

CS4780 Dec 21

## Model Set / Kernels

Error = Bias + Variance + Noise

Error is high - debug

test error

error

Variance

training error

✓ Revised  
error

↑ Bias

← Adding data  
won't help

Test error  
is slightly  
above training

↑ Power of  
Algorithm.

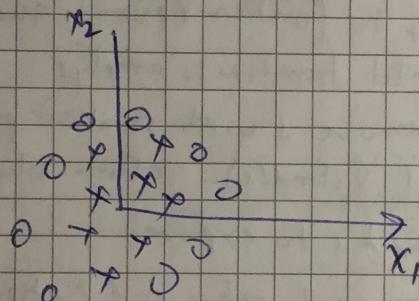
↑ Add features  
- add Boosting

- Decrease  
Regularization  
- Kernelize

- Add data
- Bagging
- Reduce complexity
- Increase Regularization

↑ fraction of data  
(Training instances)

One thing to do is Kernelization



$\vec{x} \xrightarrow{\text{Feature}} \phi(\vec{x})$  or Add interaction terms

$$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \rightarrow \begin{pmatrix} 1 \\ x_1 \\ x_2 \\ x_1 x_2 \\ x_1 x_3 \\ \vdots \\ x_1 x_d \\ x_2 x_2 \\ \vdots \\ x_1 x_2 \dots x_d \end{pmatrix}_{2^d}$$