Fuzzy Time Series Chen Forecasting

Application Description

This application is used to perform forecasting using the Fuzzy Time Series method according to the algorithm proposed by Chen in 1994. This application is made with Package R Shiny Web Application so that it can be used online without having to install R Studio software.

Application Start View

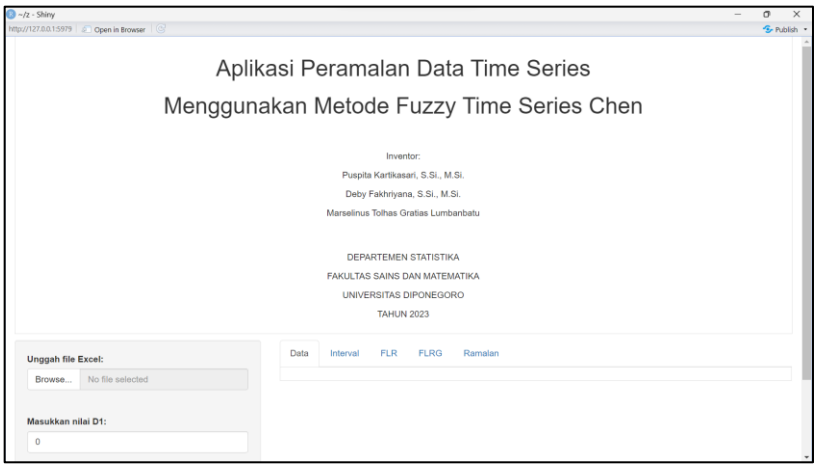


Figure 1. Application Start View

This GUI consists of 7 panels, **Upload Excel file**, **D1 and D2**, **Data**, **Interval**, **FLR**, **FLRG**, and **Ramalan**. The following is an explanation of each of these panels.

1. **Unggah file Excel**:

   This panel serves to upload the time series data that will be the object of forecasting. The application only supports file formats with the extension .xlsx (Microsoft Excel). There are some data customization requirements that need to be implemented so that the data can be accepted by the

application. One such customization is the addition of a "penutupan" header to the Excel datasheet, as shown in Figure 2.

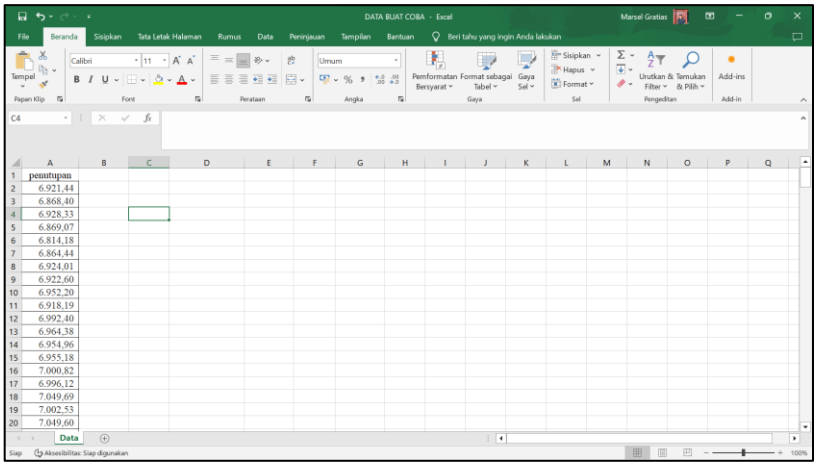


Figure 1. Excel Work Sheet

To utilize this panel, the first step is to press the "Browse" button to open a location where you can select the file to upload. The data upload view can be seen in Figure 3.

