Dataset   1000

Training Dataset   Validation dataset   Test Dataset

$\downarrow$ 60% $\downarrow$ 20% $\downarrow$ 20%

we will train over model

key par tuning of model

model will be test

Model   90% $\rightarrow$ accuracy

en   Books   different   Exam
       $\downarrow$ Books
       Q&A   Hyper tuning   model
       train   Test

Overfiting & Underfiting

(1)   Train $\rightarrow$ model is trained $\Rightarrow$ Accuracy $\uparrow\uparrow$
                                                        (95%)

Test $\rightarrow$ model is tested $\Rightarrow$ Accuracy $\downarrow\downarrow$
                                                (60%)

Test → model is test → Accuracy ...
(60%)

Overfitting

{ Low Bias
  High variance } ✓

② Train → Accuracy ⟹ 55% } ↑↑
  Test → Accuracy ⟹ 50% } ↓↓

↓↑

underfitting

{ High Bias
  High variance }

③ optimized model or Generised model

{ Train → Acc ↑↑ → 95% }
{ Test → Acc ↑↑ → 93% }

{ low Bias
  low variance }

low variance }

Bias – Variance Tradeoff

Error → The difference b/w actual value & Predicted value is the error & it is used to evaluate the model.

1) Bias Error

2) Variance error

3) The noice

✗ Noice is irreducible error but Bias & variance is reducible error.

High bias $\longrightarrow$ underffiting model

High variance $\longrightarrow$ overfitting model

Bias $\rightarrow$ Bias is difference b/w the Predicted value & the expected value.

Bias $\uparrow \propto$ underfitting

x Model with high bias pays very little attention to the training data.

x If always leads to high error on training & test data
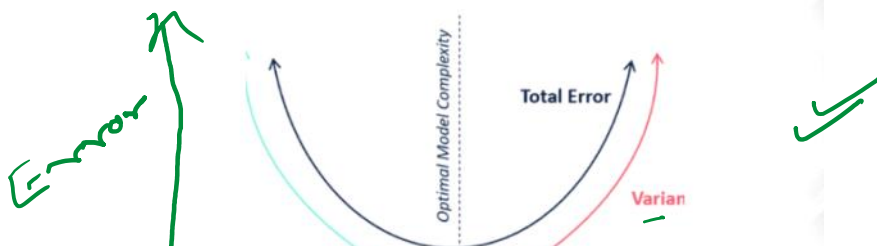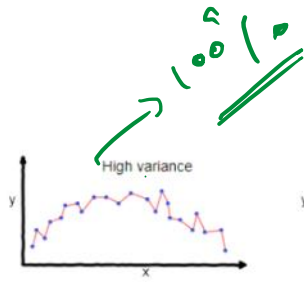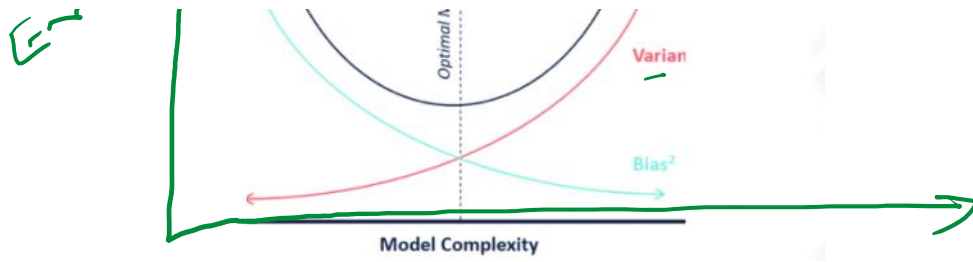
Variance

fluctuation in the data

Variance

If there are more fluctuation in the data i.e the more as well. So has a high variance. The model still consider the variance as something to learn from.

* model with high variance pays a lot of attention to training data & does not generalize on the data which it has not seen before.

As result, such model perform very well on training data but has high error rates on test data.
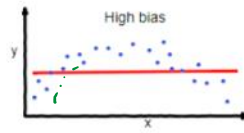
variance ↑ ∝ overfitting

Variance
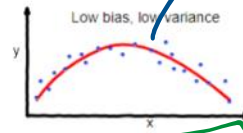
Bias²

Optimal M

Model Complexity

E_{rr}

→ 100% ⊙

Good fit line

→ 95 − 98% ⊙

High variance

overfitting

test ↓

High bias

underfitting

training ↓
test ↓

Low bias, low variance

Good balance