Assignment 1

Computational Intelligence, SS2017

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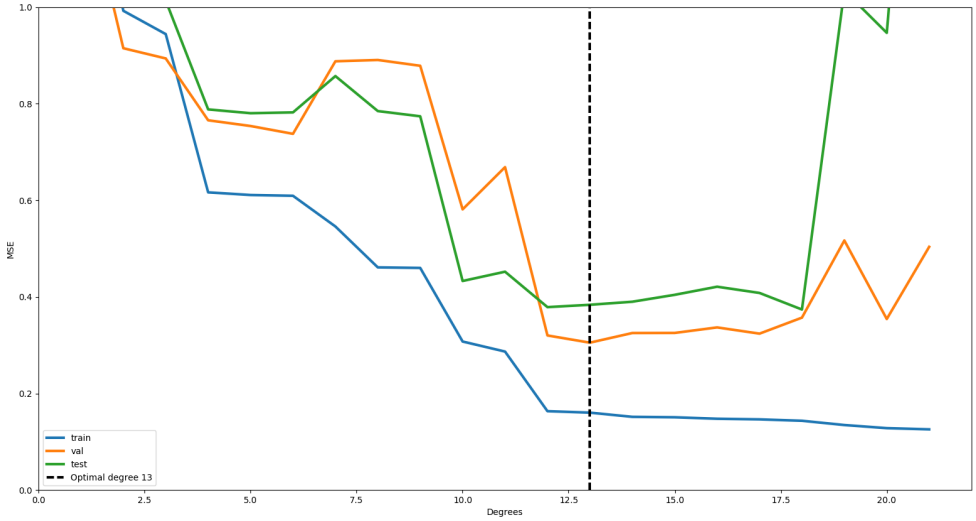

Figure 1: Training, validation and testing errors

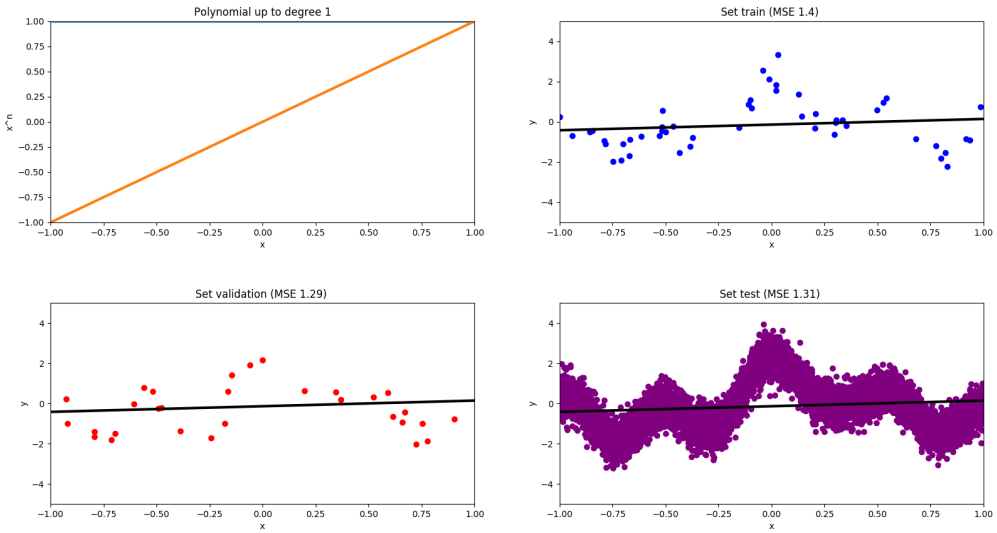

Figure 2: Linear Regression (Polynomial, Degree 1)

