# Boston Houses Pricing

*Predictive Model using Linear Regression*

*Machine Learning I*


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# Agenda

# Boston residents' face multiple challenges when navigating through housing options

*Some of the features in the dataset:*

- **N° rooms** – tailored to meet your specific requirements
- **Crime rate per capita** – providing insights into neighborhood safety
- **Pollution levels** – helping you evaluate the environmental quality
- **Pupil-teacher ratio** – supporting decisions for families with children
- **Tax rate and industrial proportion** – offering economic perspectives

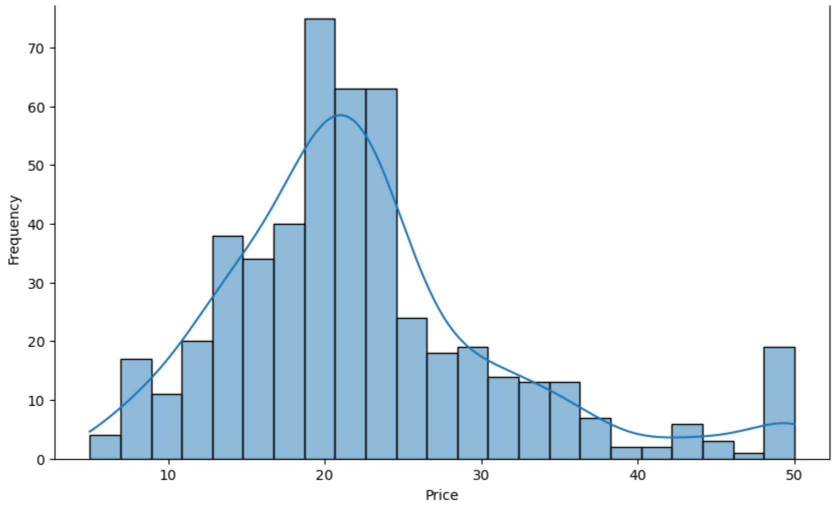
This **user-friendly platform simplifies the journey** of house hunting by allowing users to **input their preferences**, visualize data trends, and instantly **receive a price estimate** tailored to their dream home.

**Boston Housing Predictor → *Value Proposition***

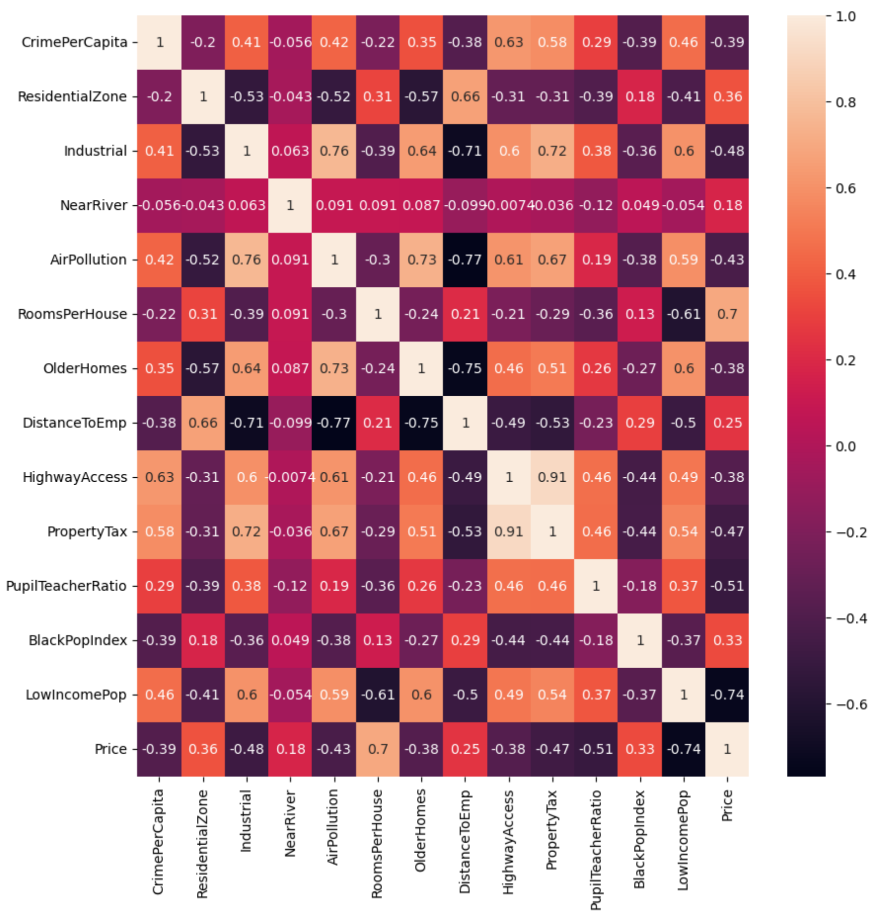
**Transparency, simplicity and confidence** to the housing market, empowering residents to find homes that meet their needs and align with their budgets

