**Section 6.2: Linear Regression in Python**

**Duration:** 2.5 hours

**Concepts:**

* Simple linear regression
* Multiple linear regression
* Potential problems
* Performing linear regression in Python

**Description:** Introduction to linear regression with emphasis on interpretation of fitted models and implementation in Python.

**Materials:** Section 6.2 slide deck; linear regression in-class exercises.

**Textbook section:** An Introduction to Statistical Learning with Applications in Python, Chapter 3.

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| **Duration** | **Lesson Section** | **Learning Objectives** |
| 30 mins | Go through the Simple Linear Regression section of the slide deck. | * Parameter estimation with least squares * Assessing accuracy of parameter estimates * Hypothesis testing for coefficients * Checking quality of model fit with R^2 and RSE |
| 15 mins | Go through the “Simple Linear Regression” section in the Jupiter Notebook file as a class. | * Use `sm.OLS()` to specify the model and `model.fit()` to fit a linear model to the `Boston` data set. * Interpret results using `summary()` * Plot model |
| 20 mins | Go through the multiple linear regression section of the slide deck. | * Estimating and assessing fit of parameters and model * Types of errors associated with predictions * Prediction intervals |
| 10 mins | Go through the “Multiple Linear Regression” section in the Jupiter Notebook file as a class. | * Use `ModelSpec()` to fit a multiple linear regression * Interpret model results. * Use `get\_prediction()` to find a prediction interval |
| 15 mins | Go through the “Qualitative Predictors” section of the slide deck. | * Qualitative predictors * Dummy variables * Two or more levels |
| 8 mins | Go through the “Qualitative Predictors” section in the Jupiter Notebook file as a class. | * Use a qualitative predictor * Interpret the coefficient estimates |
| 10 mins | Go through the linear model extensions section of the slide deck. | * Removing the additive assumption * Interaction effect * Hierarchical principal |
| 5 mins | Go through the “Interaction Term” section in the Jupiter Notebook file as a class. | * Use `ModelSpec()` and ‘model.fit()` with an interaction term |
| 30 mins | Go through the remaining sections of the slide deck. | * Non-linear response-predictor relationship * Correlation of error terms * Non-constant variance of error terms * Outliers * High-leverage points |
| 20 mins | Go through the “Helpful Plots” section in the Jupiter Notebook file as a class. Students should be given time to finish the question at the end. | * How to use plots to examine data and fit * Plot studentized residuals * Cumulative exercise |