

Variance  
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# 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 fit a quadratic curve that touches exactly those number of points. Hence:

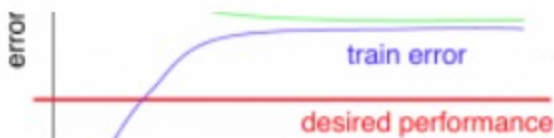
- As the training set gets larger, the error for a quadratic function increases.
- The error value will plateau out after a certain m, or training set size.

## 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.



**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.  $J_{train}(\Theta) < J_{CV}(\Theta)$  but the difference between them remains significant.

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