# All the features are seemingly correlated with the dependent variable

## Distribution of House Pricing




## Correlation Heatmap




## Key Takeaways

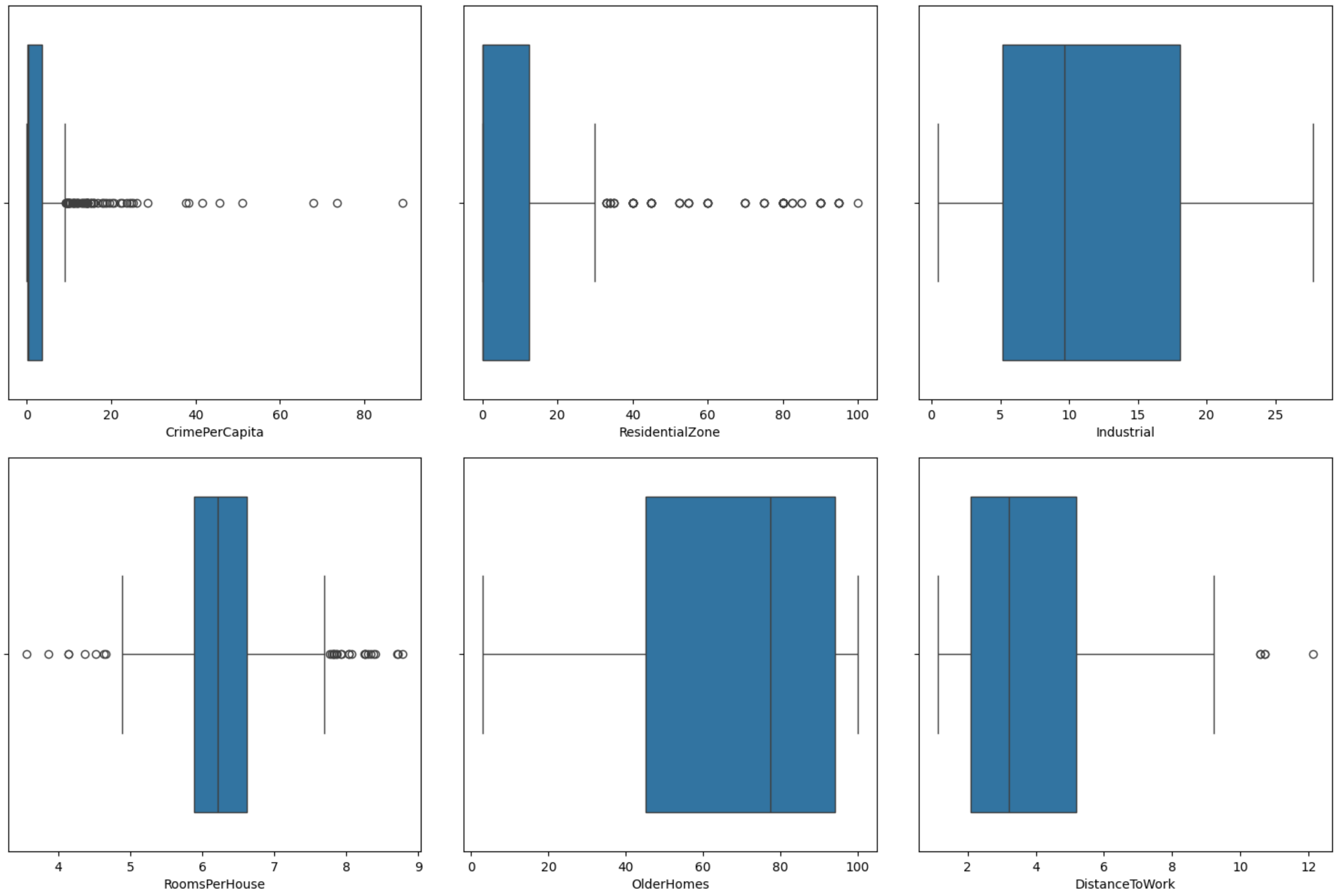
### Distribution of House Pricing:

- Most houses **are priced between 14K and 26K,** although there is a considerable amount in the 50 thousands' **(right-heavy tail)**

### Correlation Heatmap:

- We will use the features with a **correlation above 0.4** (absolute value)
- **PropertyTax and HighwayAccess are highly correlated (0.91)** between each other, which would possibly lead to multicollinearity, if they were variable of the same type

# No outliers were detected




## Key Takeaways

**Boxplots for Outlier Detection:**

- Example: **6 Charts**
- **Machine Learning's** outliers are considered differently than **Statistics**
- Charts that have plenty of circles outside the IQR means that the dataset has a **wide distribution,** hence are not considered outliers
- **DistanceToWork** required further investigation but lead to be considered as no outlier
- **No outliers detected**

# 3 models were trained: df – every feature contemplated; df1 – correlation threshold of 0.4; df2 – correlation threshold of 0.2

**Macro Process** for a Linear Regression Model

**Understand the problem and have a clear value proposition**

**Dependent variable:**
Price

**Test proportion:**
10%

**Scale the features:**
Fit and transform for training
Transform for test

**Elastic Net model** for regularization

**Cross Validation through Grid Search**

**df** | **14** features

**df1** | **8** features

**df2** | **12** features

**Model I (df)** every feature

**Parameter Grid Definition** – 210 fits

**Best hyperparameters:** alpha = **0.1**; l1_ratio = **0.7**

**Model II (df1)** >0.4 correlation

**Parameter Grid Definition** – 210 fits

**Best hyperparameters :** alpha = **0.1**; l1_ratio = **0.5**

**Model III (df2)** >0.2 correlation

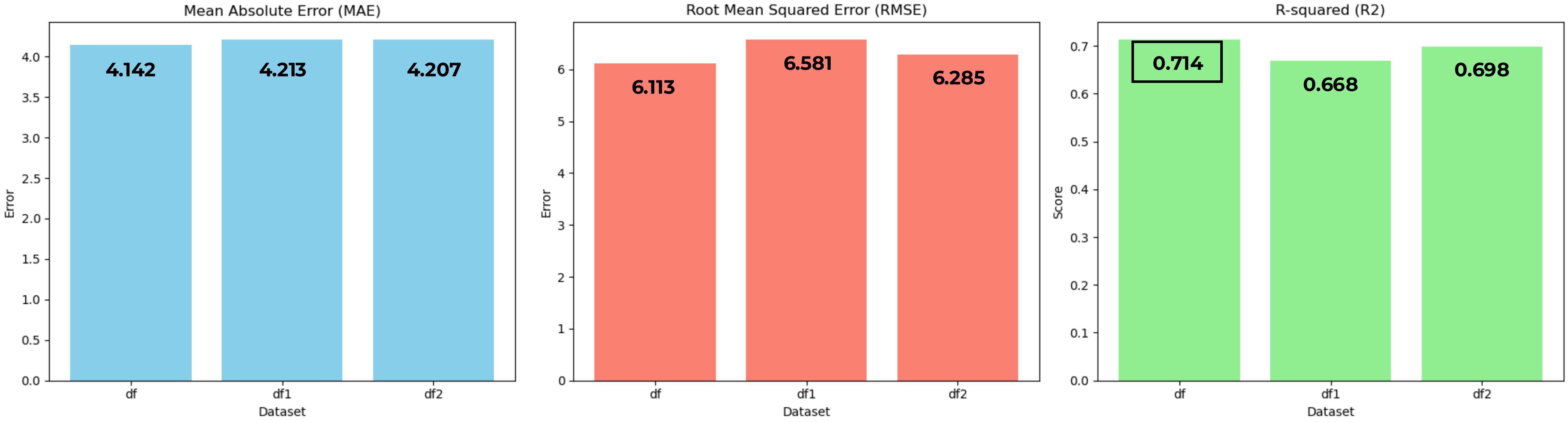
**Parameter Grid Definition** – 210 fits