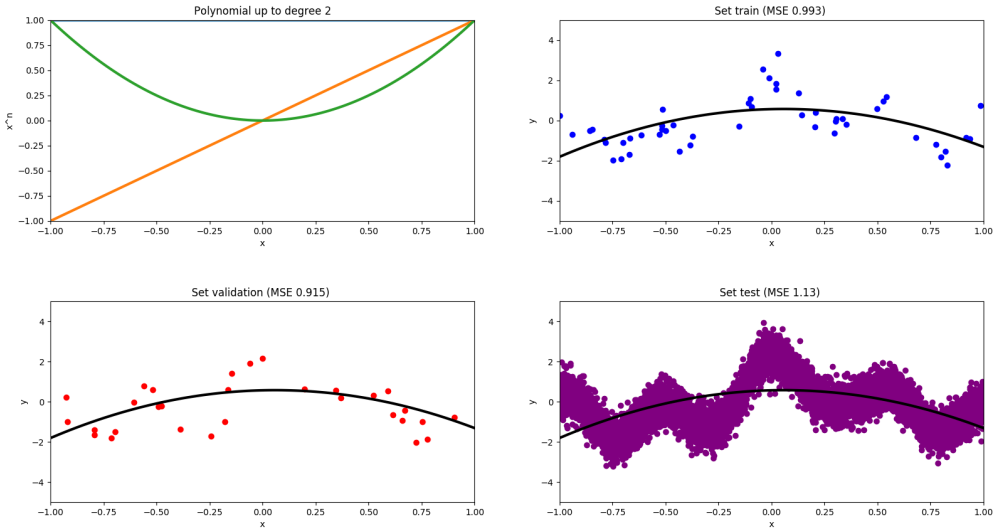

Figure 3: Linear Regression (Polynomial, Degree 2)

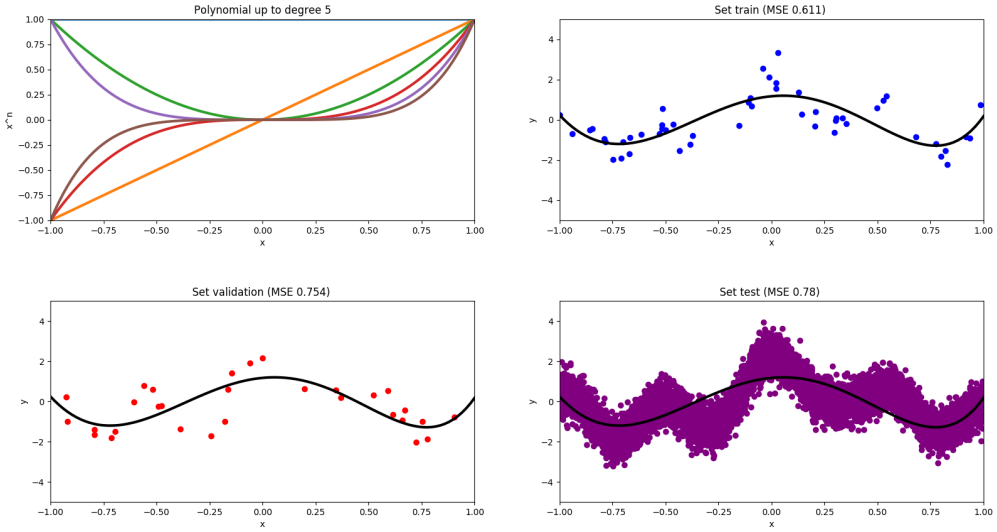

Figure 4: Linear Regression (Polynomial, Degree 5)

