DICE ANALYTICS

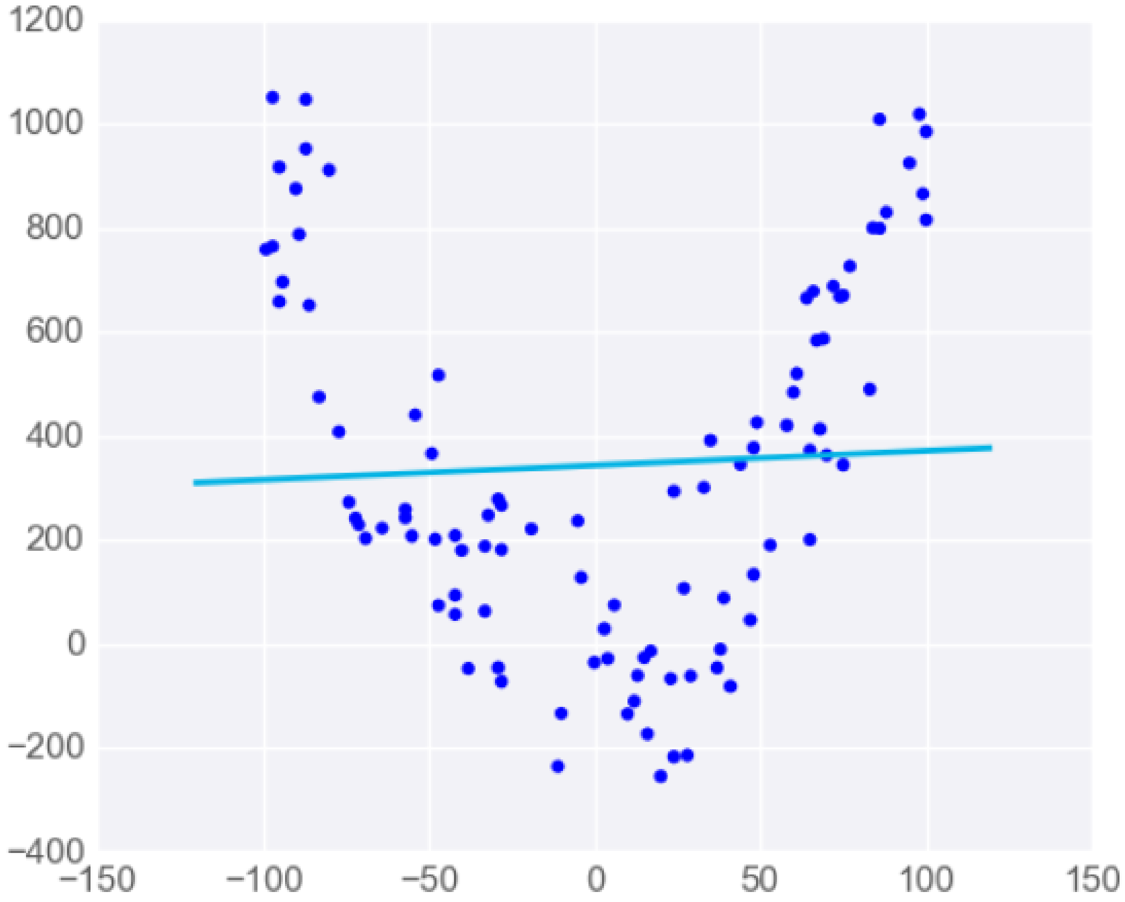
DATA SCIENCE & MACHINE LEARNING COURSE

https://www.facebook.com/diceanalytics/
https://pk.linkedin.com/company/diceanalytics

