

# Forecasting combined stock price index (CSPI) at the Jakarta stock exchange (JSE) using the high-order intuitionistic fuzzy time series (HOIFTS) method

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**Abbreviated abstract:** The CSPI is an index that measures the price performance of all stocks listed on the JSE. The CSPI provides data on stock price fluctuations. Forecasting is used to predict events that will occur in the future. This study applies the HOIFTS forecasting method by trying several orders and compared with Chen and Yu methods. The comparison result shows that the proposed method is better than Chen and Yu methods, in terms of RMSE and MAPE.

## **Related publications:**

- Abhishekh, G. S. S., dan Singh, S. R. A refined method of forecasting based on high-order intuitionistic fuzzy time series data 7 (4), 339–350 (2018).
- Chen, S. M., Forecasting enrollments based on high-order fuzzy time series 33 (1), 1-16 (2002)

# Previous work, challenge, and approach

1994 - Song and Chissom

Song and Chissom introduced the fuzzy time series method that implemented to the historical enrollments of Alabama University.

2002 - Chen

Chen developed a model from Song and Chissom (1994) using the high-order fuzzy time series method.

2018 - Abhishekh

Abhishekh developed a hybrid forecasting method based on high-order fuzzy time series and intuitionistic fuzzy time series.

The results of Abhishekh (2018) method has the smallest MSE compared with the Chen (2002) method. So, the HOIFTS forecasting method gets better forecasting accuracy rates over the existing methods.

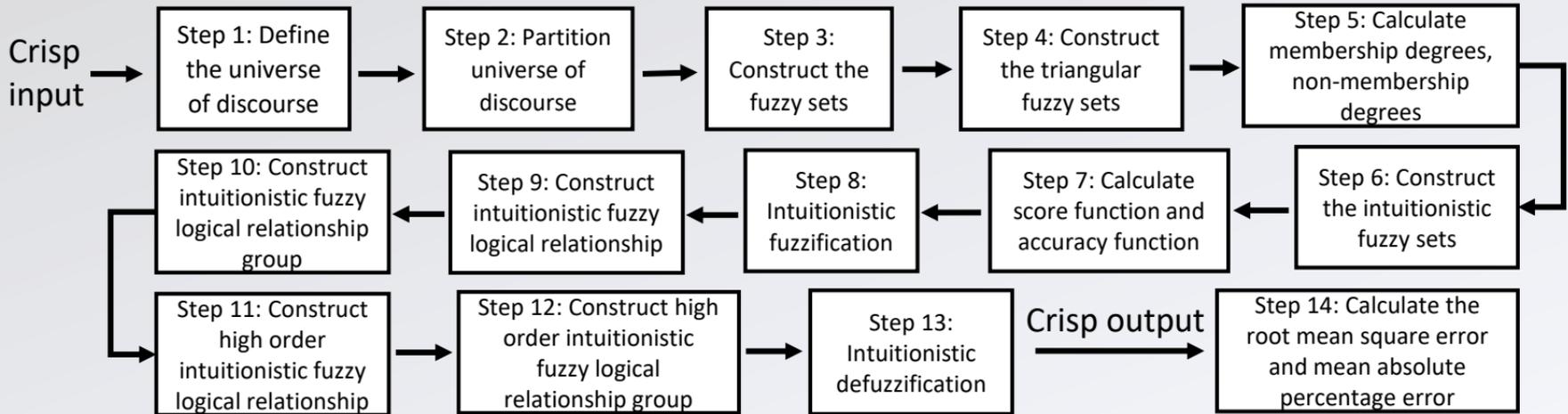
**CHALLENGE:** Applying the HOIFTS forecasting method to the CSPI data at the JSE with a multiple order.

**APPROACH:** Tried several orders using HOIFTS then compared with Chen and Yu methods in terms of RMSE and MAPE.



Fig. 1 Data Plot CSPI from 2018 – 2021

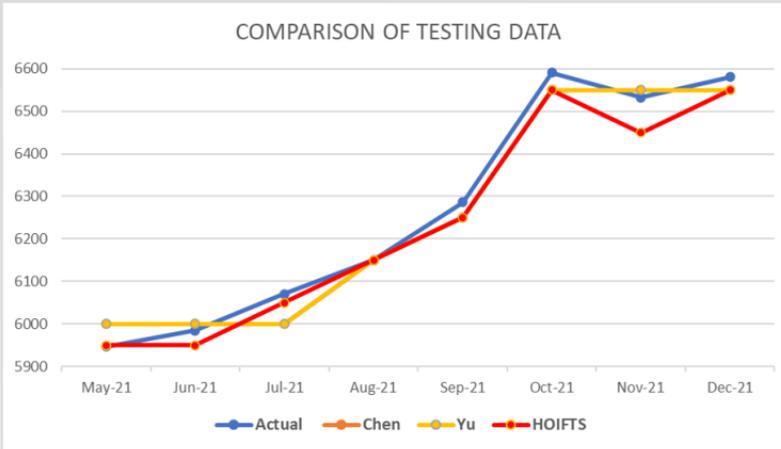
# Techniques and Methods



## Techniques:

1. The fuzzification of historical time series data is intuitionistic fuzzification which is based on their score and accuracy function.
2. Forecasting methods Chen and Yu's models are used as a comparison method.
3. Model evaluation based on RMSE and MAPE.

# Results and Conclusions



**Fig. 2** A comparison graph between actual and forecasted enrollments

| Data                                       | Method  | RMSE          | MAPE           |
|--|---|---------------|----------------|
| Training<br>(January 2018 –<br>April 2021) | <b>High order intuitionistic fuzzy time series (HOIFTS)</b> | <b>57.042</b> | <b>0.837 %</b> |
|  | Chen (1996)   | 159.994       | 2.226 %        |
|  | Yu (2004)   | 143.971       | 1.809 %        |
| Testing<br>(May 2021 –<br>December 2021)   | <b>High order intuitionistic fuzzy time series (HOIFTS)</b> | <b>38.466</b> | <b>0.487 %</b> |
|  | Chen (1996)   | 38.988        | 0.527 %        |
|  | Yu (2004)   | 38.988        | 0.527 %        |

**Table.1** A comparison of forecasting accuracy with existing methods

Table 1 shows forecasting value of the training data from the HOIFTS method has a significant difference in RMSE and MAPE values, but testing data has a small difference, even insignificant in RMSE and MAPE values compared to the Chen (1996) and Yu (2004) methods. So, it can be concluded that the best method to predict the CSPI at the JSE is the HOIFTS method.