Bias - Variance Tradeoff

Bias → refers to error introduced by approximating a real world problem
↳ model oversimplifies data

Variance → measures how much a model's predictions fluctuate with different training sets.
↳ model poorly generalizes data

Bias - Variance Tradeoff → balance between both bias and variance for a model
↳ goal is to find optimal complexity where both are minimized, ensuring good performance.

Techniques to reduce bias and variance:

Bias
- Increase model complexity → deeper trees, more features
- Use more flexible algorithms → switch from linear to non-linear models
- Reduce Regularization strength

Variance
- Reduce model complexity → prune trees, fewer features
- Use regularization techniques → L1, L2, elastic
- Increase training dataset size
- Ensemble Learning
- Cross validation techniques

Overfitting → when model is too complex
↳ excellent on training data but poorly on unseen (testing) data
low bias - high variance

Underfitting → model is too simple to understand the underlying patterns in data
↳ performs poorly in both training and testing
high bias - low variance