

Stat 340
Applied Regression
Class Overview

Learning Task 1: Regression

For given values of covariates/features/explanatory variables X_1, \dots, X_p , what is the expected value of the quantitative response variable Y ?

- X_1 = Years of Education, X_2 = Seniority
- Y = Income

Goal: $Y = f(X_1, X_2) + \varepsilon$

Learning Task 1: Regression

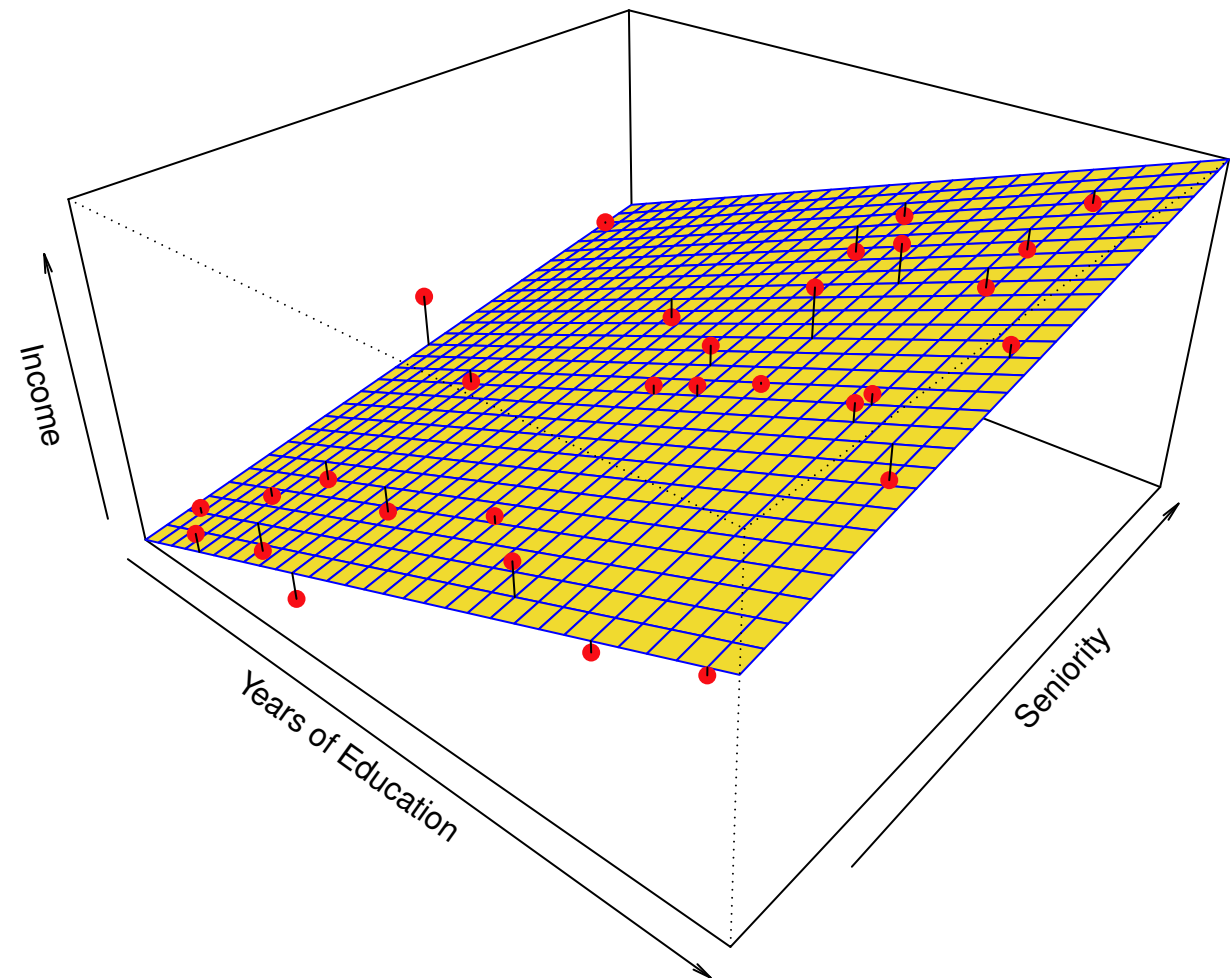
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Approach 1:
Multiple Linear Regression