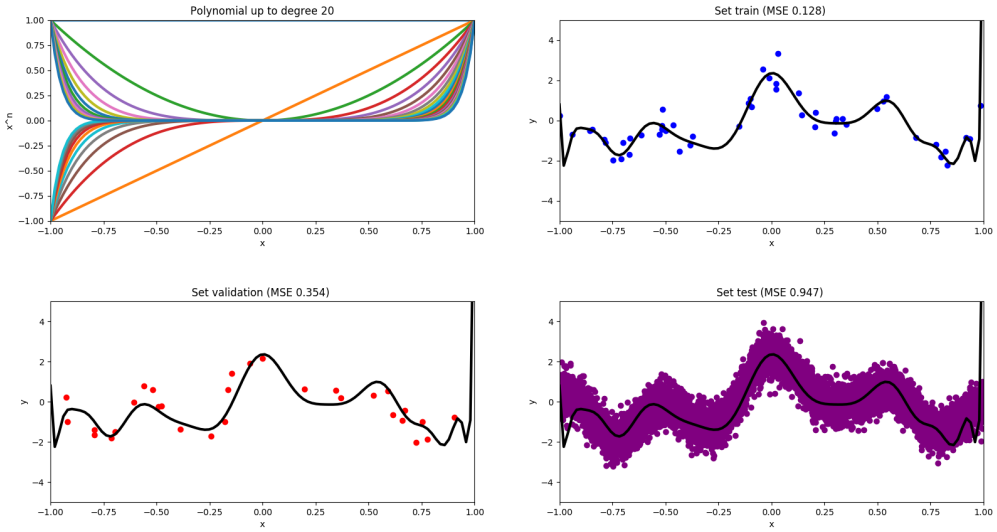

Figure 5: Linear Regression (Polynomial, Degree 20)

- Lowest training error when using degree 21

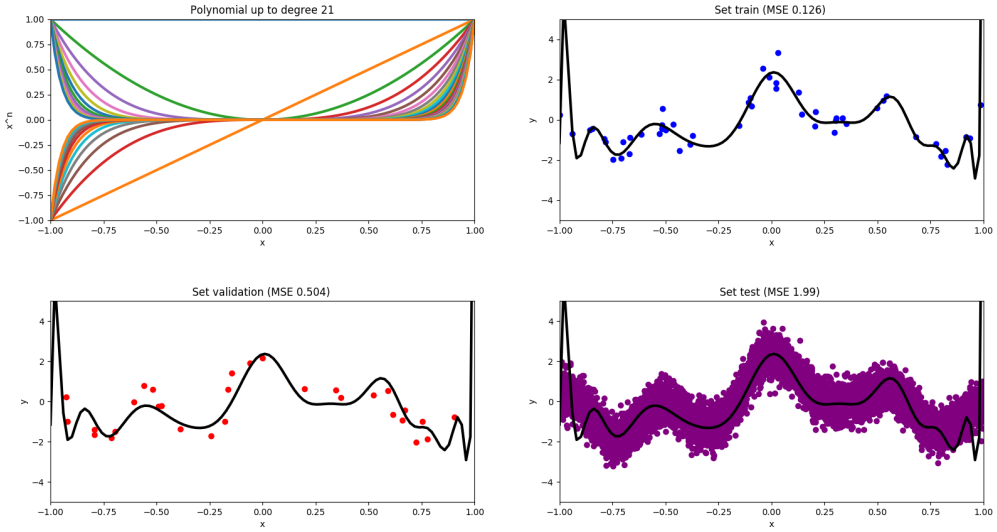

Figure 6: Linear Regression (Polynomial, Degree 21)

