STATS 7022 – Data Science PG Assignment 1

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**Question 2: Variance-Bias Trade-Off**

We have:

* General form:
* Mean square error (MSE):
* Bias: (1)
* Variance: (2)

From a single new observation , MSE becomes:

(3)

By definition, is independent of **X**, , , (3) becomes:

(4)

Substitute (1) and (2) into (4), we have:

(5)

We have: and are constant, is also a constant. Thus:

The equation (5) becomes:

(6)

Because is a constant:

So:

(7)

Substitute (7) into (6), we have: