

Learning Curves

Training an algorithm on a very few number of data points (such as 1, 2 or 3) will easily have 0 errors because we can always find a quadratic curve that touches exactly those number of points. Hence:

- As the training set gets larger, the error for a quadratic function increases.
- The error value will plateau out after a certain m , or training set size.

Experiencing **high bias**:

Low training set size : causes $J_{train}(\Theta)$ to be low and $J_{CV}(\Theta)$ to be high.

Large training set size : causes both $J_{train}(\Theta)$ and $J_{CV}(\Theta)$ to be high with $J_{train}(\Theta) \approx J_{CV}(\Theta)$.

If a learning algorithm is suffering from **high bias** , getting more training data will not **(by itself)** help much.

More on Bias vs. Variance

Typical learning curve for high bias(at fixed model complexity):



Experiencing **high variance**:

Low training set size : $J_{train}(\Theta)$ will be low and $J_{CV}(\Theta)$ will be high.

Large training set size : $J_{train}(\Theta)$ increases with training set size and $J_{CV}(\Theta)$ continues to decrease without leveling off. Also, $J_{train}(\Theta) < J_{CV}(\Theta)$ but the difference between them remains significant.

If a learning algorithm is suffering from **high variance** , getting more training data is likely to help.

More on Bias vs. Variance

Typical learning curve for high variance(at fixed model complexity):