- Lowest validation error occurs when using degree 13

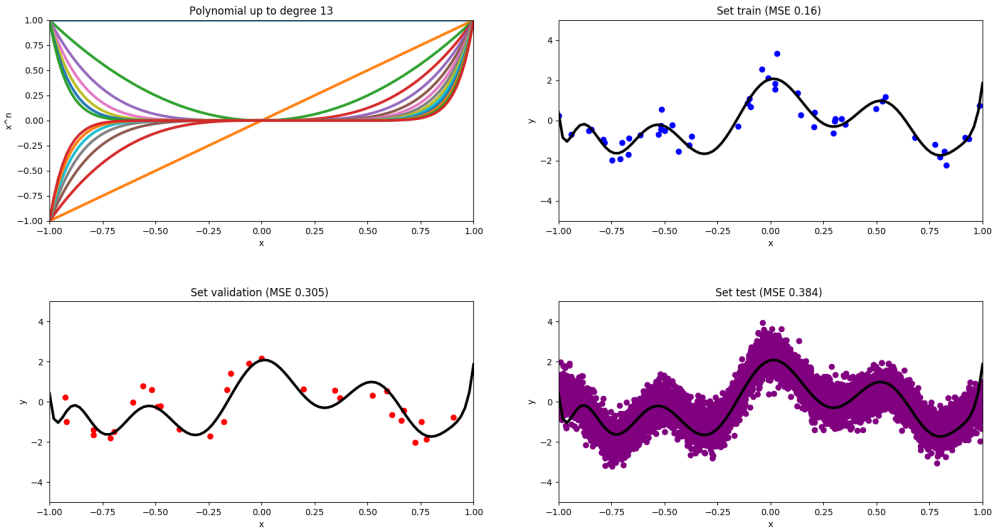

Figure 7: Linear Regression (Polynomial, Degree 13)

- **Discussion**

  Validation sets help to estimate performance of algorithms used for predictions and also to select a hypothesis (lowes error on set data). According to the error in the test set no over-fitting occured up to a degree of 13 (but would on higher degrees as can clearly be seen in Figure for degree 21, outliers and lesser data).