**Best hyperparameters :** alpha = **0.1**; l1_ratio = **0.9**

Worse results

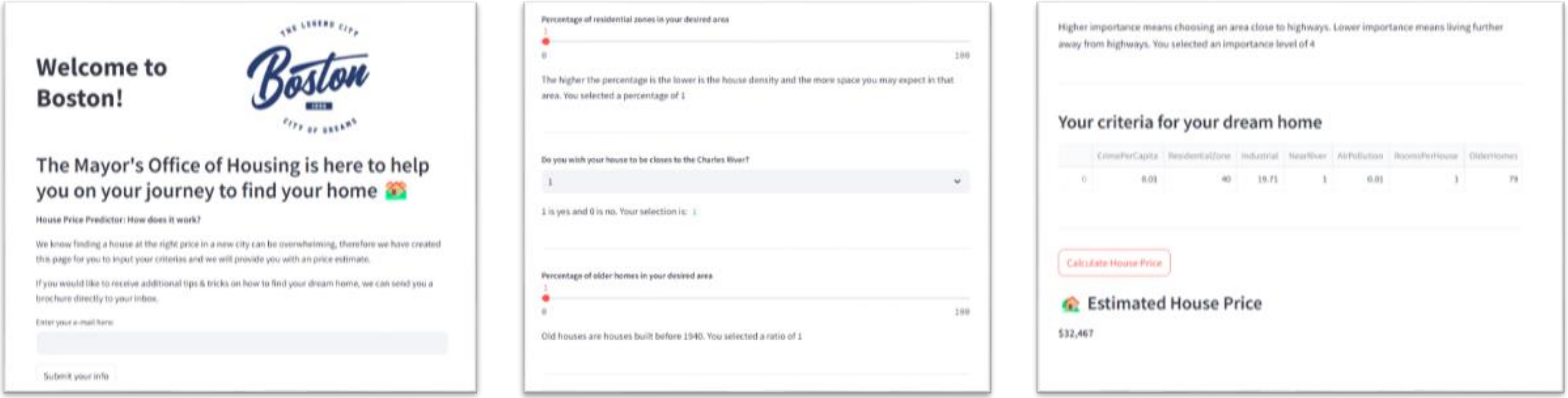
Worse results than df, but better than df1

# The ‘best’ model is the one with all the features with a R-square of 0.714. We should use a more complex model (Neural Networks e.g.) to improve results




- **The results indicate that DF performs best across all metrics →** including all features yields better predictive accuracy and explains more variance in the target variable.
- While **DF1** simplifies the model by using fewer features, it **sacrifices performance**, as shown by its higher RMSE and lower R-squared.
- **DF2 balances feature reduction and performance** but still underperforms compared to DF.
- Conclusion: **Linear regression not suitable as ML model**, opt to use a more complex model, e.g. neural network

# The following app in *Streamlit* predicts the house price (in Boston) based on user preferences




Application interface

## Check your dream house price here!