$$f(X_1, X_2) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$



Learning Task 1: Regression

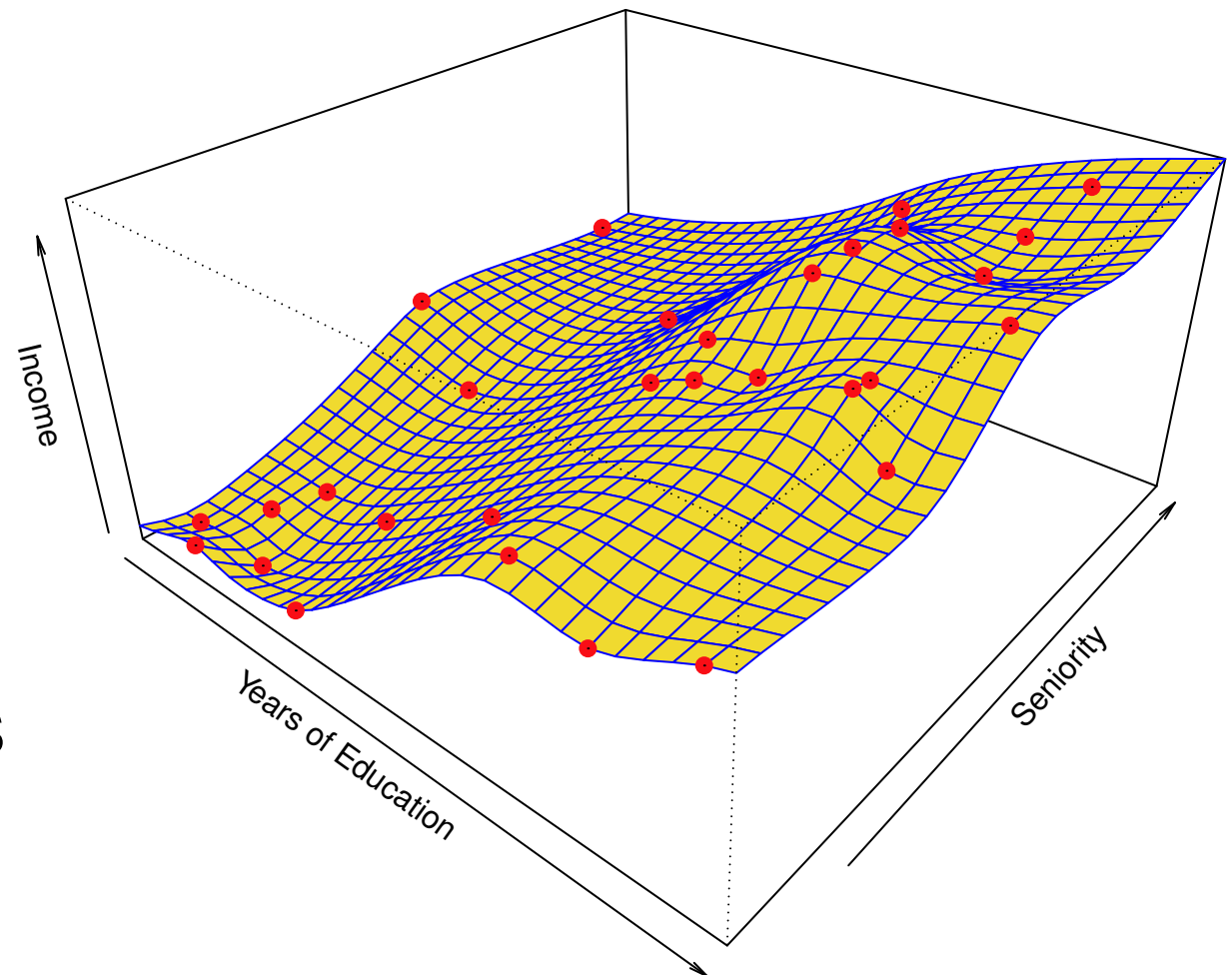
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Additional Approaches:

- Splines (pictured right)
- Regression Trees
- K Nearest Neighbors
- Generalized Additive Models



Learning Task 2: Classification

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- X_1, \dots, X_{57} = Summaries of contents of email messages (e.g., percent of words in message that are “business”, average length of sequences of capital letters, ...)
- Y = Indicator of whether a given email was spam.

Goal: $P(Y = k | X_1, X_2) = f_k(X_1, X_2)$ for each category k

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Approach 1:

Logistic Regression

$$f(X_1, \dots, X_{57}) = \frac{\exp(\beta_0 + \beta_1 X_1 + \dots + \beta_{57} X_{57})}{1 + \exp(\beta_0 + \beta_1 X_1 + \dots + \beta_{57} X_{57})}$$

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Additional Approaches:

- Linear Discriminant Analysis
- Classification Trees
- K Nearest Neighbors
- Generalized Additive Models

Goals for this Class

1. Understand statistical models listed on previous slides
2. Perform model estimation using implementations in R packages
3. Visualize data and model outputs in R
4. Compare/evaluate different models graphically and quantitatively
5. Collaborative coding and writing with Git and GitHub
6. Generally - what to do when presented with a new data set?

Prerequisites

Stat 242:

- Multiple Linear Regression
 - Estimating and interpreting linear regression models with multiple explanatory variables
 - Confidence intervals for parameters, interpretations
 - Hypothesis tests (F and t) about parameters
 - A first look at polynomial regression
 - Data transformations with log and square root
- Logistic Regression
 - One explanatory variable
- Some familiarity with R

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All of this will be reviewed!

Some of the figures in this presentation are taken from
"An Introduction to Statistical Learning, with applications in R" (Springer, 2013)
with permission from the authors: G. James, D. Witten, T. Hastie and R. Tibshirani