1.3 Linear Regression with radial basis functions

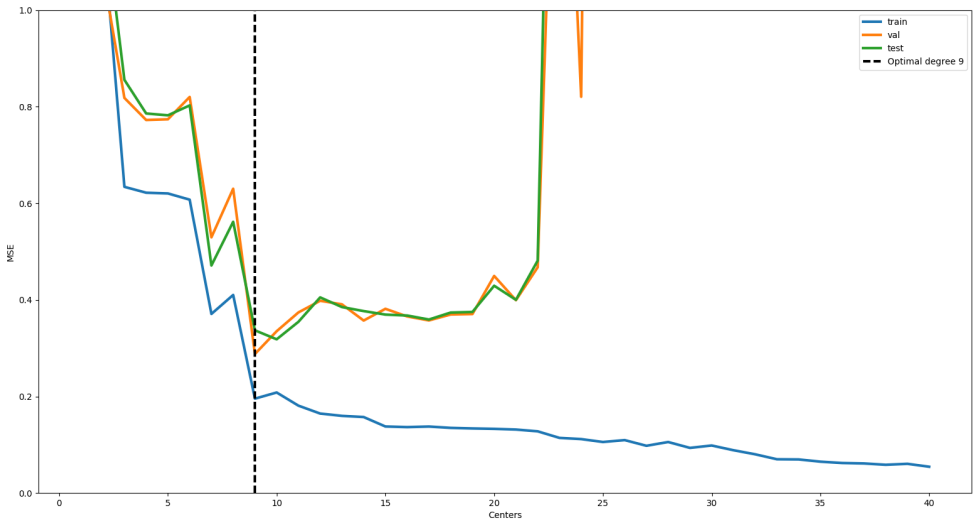

Figure 8: Training, validation and testing errors

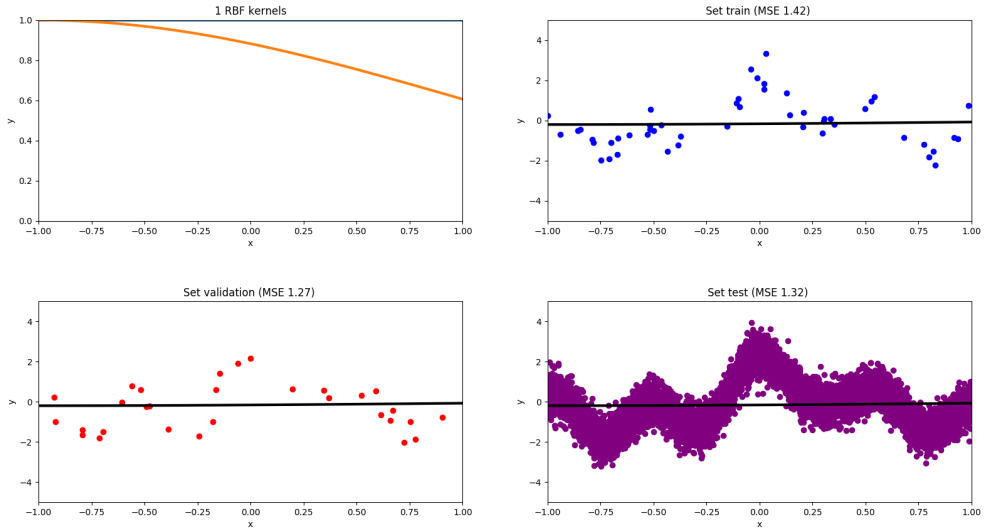

Figure 9: Linear Regression (Bias, Center 1)

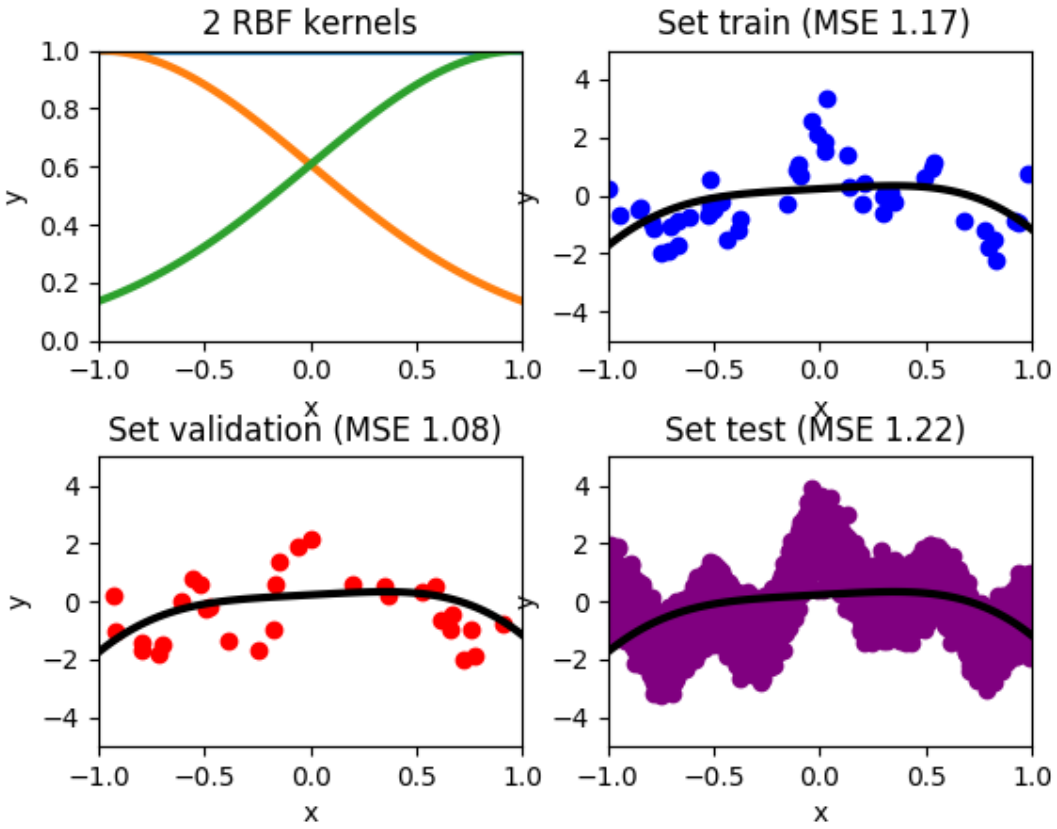

Figure 10: Linear Regression (Bias, Center 2)

