Summary

➢ 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
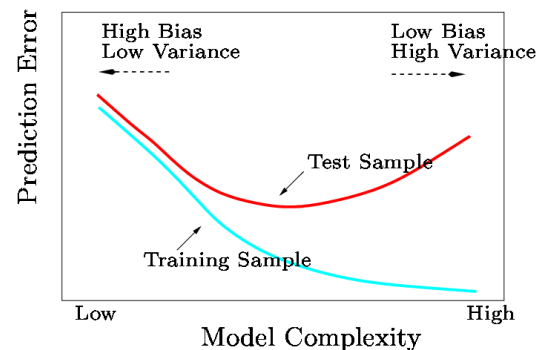
Topic 2: Linear Regression

➢ 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 of questions:**

  ➢ True-false questions

  ➢ Multiple-choice questions (choose the best answer)

  ➢ Answer on the multiple-choice answer sheet in pencil

➢ **Allowed:**

  ➢ One formula/note ("cheat") sheet (A4 size, double-sided)

  ➢ Calculator

➢ **Requirements**

    ➢ Be silent in the exam room!

    ➢ Wear mask properly during the exam!

    ➢ If you have to leave the room:

        ➢ Get the invigilator's permission first

        ➢ Write down your leaving/back time on a form

        ➢ Cannot take cell phone or course-related materials with you

Time Schedule

➢ Office hours before exam

    ➢ Nov 24 (Thu) @ **6:00 pm**

    ➢ Dec 1 (Thu) @ **9:00 am**

    ➢ Dec 5 (Mon) @ **9:00 am**

    ➢ Please log in within 10 minutes after the session starts!

➢ Exam time: Dec 8 (Thursday) @ 9:30 – 11:30