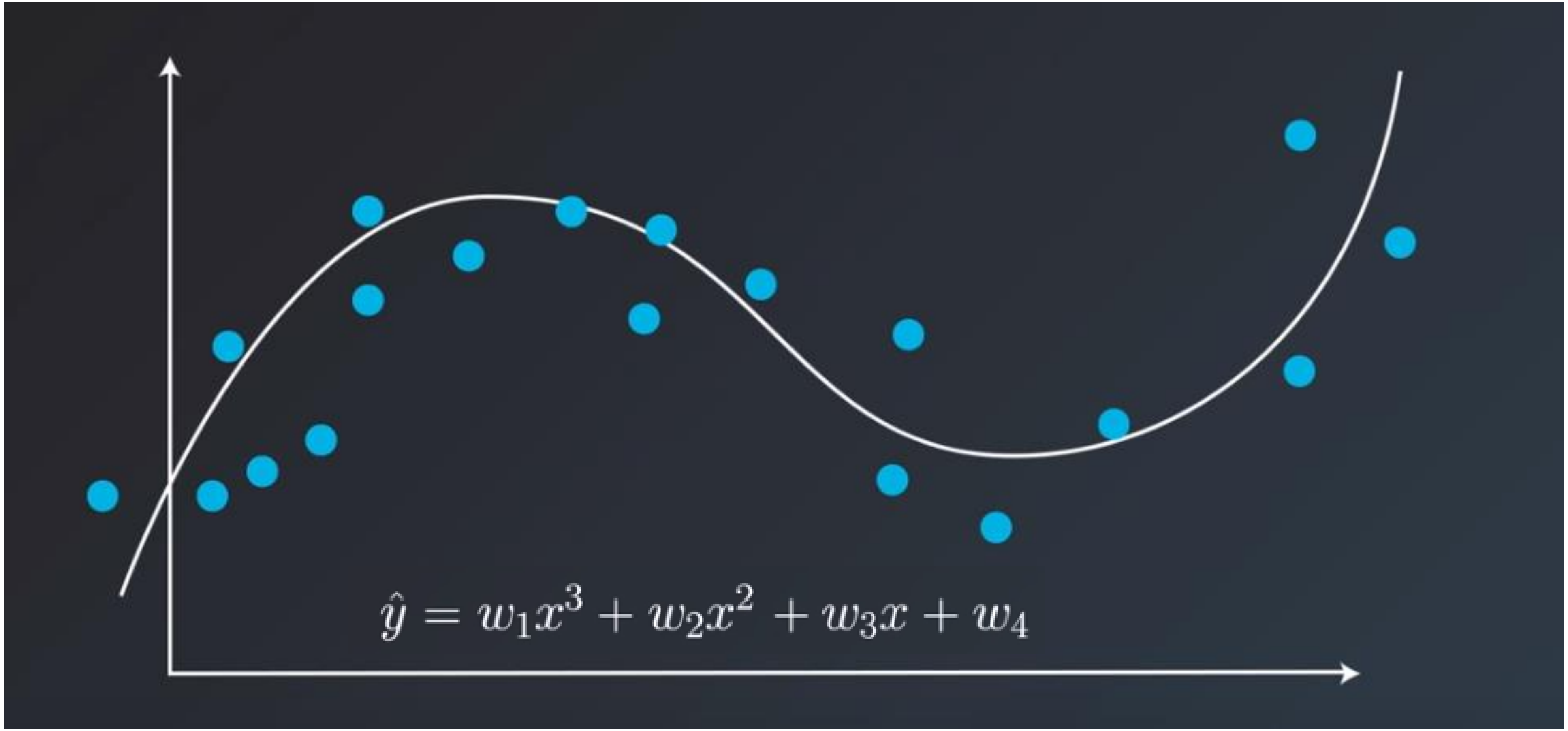
Regression

Polynomial Regression

Linear Regression Works Best When the Data is Linear



Polynomial Regression



Model Selection

Simple Problem

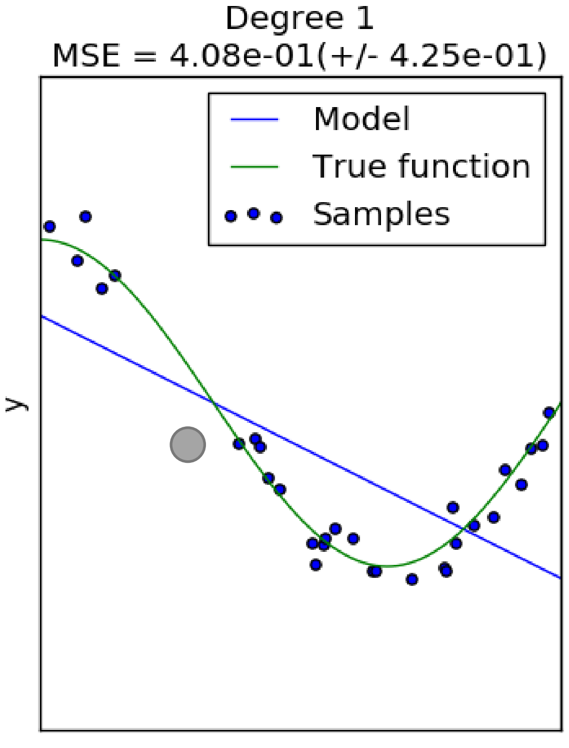
Complex Solution

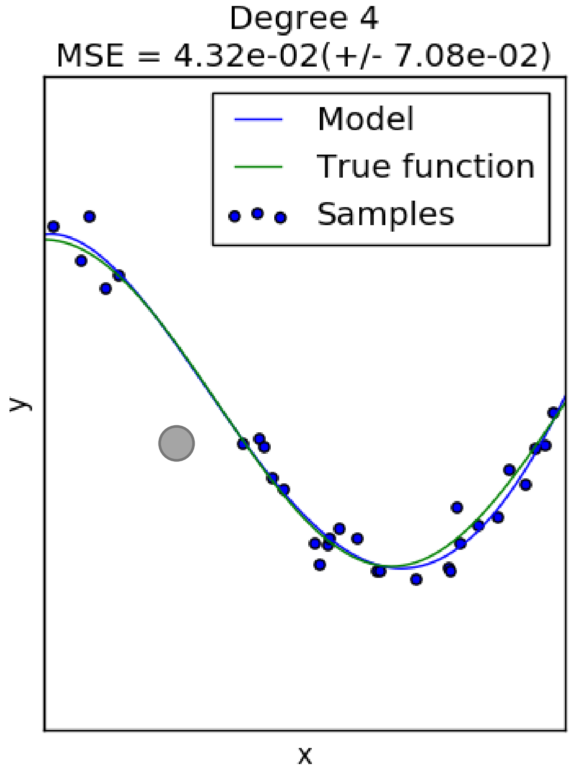
Model Selection

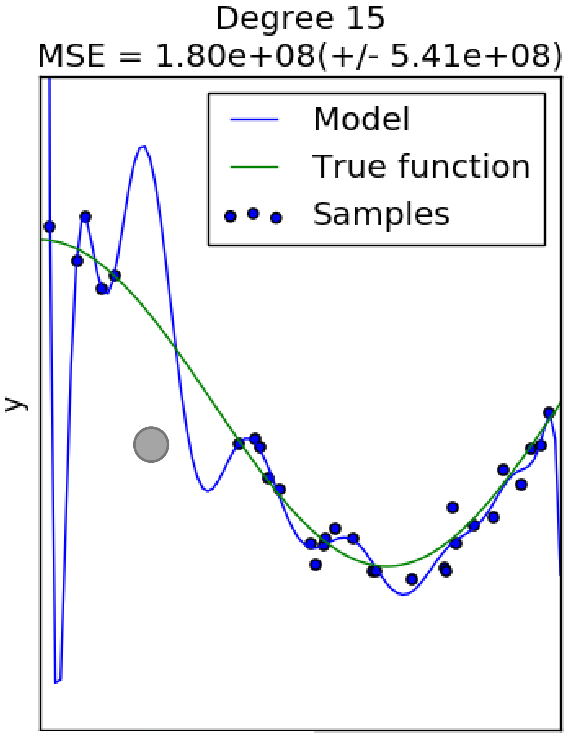
Complex Problem

