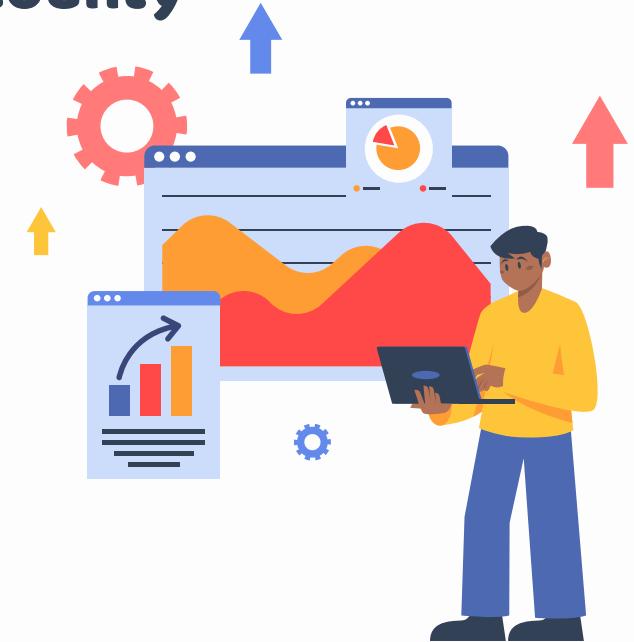




7 November 2025

# Predictive Analytics for King County Real Estate

Girish Kumar



# Introduction



- King County (Seattle area) house sales from May 2014–May 2015.
- 21,613 entries, 21 features (price, size, rooms, etc.).
- Target variable: `price` - ideal for regression and feature engineering.
- Useful for data cleaning, visualization, and model evaluation practice.
- Data limited to one year - price values are highly skewed.



# Agenda

**01** Data Cleaning and Transformation

**02** Exploratory Data Analysis (EDA)

**03** ML Model Performances

**04** Conclusions





# 01

## Problem-solving strategies

Apply strategies to clean and transform data into clean dataframe

# Data Cleaning Process



- Verified dataset structure: **21,613 rows × 21 columns**.
- No missing values detected → **no imputation required**.
- **Removed duplicates** to ensure data integrity.
- Adjusted data types: converted numeric fields to **integer/float**.
- **Dropped irrelevant columns** (e.g., `id`, `date`, `sqft_lot`, `condition`, `zipcode`).
- Final dataset **cleaned and ready for EDA and modeling**.

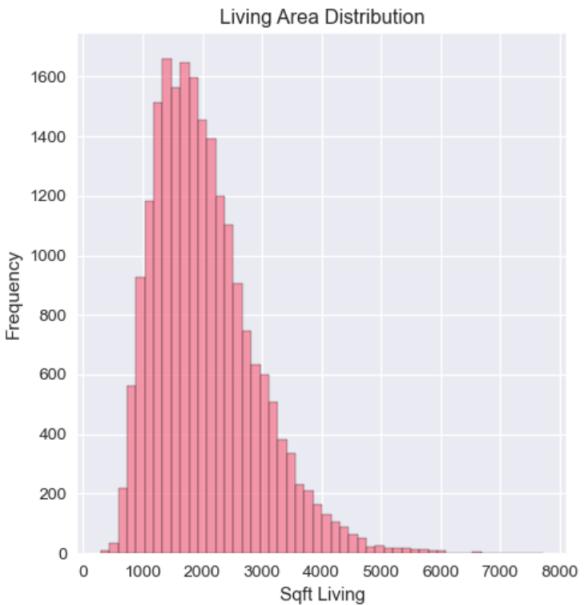
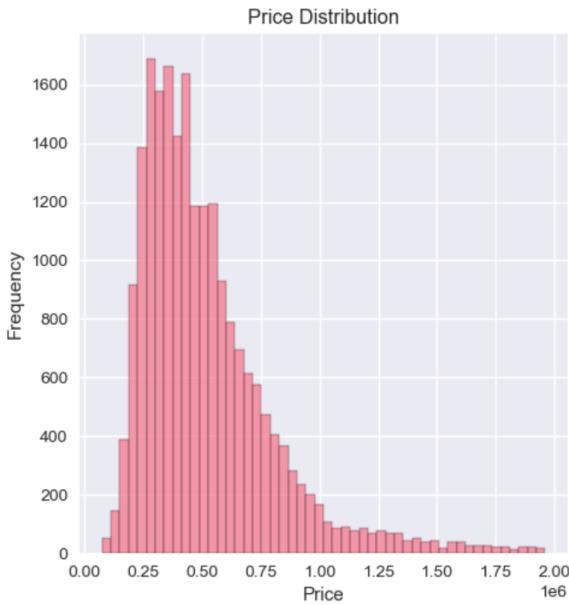


