

## 5.1 Getting Started

1. Which country had the highest child mortality rate in 1990? What was the rate?

Ans: The country which had the highest child mortality rate is Niger. The rate was 313.7.

2. Which country had the highest child mortality rate in 2011? What was the rate?

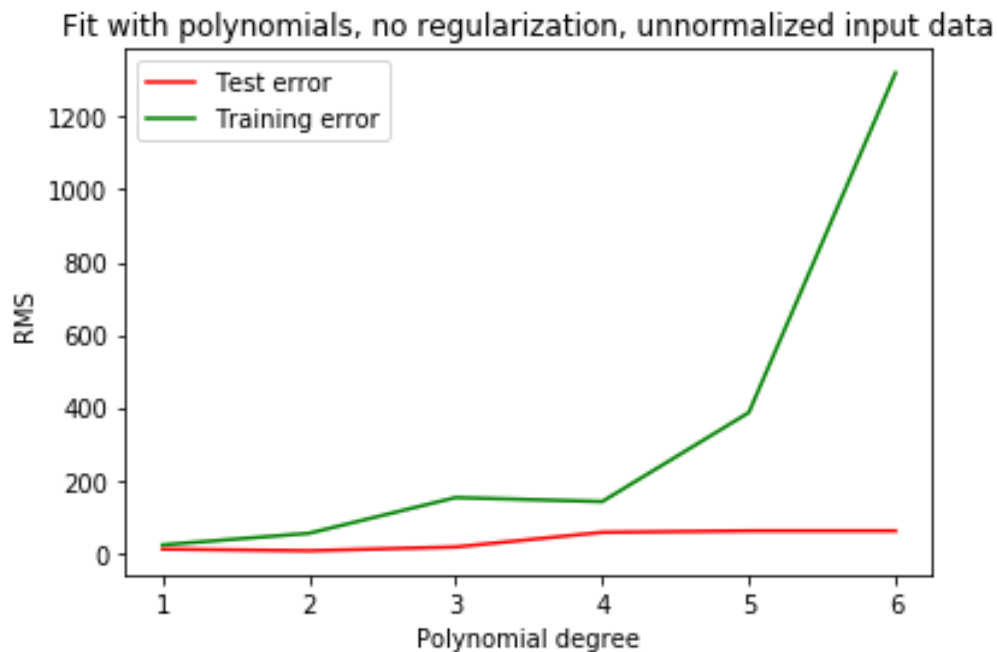
Ans: In the year 2011, Sierra Leone had the highest child mortality rate. The rate was 185.3.

3. Some countries are missing some features (see original .xlsx/.csv spreadsheet). How is this handled in the function `assignment1.load_unicef_data()`?

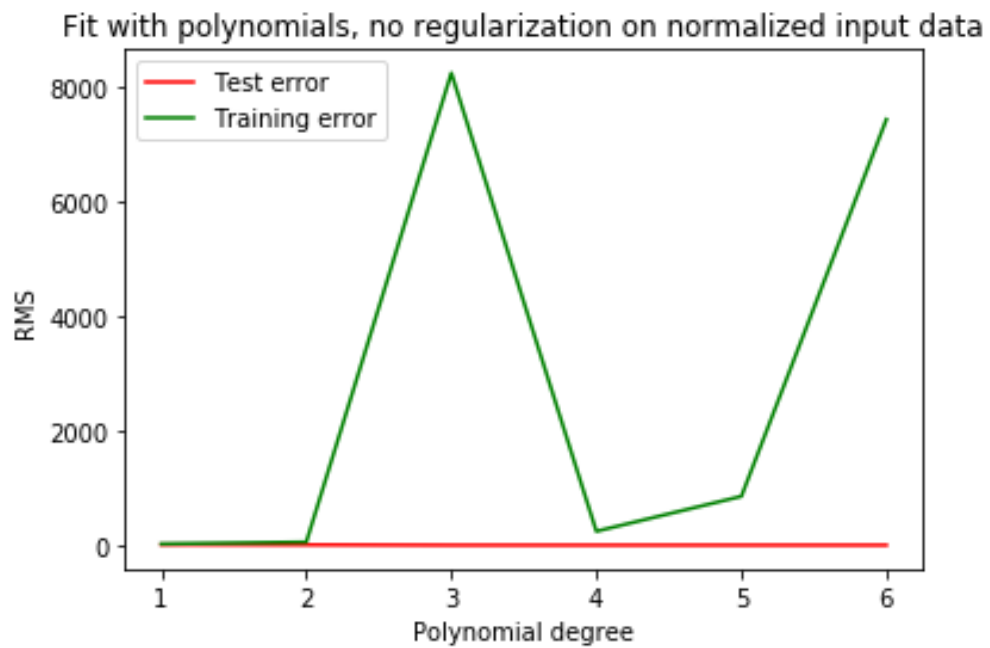
Ans: The function `assignment1.load_unicef_data()` handled the missing features by replacing them with the mean of values of feature for other countries.

## 5.2 Polynomial Regression

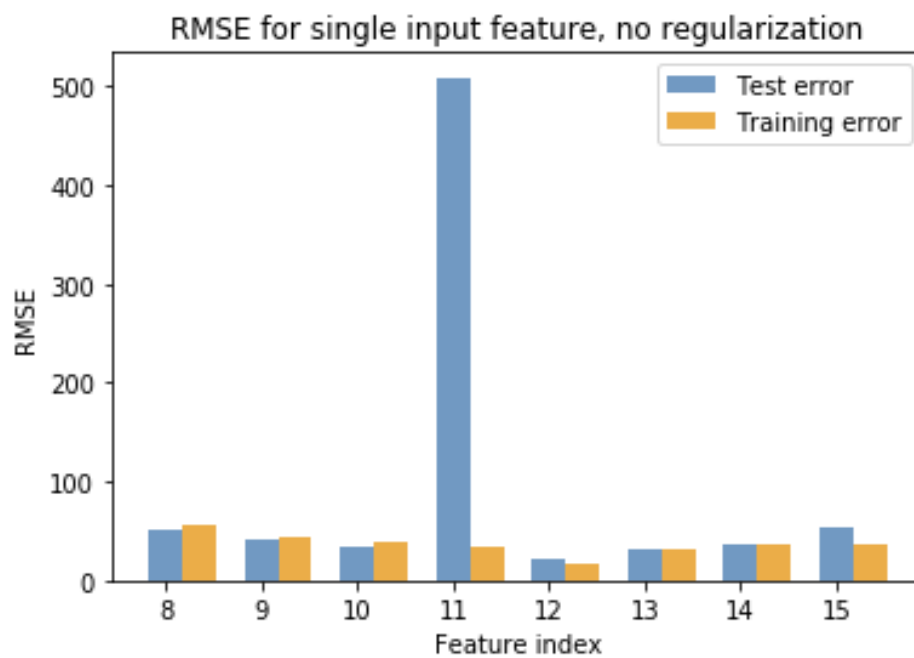
1.1) Plot training error and test error (in RMS error) versus polynomial degree.



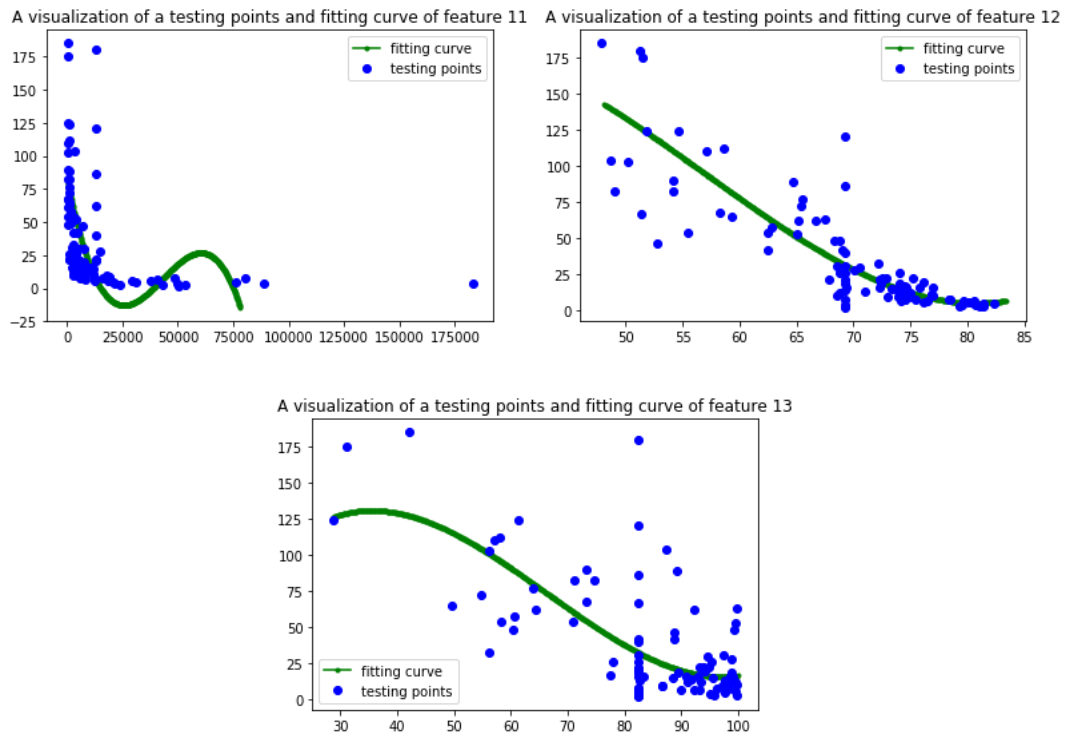
1.2) Normalize the input features before using them (not the targets, just the inputs  $x$ ).