Simple Solution

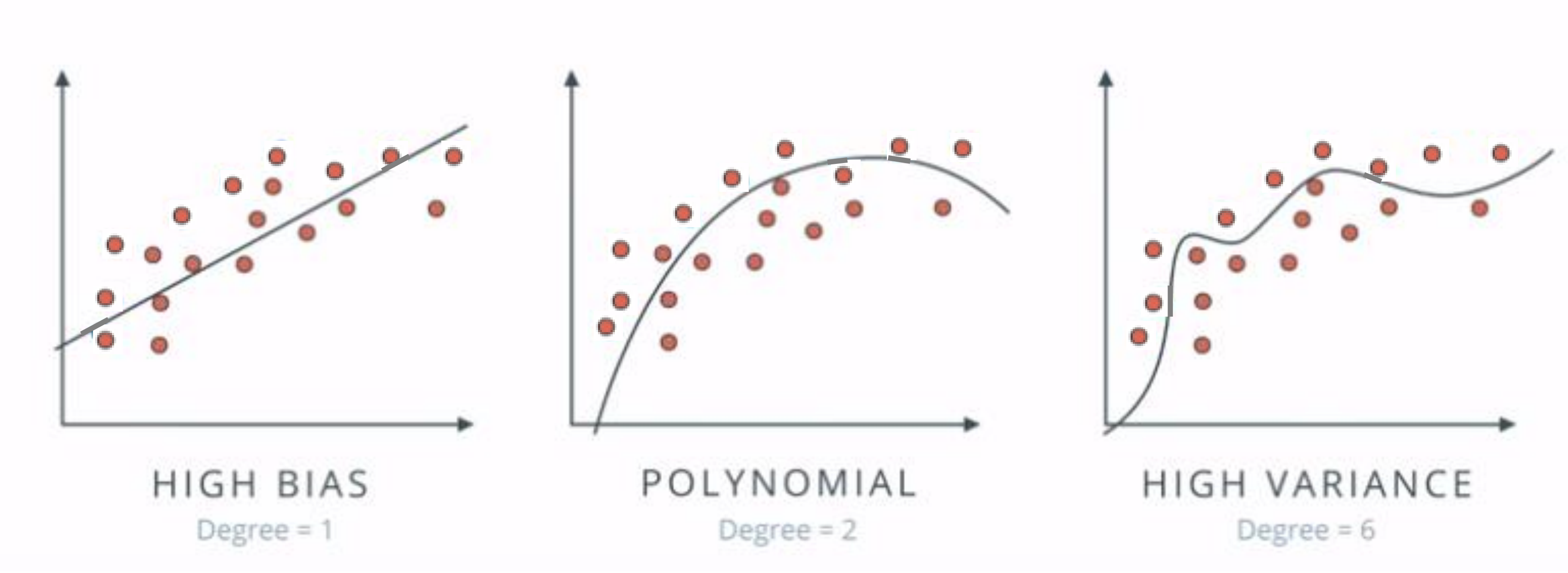
Under-fitting & Over-fitting



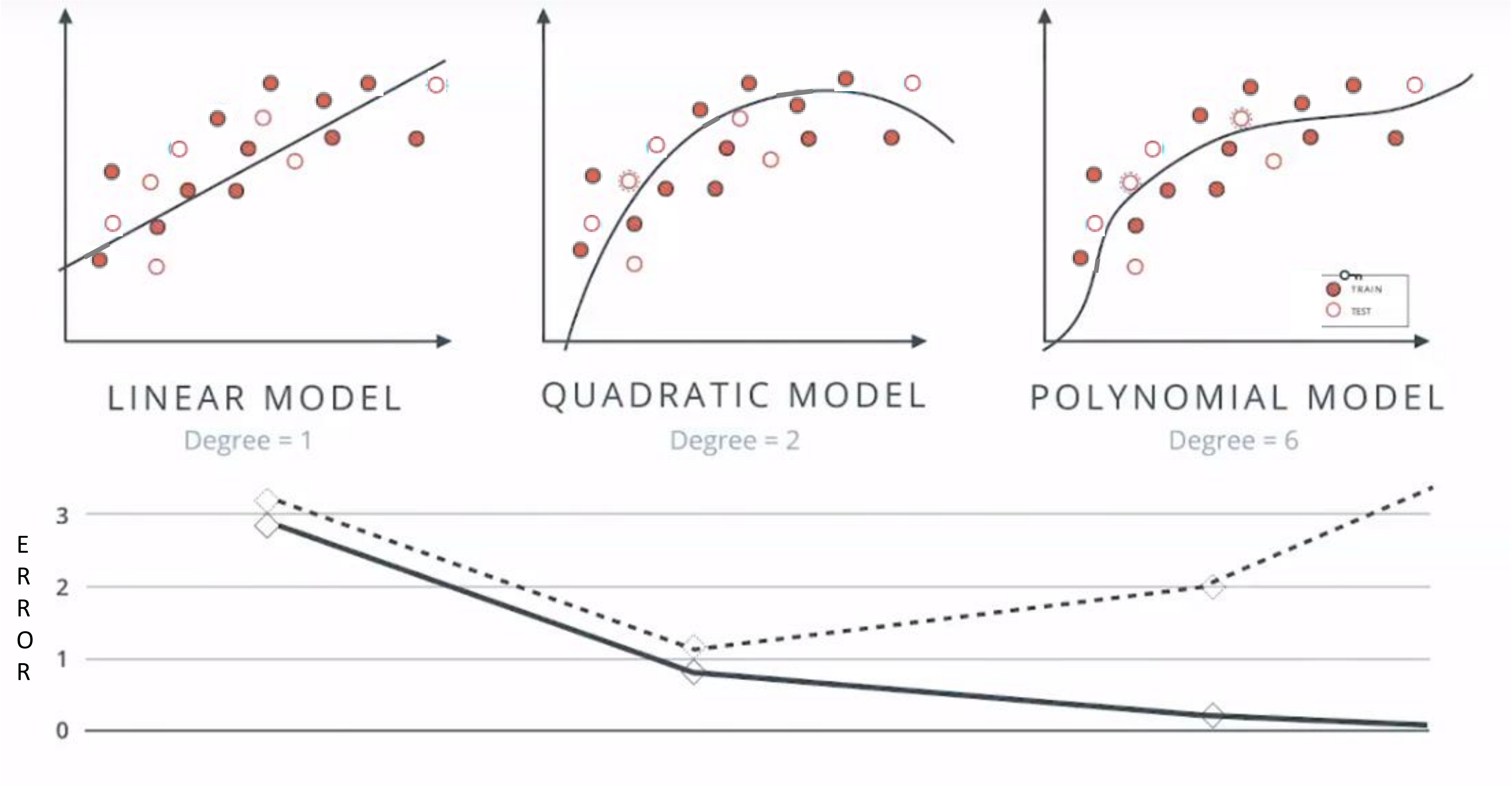




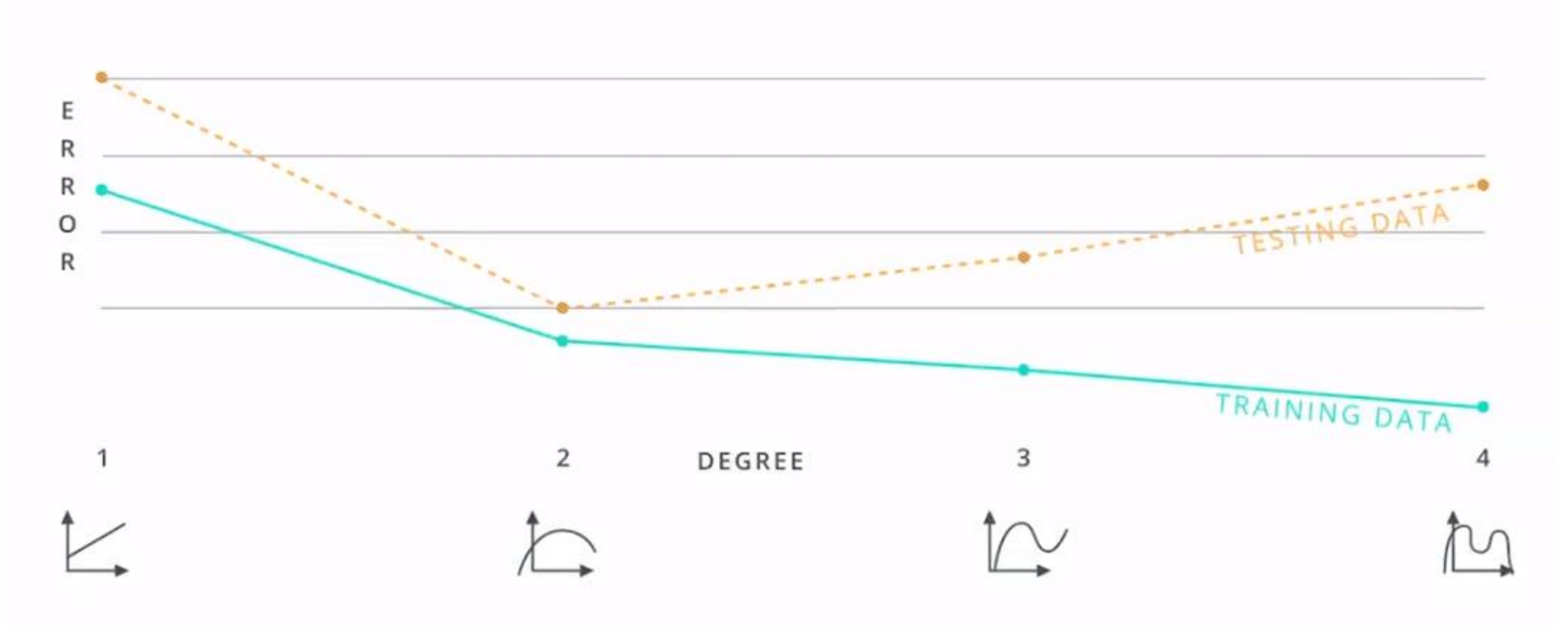
Model Complexity



