# Housing Prices

Mine Çetinkaya-Rundel

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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.

```
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 and the regression model in Section 3.

We're going to do this analysis using literate programming (Knuth 1984).

## 2 Exploratory data analysis

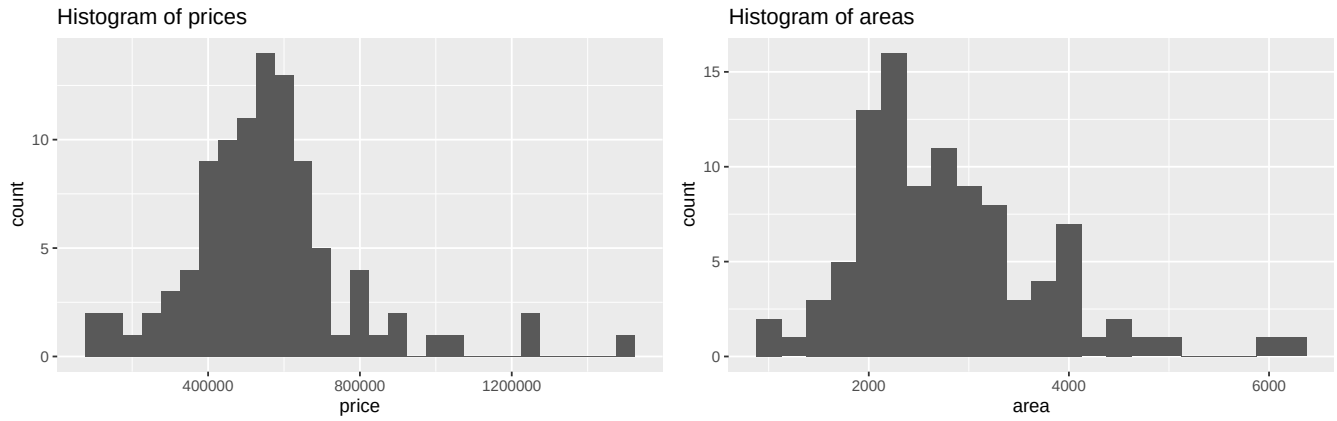
The data contains 98 houses. As part of the exploratory analysis let's visualize and summarize the relationship between areas and prices of these houses.

## 2.1 Data visualization

Figure 1 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 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")
```

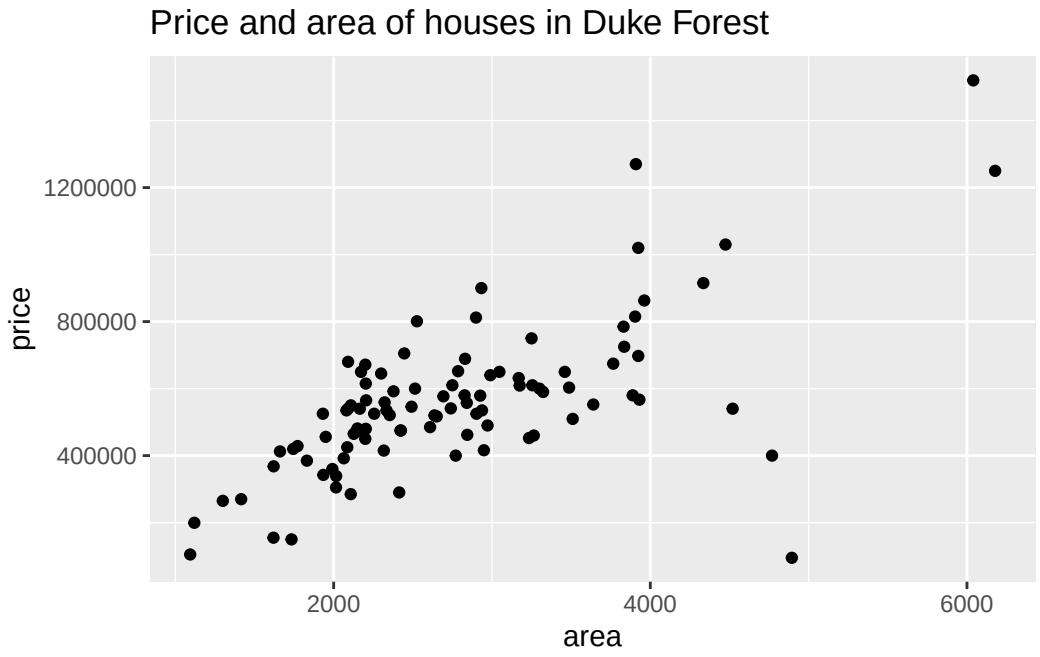



Figure 2: Scatterplot of price vs. area of houses in Duke Forest

## 2.2 Summary statistics

Table 1 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 |

## 3 Modeling

We can fit a simple linear regression model of the form shown in Equation 1.

$$price = \hat{\beta}_0 + \hat{\beta}_1 \times area + \epsilon \tag{1}$$

Table 2 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 |

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

## References

Knuth, D. E. 1984. "Literate Programming." *The Computer Journal* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.