

Models fail twice, for opposite reasons.

D8A.ACADEMY/RESOURCES/BIAS-VARIANCE

THE TWO FAILURE MODES

High bias	model too simple to see the pattern. Underfits everything.
High variance	model so flexible it memorized the noise. Overfits train.
The tradeoff	capacity moves you along the line. You choose where to sit.

DIAGNOSE FROM TWO NUMBERS

TRAIN ERR	VAL ERR	DIAGNOSIS
high	high	bias
low	high	variance
low	low	ship it
high	low	check your split

FIXES FOR HIGH BIAS

more features	give the model something to see
bigger model	more capacity, more expressiveness
less regularization	loosen the leash
train longer	it may simply not be done

FIXES FOR HIGH VARIANCE

more data	the single most reliable fix
regularization	L1 / L2, dropout, early stopping
simpler model	fewer parameters to memorize with
cross-validation	not a fix: an honest measurement

→ The fixes are opposites. Diagnose first, or you make it worse with confidence.

WORTH MEMORIZING

01 Trap: one fix for both

"Add more data" is a variance cure. It does nothing for bias.

high bias + more data	same underfit, now slower to train
high variance + bigger model	memorizes the noise in HD
the rule	two numbers first, then exactly one fix
→ Half of "we tried everything" stories are one disease treated with the other disease's medicine.	