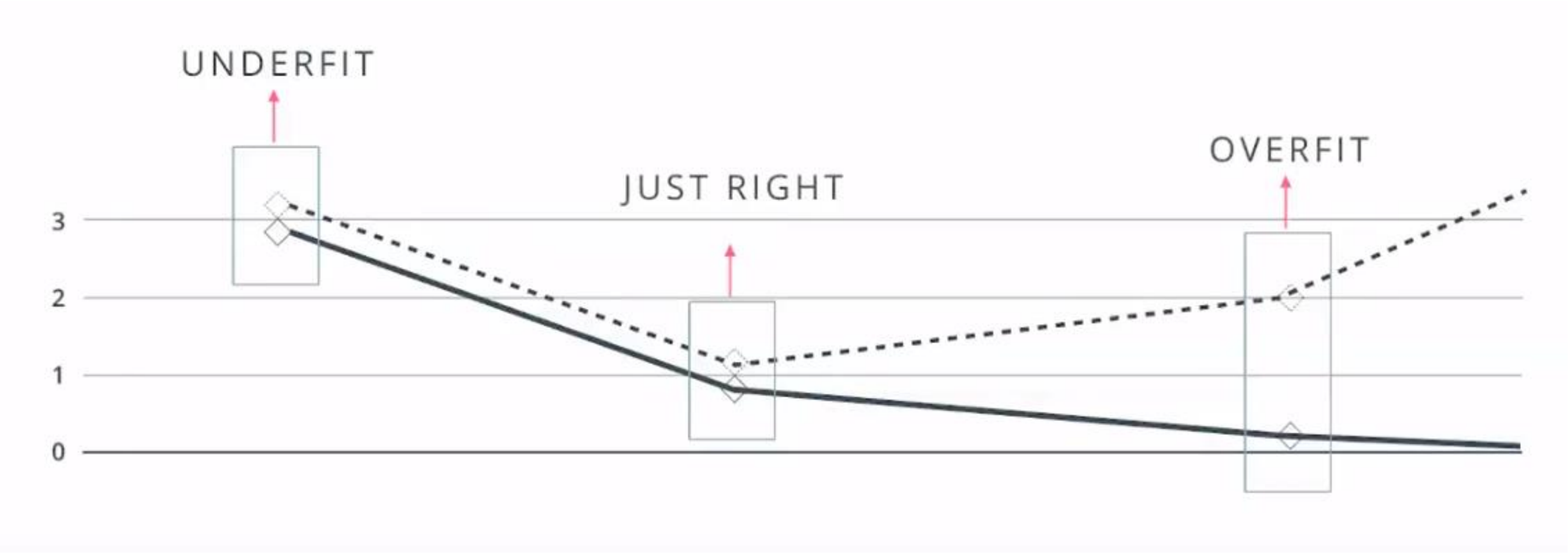
Model Complexity



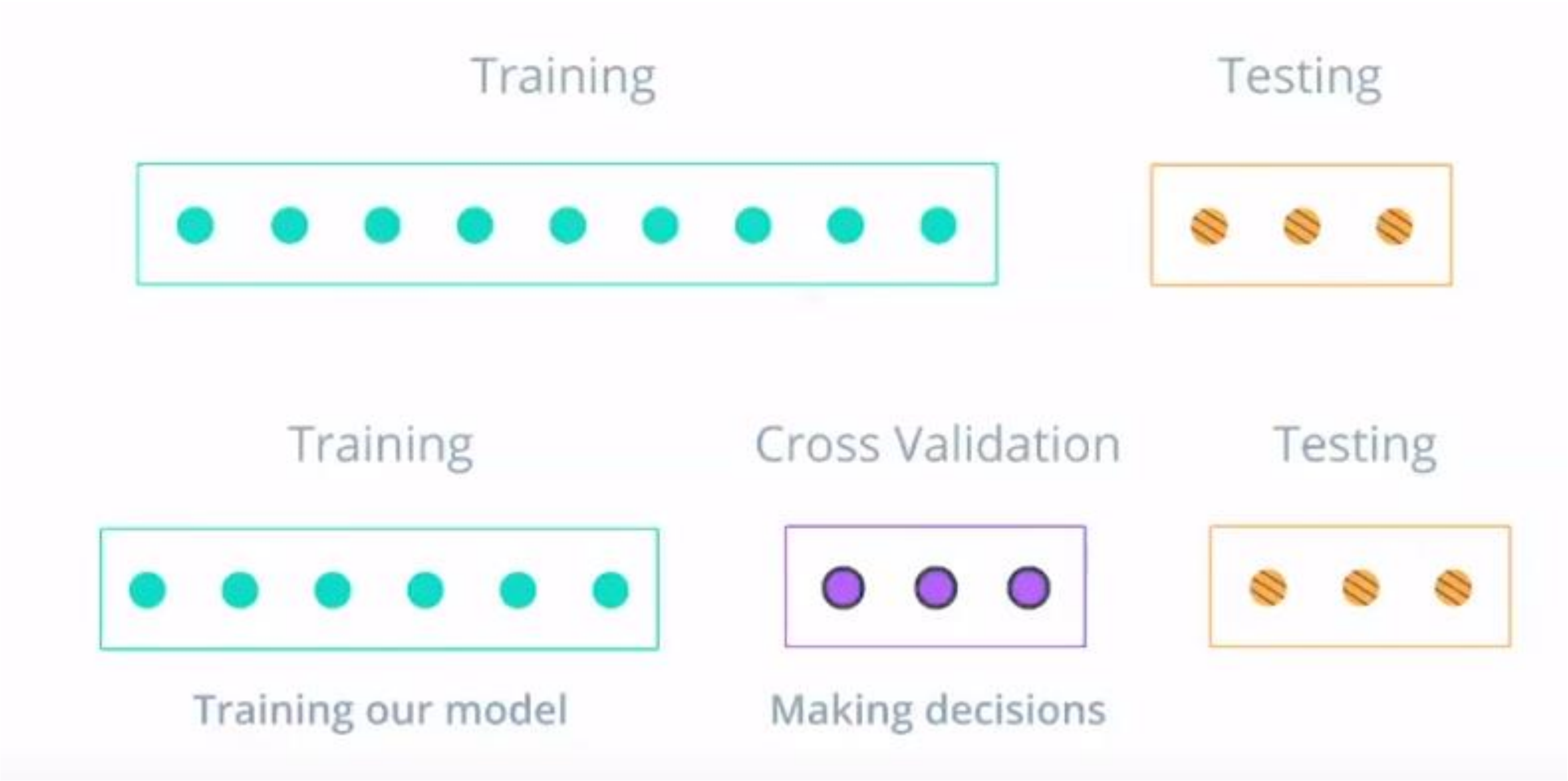
Model Complexity



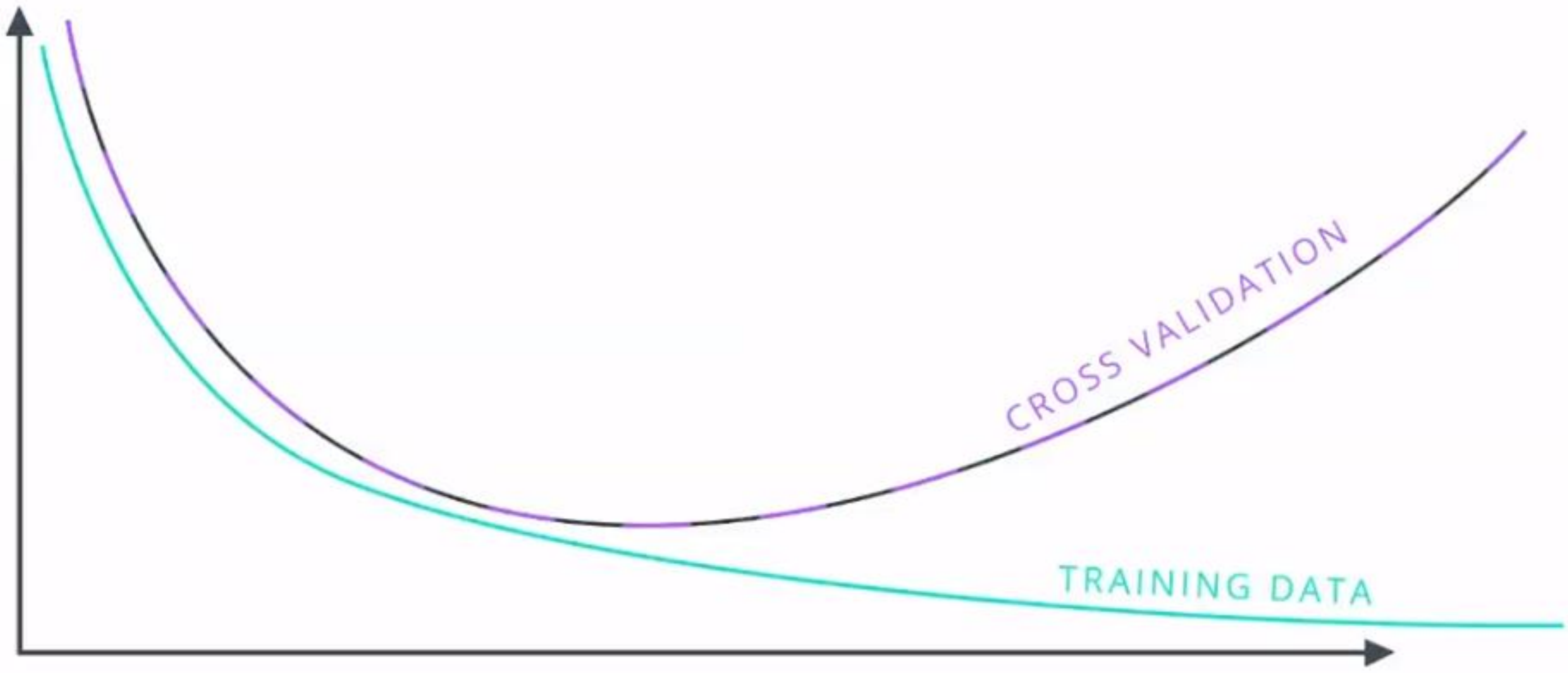
Model Complexity



