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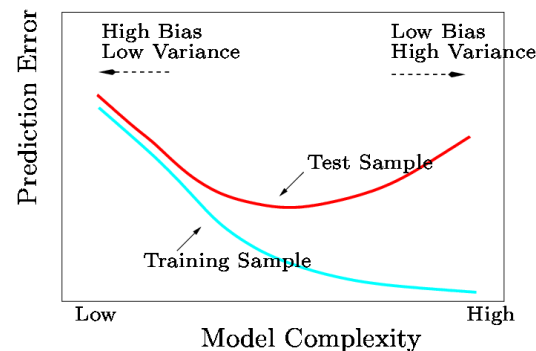
## Summary

# Topic 1: Overview of Statistical Learning

- Model the relationship

$$Y = f(X) + \varepsilon$$

- Supervised learning vs. unsupervised learning
- Regression vs. classification
- Learning for prediction vs. inference
- Selecting a learning method
- Bias-variance tradeoff
- Fundamental picture



# Topic 2: Linear Regression

- Model form

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \varepsilon$$

- Model estimation

- Accuracy of coefficient estimates

- Testing on coefficients

- Assessing model fitting (RSE,  $R^2$ , adjusted  $R^2$ )

- Other considerations

- Qualitative predictors

- Interaction terms

- Nonlinear relationship

- Model diagnostics

# Topic 3: Classification

- Popular classifiers
  - Logistic regression
  - Linear discriminant analysis (LDA) & QDA
  - K-Nearest Neighbors (KNN)
- Performance assessment

# Topic 4: Resampling

- Cross validation
  - The Validation Set Approach
  - Leave-One-Out Cross Validation
  - K-fold Cross Validation
- Bootstrap

# Topic 5: Model Selection and Regularization

- Reasons for improving the OLS model
- Subset selection methods
- Shrinkage methods
- Dimension reduction methods

# Topic 6: Tree

- Regression/classification tree
- Building a tree
- Pros and cons of tree models
- Tree pruning
- Methods to improve trees

# Topic 7: SVM

- Maximal margin classifier
- Support vector classifier
- Support vector machine



# Topic 8: Principal Components Regression

- Principal components analysis (PCA)
- PCR

# Topic 9: Deep Learning

- Single layer neural network and fitting
- More complex neural networks
- When to use deep learning

# Final Exam

- **Closed-book**
- **Focus:** concepts/ideas
- **Types:**
  - Multiple-choice questions (choose the best answer)
  - Other questions
- **Allowed:**
  - One formula sheet (A4 size, double-sided)
  - Calculator

# Time Schedule

- Office Hour on Mondays
  - Nov 22, Nov 29, Dec 6, Dec 13 @ **4:00 – 5:00 PM**
  - Please attend the Zoom session before 4:10 PM
  
- Dec 17 (Fri) @ 2:00 – 4:00 PM: Exam