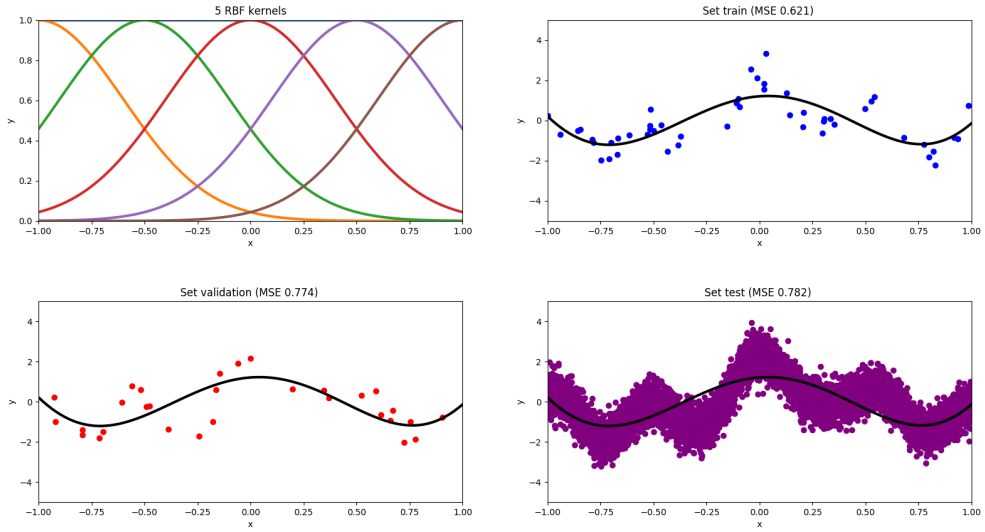

Figure 11: Linear Regression (Bias, Center 5)

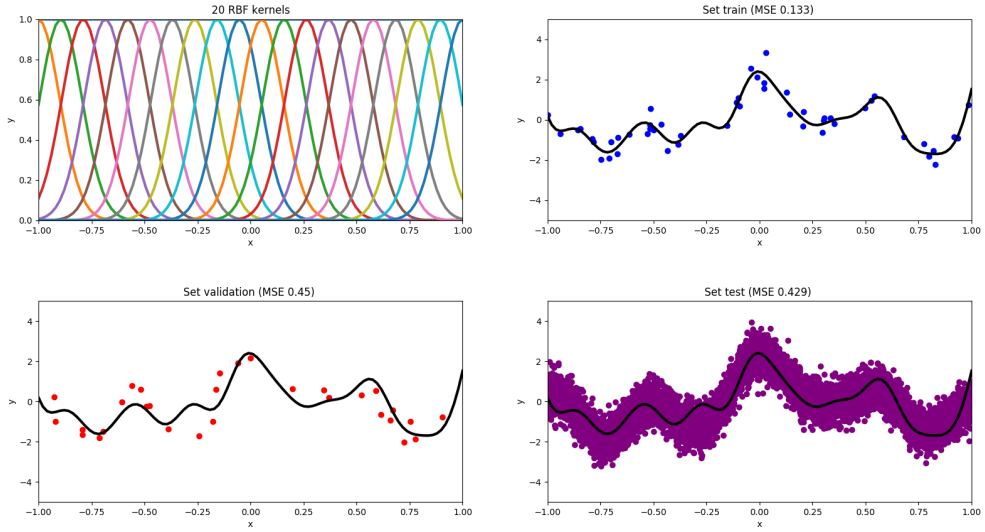

Figure 12: Linear Regression (Bias, Center 20)