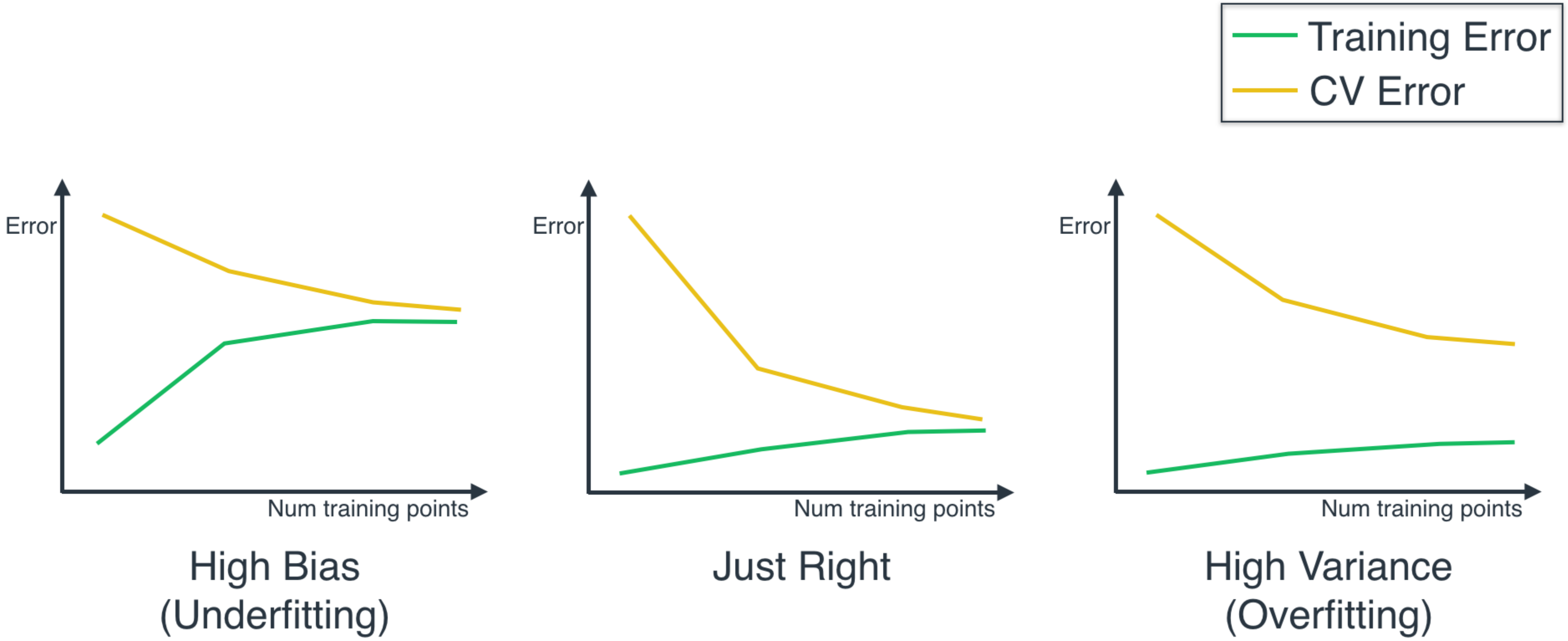
Model Complexity



Model Complexity



Impact of training points

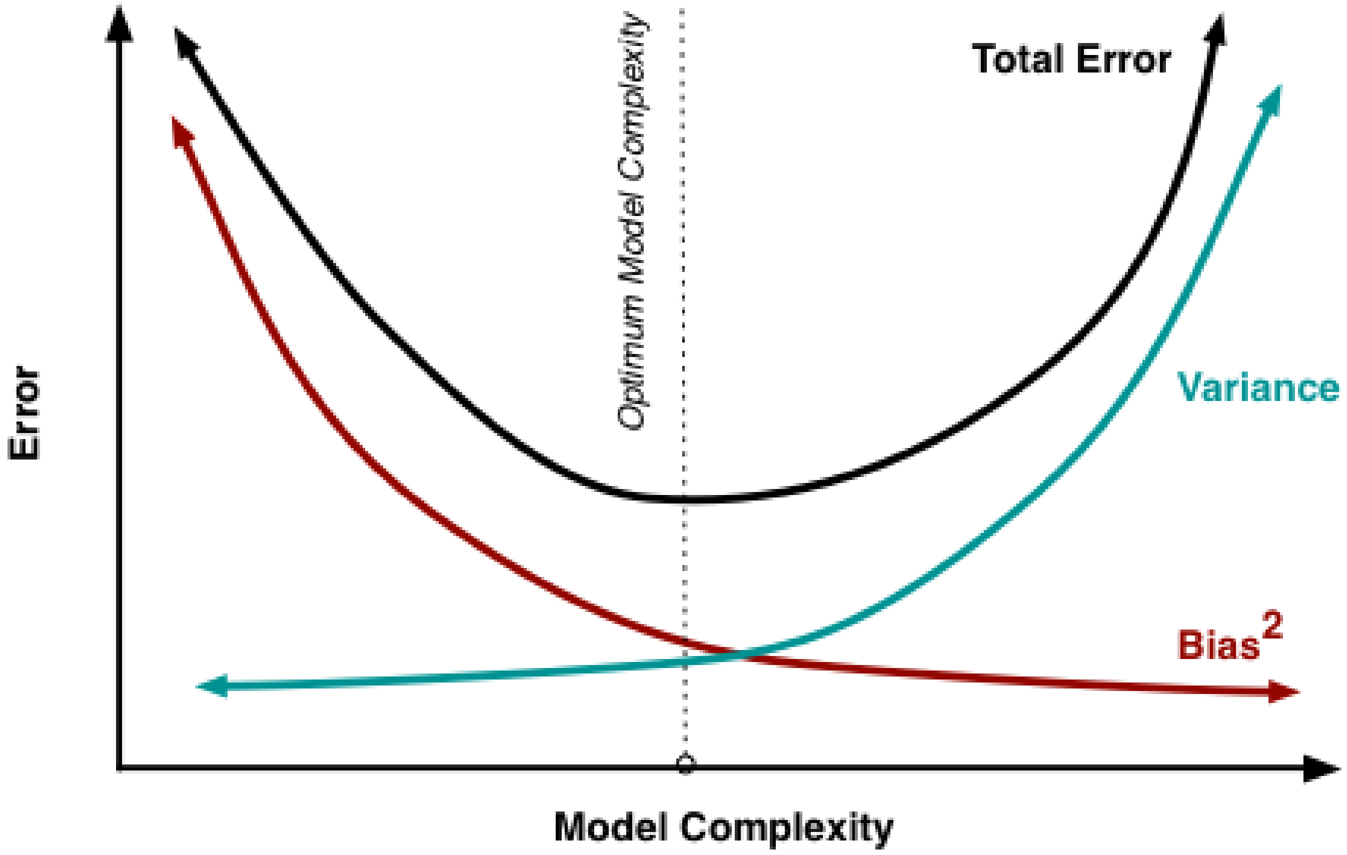


High Bias
(Underfitting)

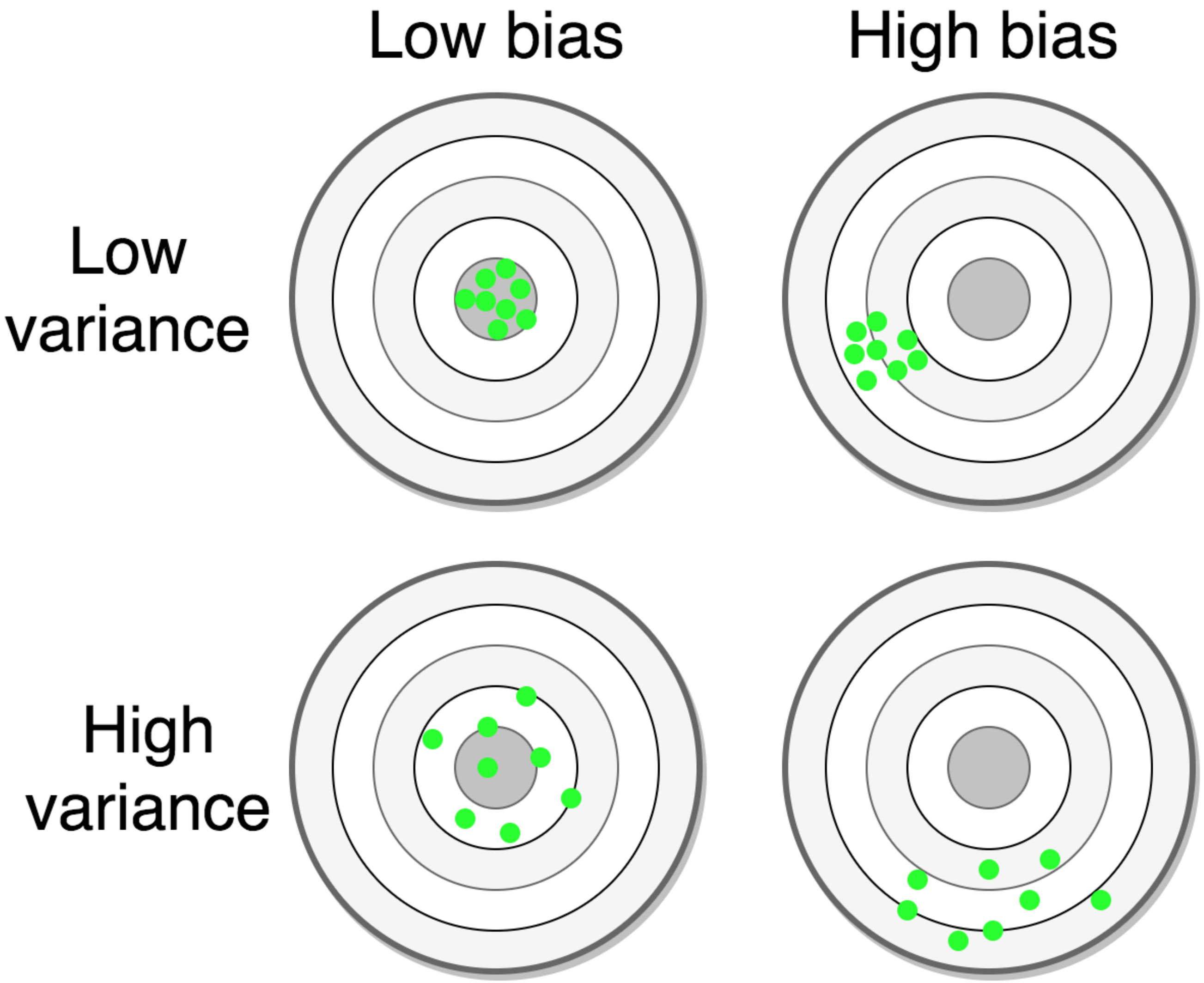
Just Right

High Variance
(Overfitting)

Bias Variance Trade-off



Bias Variance Trade-off



https://elitedatascience.com/bias-variance-tradeoff

Regularization / Shrinkage

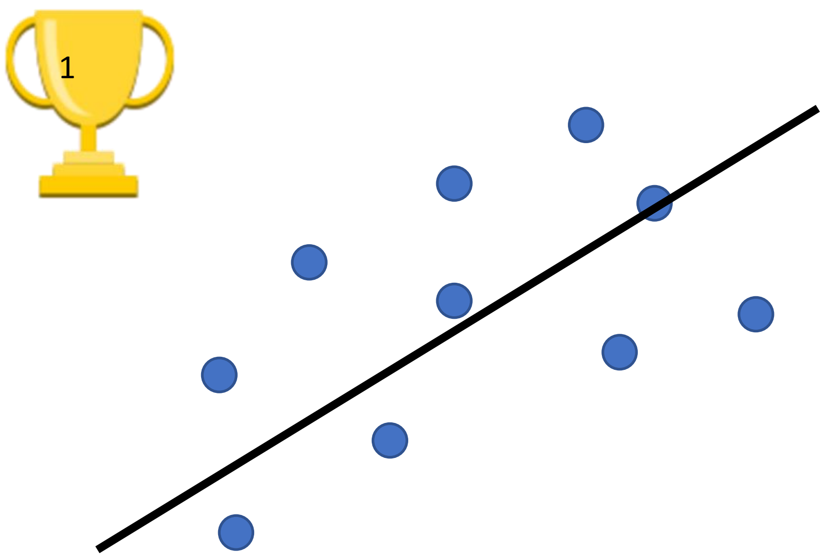
Ridge / L2

$$\sum_{i=1}^{n}\left(y_i-\beta_0-\sum_{j=1}^{p}\beta_j x_{ij}\right)^2+\lambda\sum_{j=1}^{p}\beta_j^2=\mathrm{RSS}+\lambda\sum_{j=1}^{p}\beta_j^2$$

Lasso / L1

$$\sum_{i=1}^{n}\left(y_i-\beta_0-\sum_{j=1}^{p}\beta_j x_{ij}\right)^2+\lambda\sum_{j=1}^{p}|\beta_j|=\mathrm{RSS}+\lambda\sum_{j=1}^{p}|\beta_j|$$

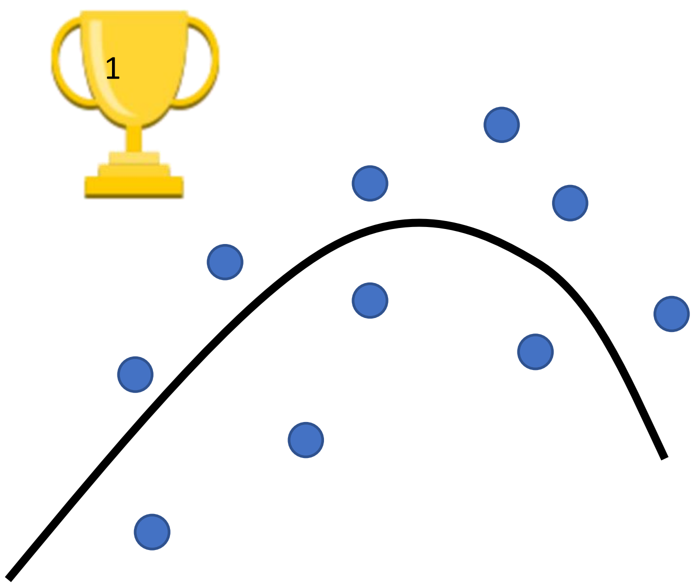
SIMPLE MODEL



ERROR:

$3x_1 + 4x_2 + 5$

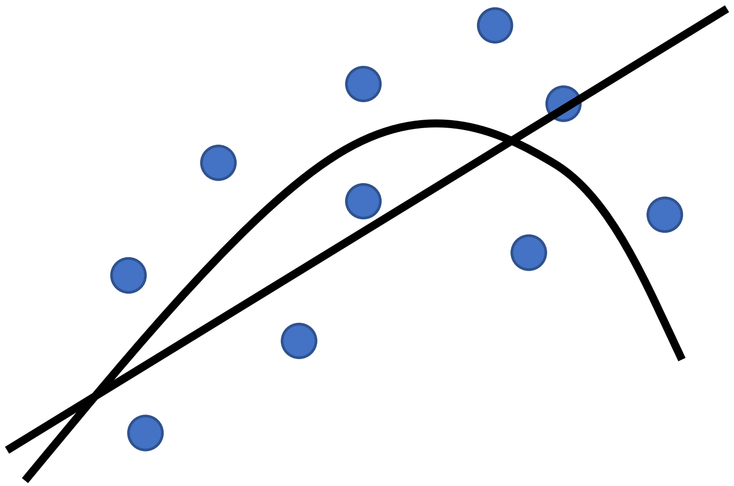
COMPLEX MODEL



ERROR:

$2x_1^3 - 2x_1^2x_2 - 4x_2^3 + 3x_1^2 + 6x_1x_2 + 4x_2^2 + 5$

L1 (Lasso) Regularization



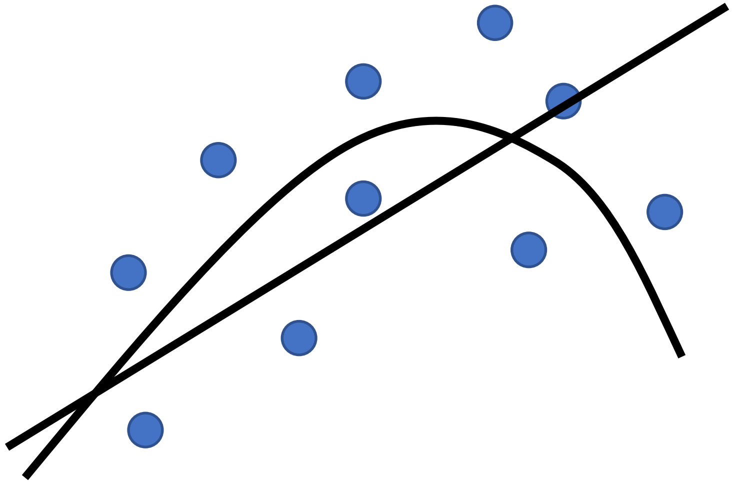
$2x_1^3 - 2x_1^2x_2 - 4x_2^3 + 3x_1^2 + 5$

$2x_1^3 - 2x_1^2x_2 - 3x_1 + 4x_2 + 6x_1x_2 + 4x_2^2 + 5$

$|2| + |-2| + |-4| + |3| = 7$

$|2| + |-2| + |3| + |4| + |6| + |4| = 21$

L2 (Ridge) Regularization



$2x_1^3 - 2x_1^2x_2 - 3x_2^3 + 4x_1^2 + 5$

$2x_1^3 - 2x_1^2x_2 - 4x_1 + 3x_2 + 6x_1x_2 + 4x_2^2 + 5$

$2^2 + (-2)^2 + (-3)^2 + 4^2 = 25$

$2^2 + (-2)^2 + (-4)^2 + 3^2 + 6^2 + 4^2 = 85$

Simple vs Complex Models

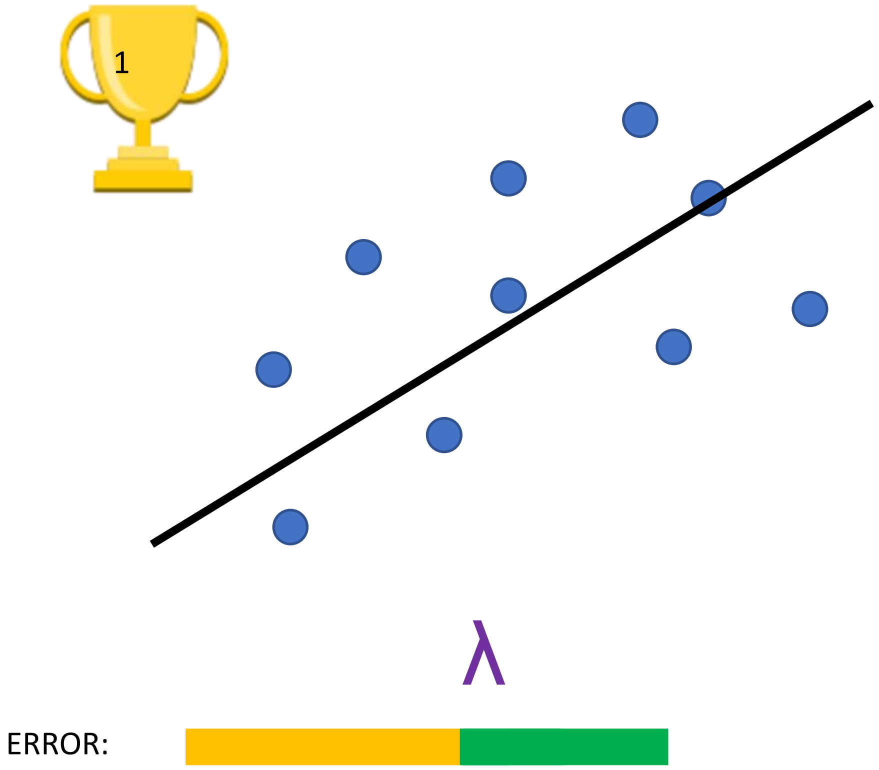
Requires LOW ERROR
OK if it’s COMPLEX

PUNISHMENT on COMPLEXITY should be SMALL

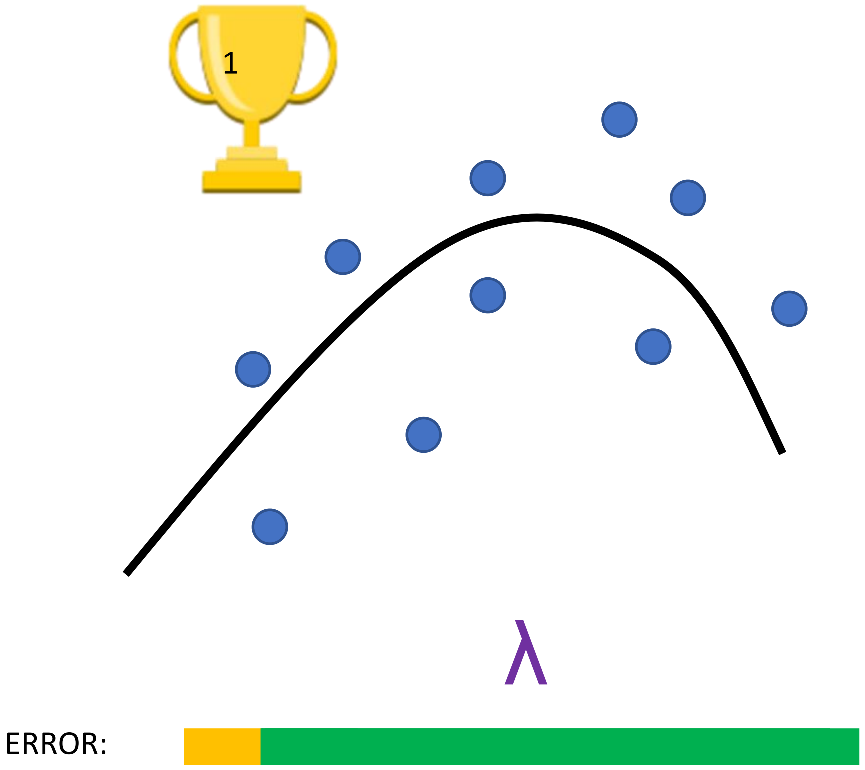
Requires SIMPLICITY
OK with ERRORs

PUNISHMENT on COMPLEXITY should be BIG

The λ Parameter



$3x_1 + 4x_2 + 5$



$2x_1^3 - 2x_1^2x_2 - 4x_2^3 + 3x_1^2 + 6x_1x_2 + 4x_2^2 + 5$

SMALL λ

LARGE λ