.

Key words: forecasting, Holt-Winters exponential smoothing, additive, train, multiplicative