

Variance


7 min

 **Reading:** Diagnosing Bias vs. Variance

3 min

 **Video:** Regularization and Bias/Variance

11 min

 **Reading:** Regularization and Bias/Variance

3 min

 **Video:** Learning Curves

11 min

 **Reading:** Learning Curves

3 min

## Deciding What to Do Next Revisited

Our decision process can be broken down as follows:

- **Getting more training examples:** Fixes high variance
- **Trying smaller sets of features:** Fixes high variance
- **Adding features:** Fixes high bias
- **Adding polynomial features:** Fixes high bias

- A neural network with fewer parameters is **prone to underfitting**. It is also **computationally cheaper**.
- A large neural network with more parameters is **prone to overfitting**. It is also **computationally expensive**. In this case, you can use regularization (increase  $\lambda$ ) to address the overfitting.

Using a single hidden layer is a good starting default. You can train your neural network on a number of hidden layers and select the one that performs best on your cross validation set. You can then select the one that performs best.

### Model Complexity Effects:

- Lower-order polynomials (low model complexity) have high bias and low variance. In this case, the model fits poorly and does not generalize well.
- Higher-order polynomials (high model complexity) fit the training data extremely well and the test data extremely poorly. These have low bias on the training data, but very high variance.
- In reality, we would want to choose a model somewhere in between, that can generalize well but also fits the data well.