Housing Prices

Arvind Venkatadri

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## 1 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.

```{r}  
#| label: load-pkgs  
#| code-summary: "Packages"  
#| message: false  
  
library(openintro) # for data  
library(tidyverse) # for data wrangling and visualization  
library(knitr) # for tables  
library(broom) # for model summary  
```

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

## 2 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.

### 2.1 Data visualization

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

```{r}  
#| label: fig-histogram  
#| fig-cap: "Histograms of individual variables"  
#| fig-subcap:  
#| - "Histogram of `price`s"  
#| - "Histogram of `area`s"  
#| layout-ncol: 2  
#| column: page-right  
  
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.

```{r}  
#| label: fig-scatterplot  
#| fig-cap: "Scatterplot of price vs. area of houses in Duke Forest"  
  
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 |

### 2.2 Summary statistics

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

```{r}  
#| label: tbl-stats  
#| tbl-cap: "Summary statistics for price and area of houses in Duke Forest"  
  
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 |

## 3 Modeling

We can fit a simple linear regression model of the form shown in [Equation 1](#eq-slr).

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

```{r}  
#| label: tbl-lm  
#| tbl-cap: "Linear regression model for predicting price from area"  
  
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 |

|  |
| --- |
| Note |
| This is a pretty incomplete analysis, but hopefully the document provides a good overview of some of the authoring features of Quarto ! |

## 4 Crossreferences

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

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

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

We can fit a simple linear regression model of the form shown in [Equation 1](#eq-slr).