Bias-Variance Trade-Off

Understanding the concepts of **Bias-Variance** Trade-Off is crucial for building statistical learning models, but first lets establish a clear definition of the term **Bias** and **Variance**

Bias

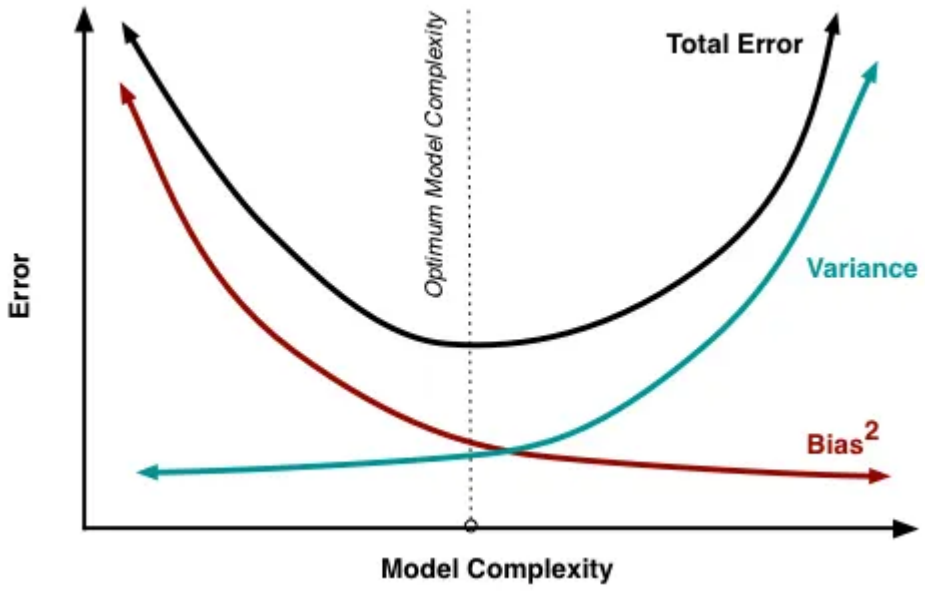
Refers to the error due to modeling a complex real world problem and simplifying it into a statistical model which leads to **underfitting** and missing some key details about it which cause the model to perform poorly since it fails to capture the essential patterns of the real world problem
Underfitting : It's a result of high **bias**, when the model is too simple which makes the model unable to learn the underlying trends in the data

Variance

It's the error from an overly complex (**Flexible**) model, leading to Overfitting where the model becomes too **sensitive** to the **training data** and start to pick patterns and noise off the data and therefore failing to **generalize** to new data

Trade-Off

Both the **Bias** and **Variance** are inversely related which means decreasing one typically increases the other



Mathematical Derivation