

# Roughness Analysis Tool

## 1. Introduction

In the Java project, we implemented a statistic calculator (roughness analysis tool) with **user-friendly** interface by JavaFX.

*The project supports:*

- Streaming from text file
- Calculate the mean, variance, median and standard deviation
- Plot the normalized histogram of the deviation, with an option to choose different bin method
- Fit and plot the histogram with a Probability Density Function model (PDF)
- Display the fitting parameters
- Save the histogram and the fitted PDF as a Bitmap png file

**Note:** The project passes test under *Java SE Development Kit 8* and requires *JFreeChart version 1.5.0*.

## 2. Design

### 2.1 Package Structure

**Main.java**

- The main class launches the program

**MainGUI.fxml** and **MainController.java**

- GUI and Controller for the main interface

**ChartGUI.fxml** and **ChartController.java**

- GUI and Controller for the interface demonstrating chart

**BinOption.java**

- Parent class to define ways to calculate number of bin

**RiceRule.java**, **SquareRoot.java** and **SturgeFormula.java**

- Classes derived from class *BinOption* and defines *Rice Rule*, *Square Root Choice* and *Sturge's Formula* respectively

### 2.2 JFreeChart

*JFreeChart* is a free 100% Java chart library that makes it easy for developers to display professional quality charts in their applications.

Creating a chart with *JFreeChart* generally follows 6 steps:

1. Sample the unprocessed data and store sampled data into a *Series*
2. Create a *Dataset* with the *Series* above
3. Create an *ItemRenderer*
4. Create a *Plot* and set its properties with the *Dataset* and *ItemRenderer* above
5. Create a chart with the *Plot* above
6. Create a *ChartViewer* to demonstrate the chart

For more information, please visit <http://www.jfree.org/jfreechart/>.

## 2.3 Update Guidance

If you want to add other ways to define number of bins, derive a class from class `BinOption` and override method `int NoOfBin()`. For example:

```
public class SquareRoot extends BinOption{

    /* constructor */
    SquareRoot(double[] data){
        super(data);
    }

    @Override
    public int NoOfBin(){
        return (int)rint(sqrt((double)n));
    }

}
```

Then add an "if" clause to the change listener in *ChartController.java*:

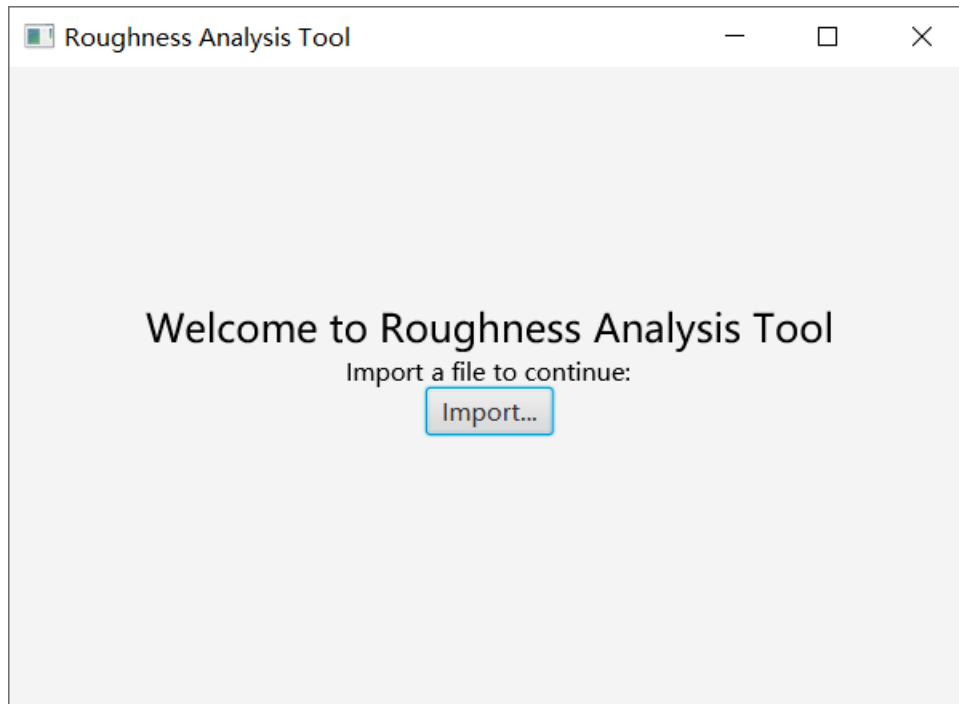
```
if(newValue.equals("SquareRoot")){
    ChartArea.getChildren().clear();//clear the chart

    /* Set properties of the histogram. */
    HistogramDataset histogramDataset = new HistogramDataset();
    histogramDataset.addSeries("",data,new SquareRoot(data).NoOfBin());//choose the
way to define number of bin
    histogramDataset.setType(HistogramType.SCALE_AREA_TO_1);//normalized
    histogram

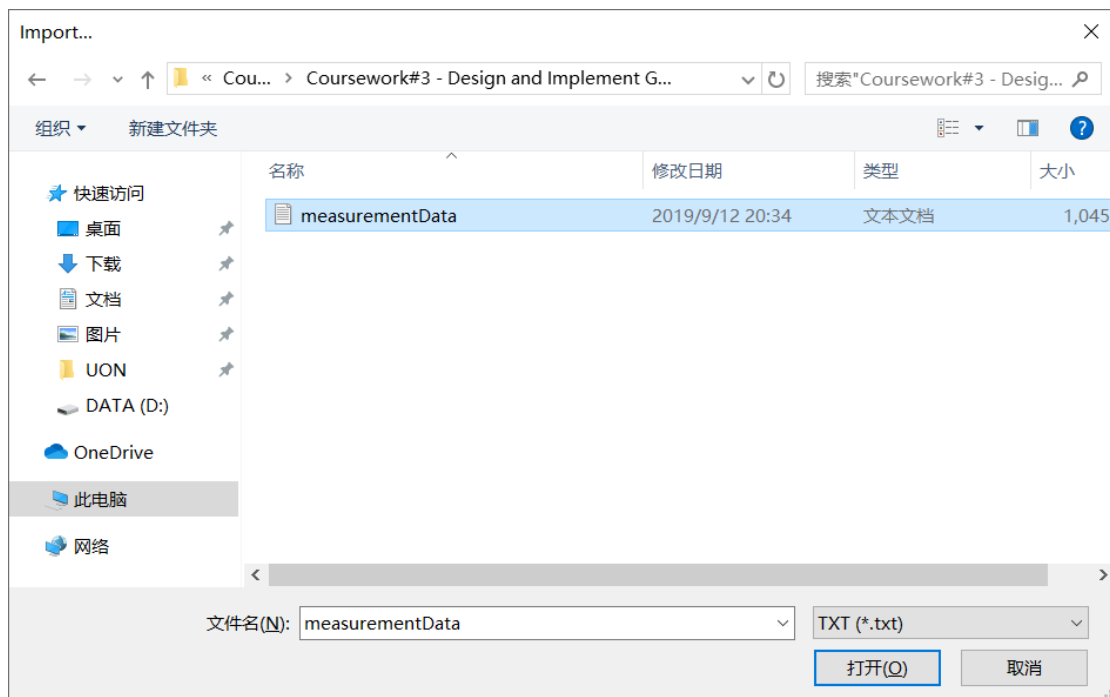
    getChart(histogramDataset);
}
```

### 3. Test

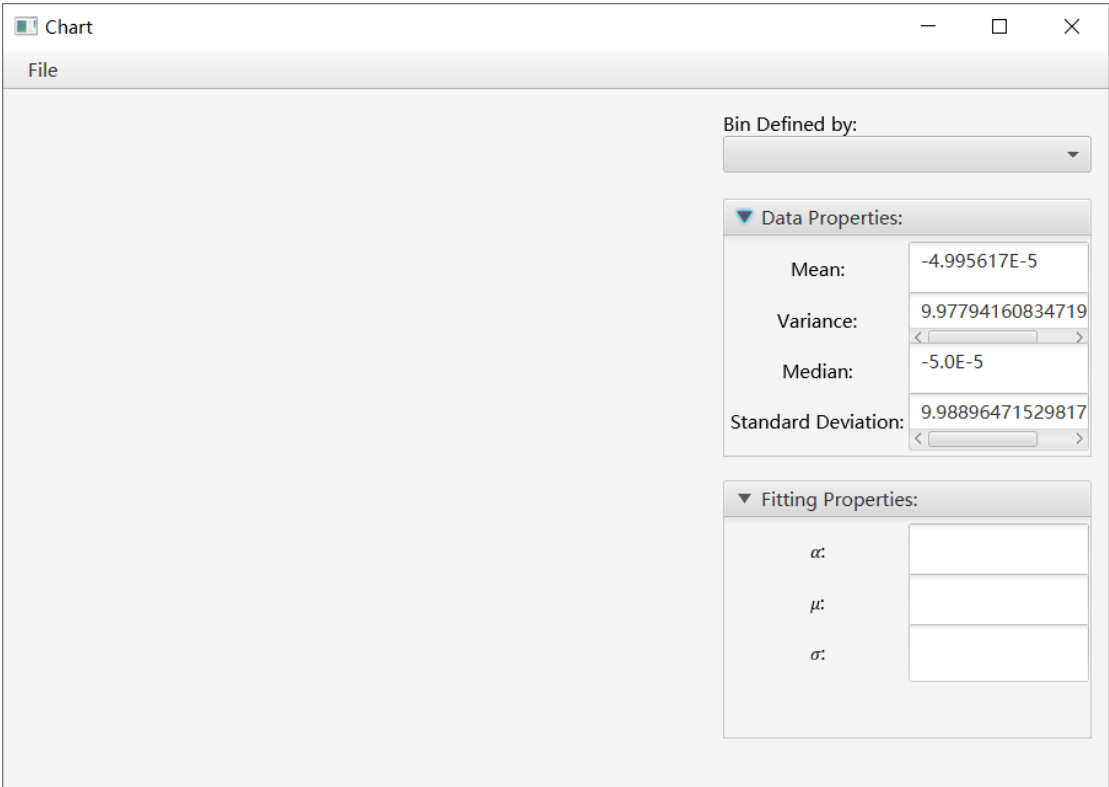
Compile the project and run, the main interface will be prompted:



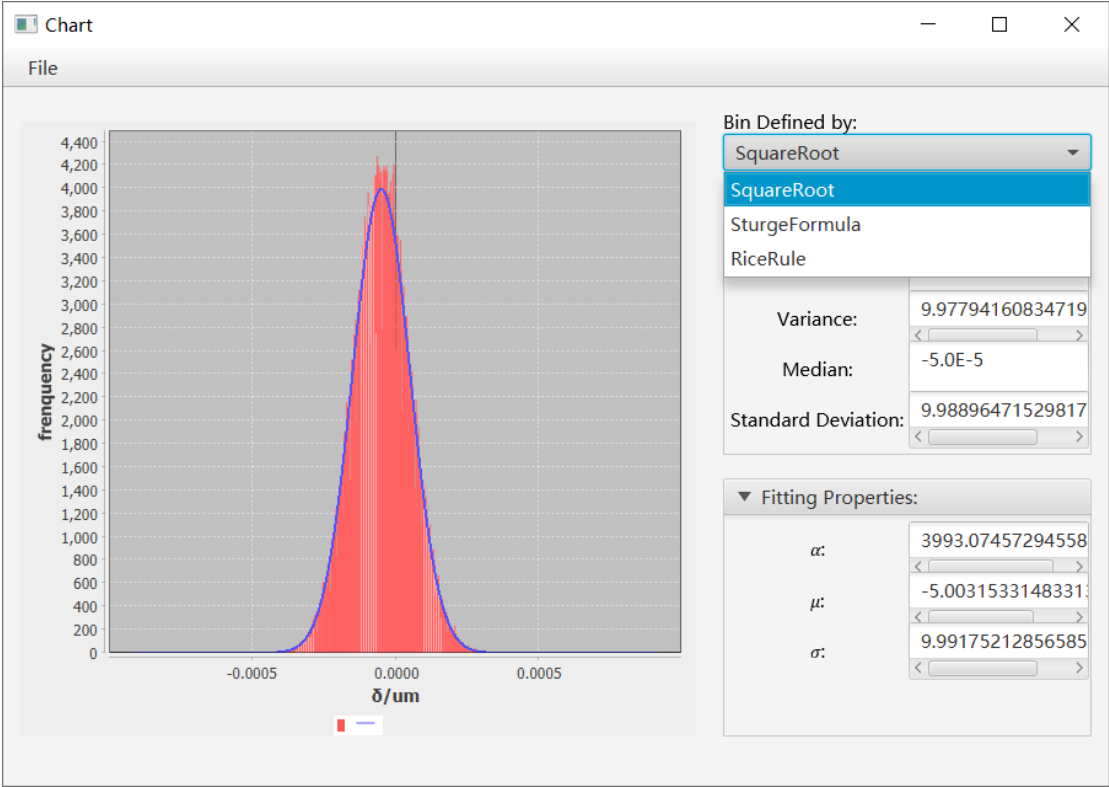
Click *Import...* and import data from a txt file:



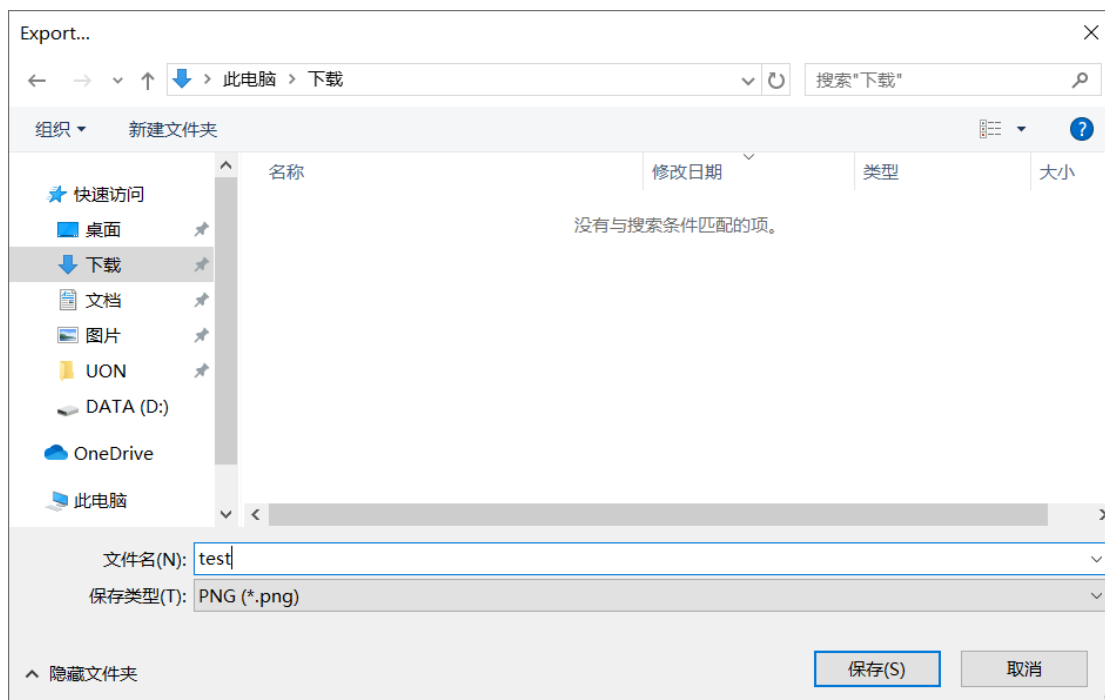
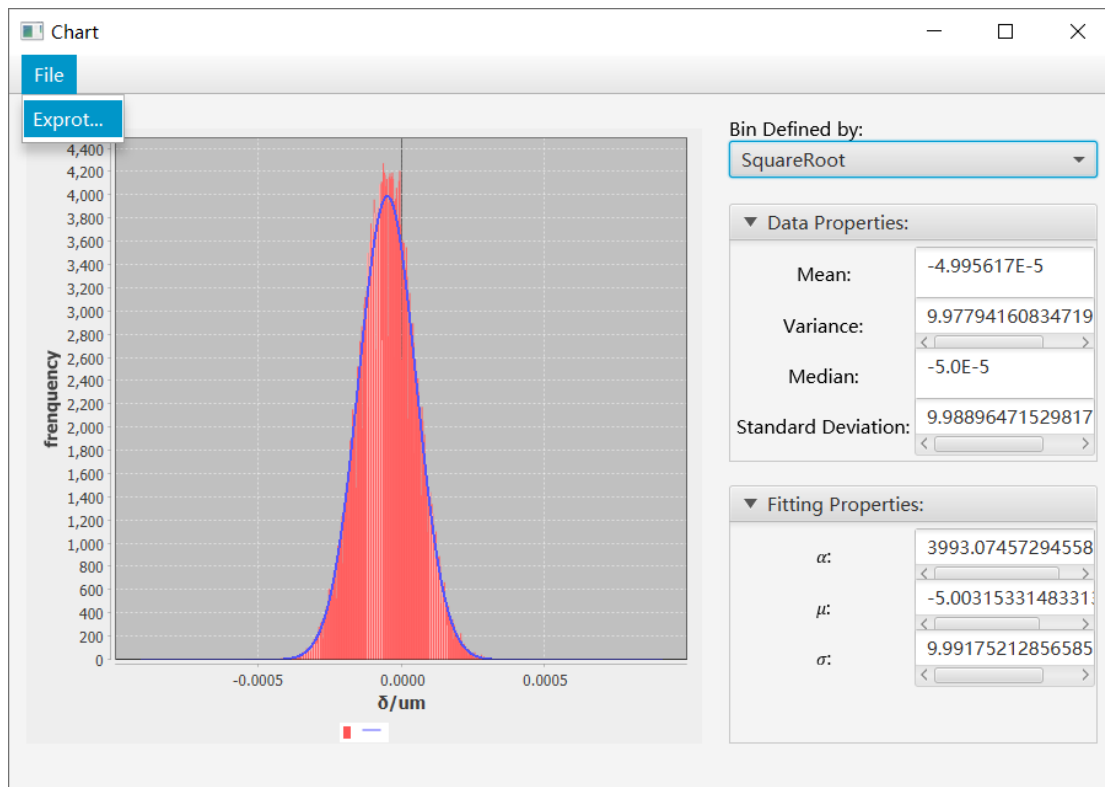
Then the interface for demonstrating the chart will be prompted. The mean, variance, median and standard deviation are also shown:



Choose a way to define number of bins, and the chart will be shown in the blank area. Fitting parameters are also displayed:



Click *File* -> *Export...* and save the chart as a png file:



File exporting is successful (test.png is also in zip file):