2.1) Plotted the training error and test error (in RMS error) for each of the 8 features using a bar chart.



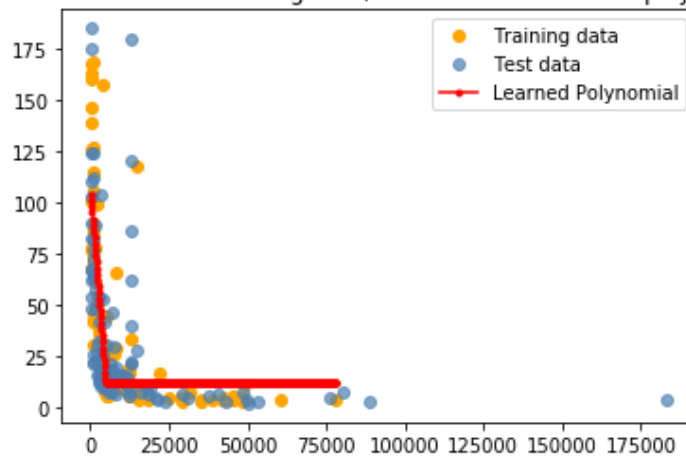
2.2) Plotted the visualization of testing points and fitting curve of feature 11-13. The testing error for feature 11 (GNI per capita) is very high.



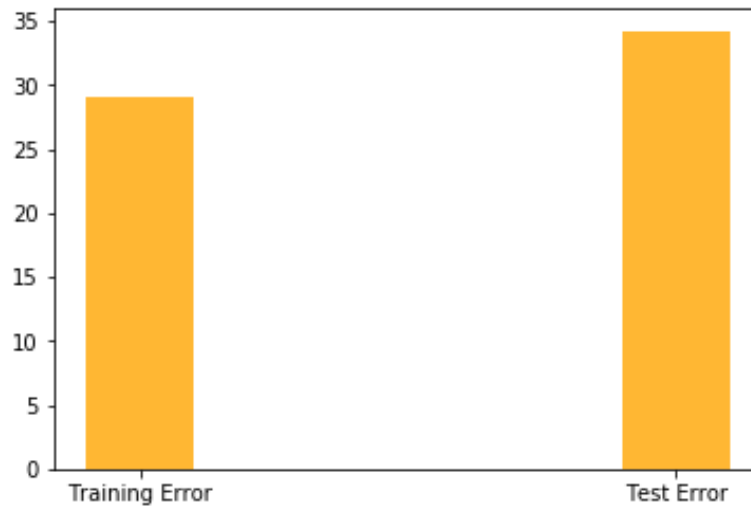
### 5.3 ReLU Basis Function

3.1) Plotted of the fit for feature 11 (GNI).

ReLU visualization: Training data, Test data and Learned polynomial



3.2) Plotted the training and testing error for this regression model.



#### 5.4 Regularized Polynomial Regression

4.1) Plotted the plot of average validation set error versus  $\lambda$ (regularizer). The value of cross-validation error for  $\lambda = 1000$  is lowest, at 28.64.

