Housing Prices

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## Introduction

In this analysis, we build a model predicting sale prices of houses based on data on houses that were sold in the Duke Forest neighborhood of Durham, NC around November 2020. Let’s start by loading the packages we’ll use for the analysis.

library(openintro) # for data

Warning: package 'openintro' was built under R version 4.1.3

Warning: package 'airports' was built under R version 4.1.3

Warning: package 'cherryblossom' was built under R version 4.1.3

Warning: package 'usdata' was built under R version 4.1.3

library(tidyverse) # for data wrangling and visualization

Warning: package 'tidyverse' was built under R version 4.1.3

Warning: package 'ggplot2' was built under R version 4.1.3

Warning: package 'tibble' was built under R version 4.1.3

Warning: package 'tidyr' was built under R version 4.1.3

Warning: package 'readr' was built under R version 4.1.3

Warning: package 'dplyr' was built under R version 4.1.3

Warning: package 'stringr' was built under R version 4.1.3

library(knitr) # for tables

Warning: package 'knitr' was built under R version 4.1.3

library(broom) # for model summary

Warning: package 'broom' was built under R version 4.1.3

We present the results of exploratory data analysis in [Section 2](#sec-eda) and the regression model in [Section 3](#sec-model).

## Exploratory data analysis

The data contains 98 houses. As part of the exploratory analysis let’s visualize and summarize the relationship between areas and prices of these houses.

### Data visualization

[Figure 1](#fig-histogram) shows two histograms displaying the distributions of price and area individually.

ggplot(duke\_forest, aes(x = price)) +  
 geom\_histogram(binwidth = 50000) +  
 labs(title = "Histogram of prices")  
  
ggplot(duke\_forest, aes(x = area)) +  
 geom\_histogram(binwidth = 250) +  
 labs(title = "Histogram of areas")

|  |  |  |  |
| --- | --- | --- | --- |
| |  | | --- | | (a) Histogram of prices | | |  | | --- | | (b) Histogram of areas | |

Figure 1: Histograms of individual variables

[Figure 2](#fig-scatterplot) displays the relationship between these two variables in a scatterplot.

ggplot(duke\_forest, aes(x = area, y = price)) +  
 geom\_point() +  
 labs(title = "Price and area of houses in Duke Forest")

|  |
| --- |
| Figure 2: Scatterplot of price vs. area of houses in Duke Forest |

### Summary statistics

[Table 1](#tbl-stats) displays basic summary statistics for these two variables.

duke\_forest %>%  
 summarise(  
 `Median price` = median(price),  
 `IQR price` = IQR(price),  
 `Median area` = median(area),  
 `IQR area` = IQR(area),  
 `Correlation, r` = cor(price, area)  
 ) %>%  
 kable(digits = c(0, 0, 0, 0, 2))

Table 1: Summary statistics for price and area of houses in Duke Forest

| Median price | IQR price | Median area | IQR area | Correlation, r |
| --- | --- | --- | --- | --- |
| 540000 | 193125 | 2623 | 1121 | 0.67 |

## Modeling

We can fit a simple linear regression model of the form shown in **?@eq-slr**.

[ADD EQUATION HERE]

[Table 2](#tbl-lm) shows the regression output for this model.

price\_fit <- lm(price ~ area, data = duke\_forest)  
   
price\_fit %>%  
 tidy() %>%  
 kable(digits = c(0, 0, 2, 2, 2))

Table 2: Linear regression model for predicting price from area

| term | estimate | std.error | statistic | p.value |
| --- | --- | --- | --- | --- |
| (Intercept) | 116652 | 53302.46 | 2.19 | 0.03 |
| area | 159 | 18.17 | 8.78 | 0.00 |