- Lowest training error when using center 40

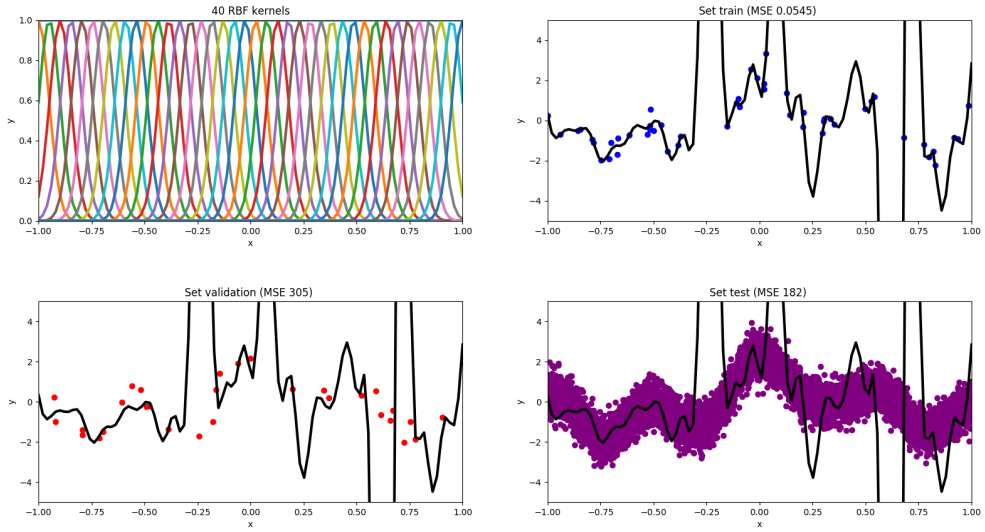

Figure 13: Linear Regression (Bias, Center 40)

- Lowest validation error occurs when using center 9

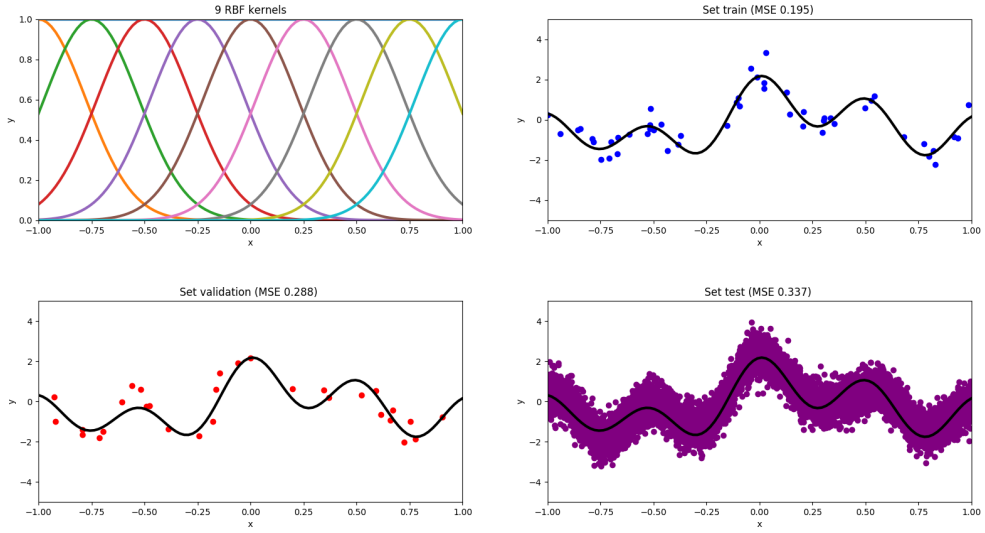

Figure 14: Linear Regression (Polynomial, Degree 9)

- **Discussion**

  Bias function is better because it fits natural phenomen better. Overfitting occurs very early on parameter center 10.

2 Logistic Regression

2.1 Derivation of Gradient

2.2 Logistic Regression training with gradient descent and scipy.optimize

2.2.1 Gradient descent

2.2.2 Adaptative gradient descent

2.2.3 Scipy optimizer