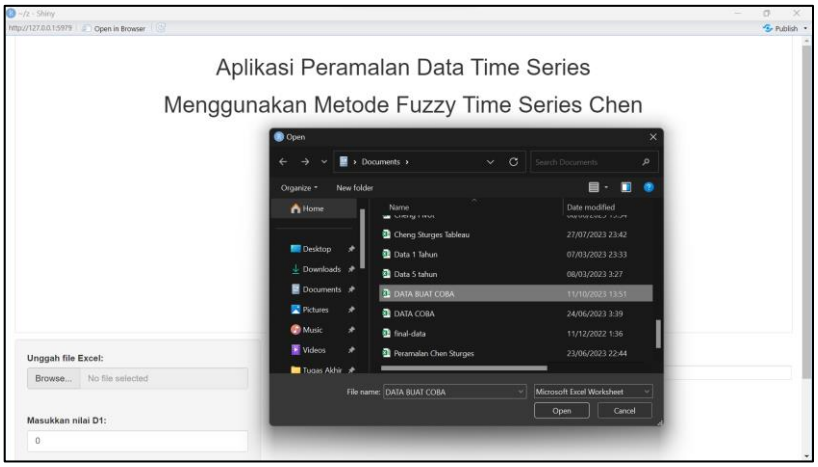


Figure 2. Data Upload Panel

2. D1 dan D2

This panel plays a role in determining the values of D1 and D2, which are positive coefficient parameters that must be determined by the researcher. This is related to the formula for forming the universe set in the Fuzzy Time Series which is described as follows:

$$U = (D_{min} - D_1) ; (D_{max} + D_2)$$

Each value inputted in panels D1 and D2 will affect various subsequent processes. An illustration of filling in the D1 and D2 values can be seen in Figure 4.

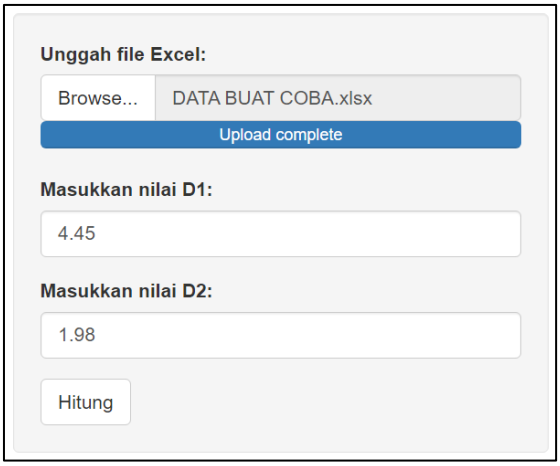


Figure 3. Panel Coefficients D1 dan D2

3. Data

This panel will display the historical data that has been uploaded in the previous step. This data will be the basis for processing in the previous panels. In this application, the data panel will display only the first 15 data from the historical data set. An illustration of the data panel display can be seen in Figure 5.

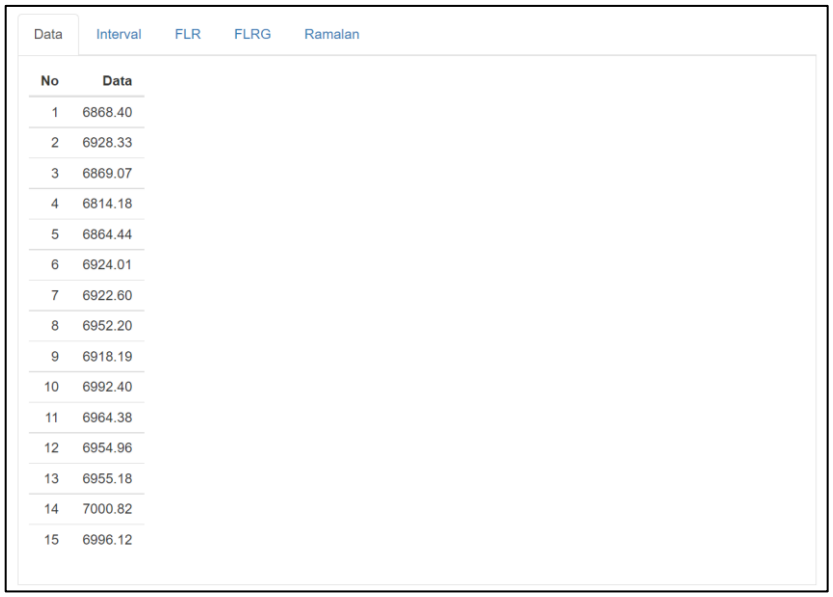


Figure 4. Result of Panel Data

This panel will display the first 15 data. For example, data No 1 is 6,868.40 and data No 15 is 6,996.12.

4. Interval

Panel ini akan menampilkan jumlah kelas yang dibentukan berdasarkan data historis yang kita miliki. Penentuan jumlah kelas ini dihitung menggunakan rumus:

$$k = 1 + 3.3\log(data)$$

The lower limit (mins) and upper limit (max) values are influenced by the D1 and D2 values set in the previous stage. The results of interval formation can be shown in Figure 6.