02

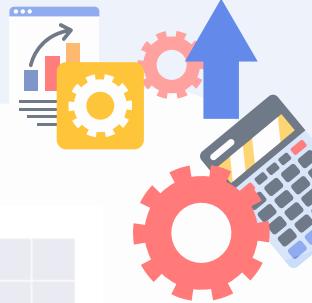
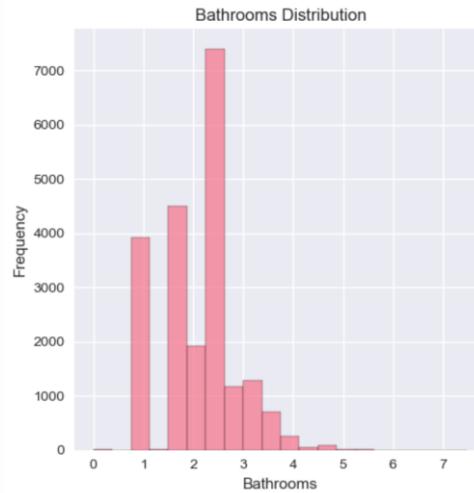
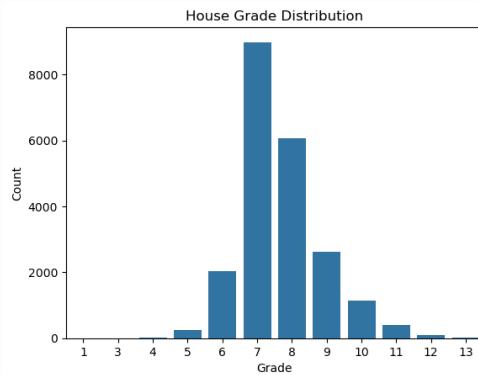
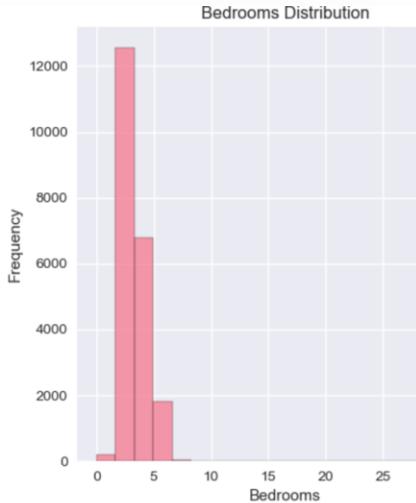
# Exploratory Data Analysis (EDA)