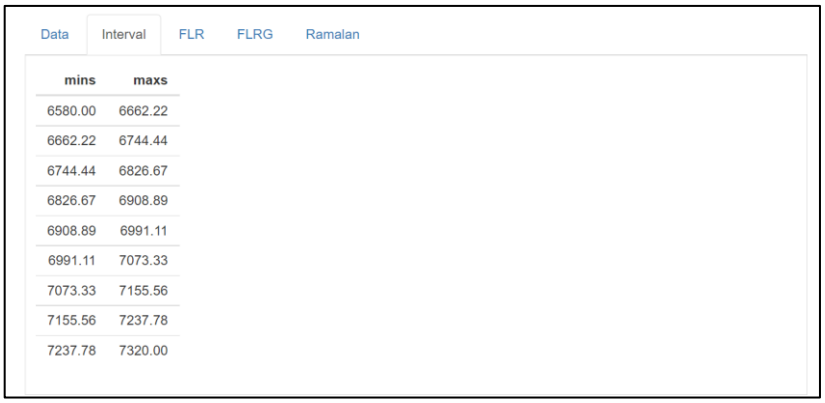


Figure 5. Interval Panel Output

In the example above, the number of classes formed is 9 with upper and lower limits respectively.

5. FLR

This panel will display the results of the relations that appear after the fuzzification process on each data. There are two columns, namely current state and next state, which reflect the relationship between the current data and the next data. The result of fuzzy logic relationship formation is shown in Figure 7.

Figure 6. FLR Panel Output

6. FLRG

This panel shows the set of relations owned by each current state that has been obtained from the FLR panel. This FLR value will be used in the defuzzification process which will provide forecast results on our time series data. The FLR results are shown in Figure 8 and Figure 9.

current_state	next_state
1	A1
1	A1
1	A3
1	A2
1	A1
1	A2
1	A2
1	A1
1	A2
1	A2
1	A1
1	A1
1	A1
1	A2

Figure 7. FLRG Panel Results Current State A1

2	A1
2	A2
2	A2
2	A1
2	A1
2	A4
2	A2
2	A3
2	A2
2	A1
2	A3

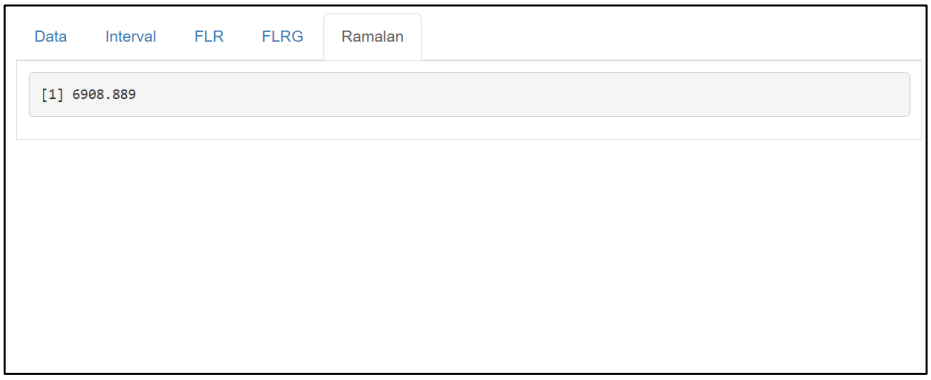
Figure 8. FLRG Panel Results Current State A2

The current_state column shows the numbers 1, 2, and so on. These numbers indicate the current state A1, A2, and so on. The formation results in the FLRG panel will be displayed sequentially according to the time of

occurrence. Figure 8 shows the FLRG owned by current state A1. Likewise, Figure 9 shows the FLRG belonging to current state A2.

7. Peramalan

This panel will show the forecasting results for the next 1 period, which is the last data we have. These results are obtained from the defuzzification principles in Fuzzy Time Series which involve the results of the previous panel. The following are the forecasting results on the example data used in this application.



Gambar 9. Hasil Panel Peramalan

In the panel results, the forecast result is 6,908,889. With the appearance of forecasting results on this panel, the functions that have been formed in the application have run successfully..