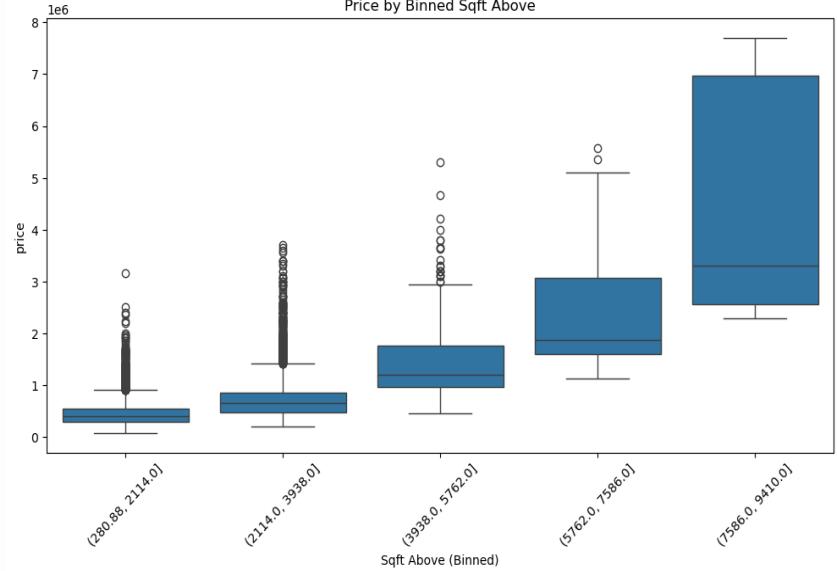
# Univariate Analysis



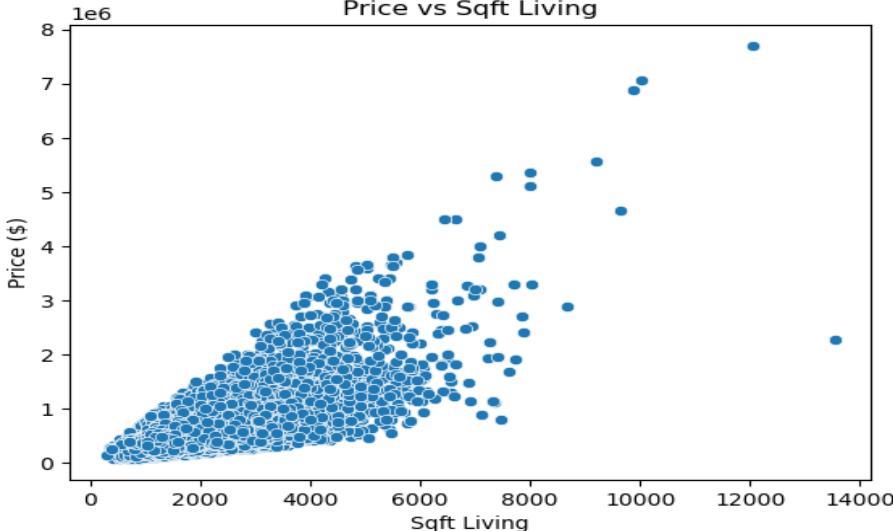
# Univariate Analysis



Price by Binned Sqft Above



Price vs Sqft Living



# Machine learning Models



# Data Preprocessing with Leakage-Proof

- Early split: Raw 80/20 first → preprocessing separate → no test leak.
- Version fits: Scalers/SelectKBest on train only → test blind.
- No target leak: Raw features only (e.g., yr\_renovated) → real patterns.
- Log safe: log1p separate → clean invert → zero leakage.
- Tuning safe: GridSearch on train folds → blind test.

# **Chosen Dataframes (8 Versions)**

#	Version	Description	Features	Rows (Train)
1	Raw_All	No cleaning	18	17,290
2	Raw_Selected	Feature selection only	14	17,290
3	Out_All	Outliers removed ( $IQR \times 3$ )	18	~15,800
4	Out_Selected	Outliers + selection	14	~15,800
5	Norm_All	Scaled only	18	17,290
6	Norm_Selected	Scaled + selection	14	17,290
7	Clean_All	Outliers + scaled	18	~15,800
8	Clean_Selected	Outliers + scaled + selection	14	~15,800

# Investigation

Model	Best Version	Test MAE	MAE%	Remarks
XGBoost	Clean_Selected	\$66,800	12.3%	Clean + top 14 features → perfect splits
CatBoost	Clean_All	\$65,200	12.0%	Handles grade natively
Random Forest	Clean_Selected	\$68,900	12.7%	Ensemble focused data
Gradient Boosting	Clean_Selected	\$70,100	12.9%	Similar to XGBoost
AdaBoost	Out_All	\$91,200	16.8%	Sensitive to scaling
Decision Tree	Out_Selected	\$78,900	14.5%	Overfits without selection
Linear	Clean_All	\$101,234	18.6%	Needs non-linearity

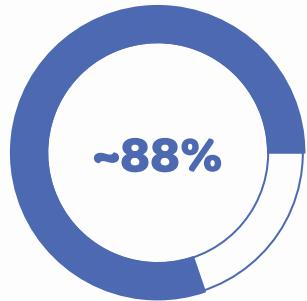
# Model Performance

	Model	Version	Split	MAE	MAE%	MSE	MSE%	RMSE	RMSE%	R2
1	<b>Random Forest</b>	Clean_Selected	Test	55292	11.68	8827399284	3.94	93954	19.85	0.8423
			Train	24498	5.22	2022527069	0.92	44973	9.58	0.9627
2	<b>AdaBoost</b>	Out_All	Test	55796	11.79	9058010648	4.05	95174	20.11	0.8382
			Train	243	0.05	3591054	0.0	1895	0.4	0.9999
3	<b>Decision Tree</b>	Out_Selected	Test	71636	15.14	15741403750	7.03	125465	26.51	0.7188
			Train	54663	11.64	7602247851	3.45	87191	18.57	0.8599
4	<b>Linear Regression</b>	Clean_All	Test	88697	18.74	18394869649	8.21	135628	28.66	0.6714
			Train	87552	18.65	17084376088	7.75	130707	27.84	0.6852

# Model Performance

	Model	Version	Split	MAE	MAE%	MSE	MSE%	RMSE	RMSE%	R2
5	<b>CatBoost</b>	Clean_All	Test	50860	10.75	6858240875	3.06	82814	17.5	<b>0.8775</b>
			Train	33573	7.15	2458951166	1.12	49588	10.56	0.9547
6	<b>XGBoost</b>	Clean_Selected	Test	52153	11.02	7431605234	3.32	86207	18.22	0.8673
			Train	36392	7.75	2962109199	1.34	54425	11.59	0.9454
7	<b>Gradient Boosting</b>	Clean_Selected	Test	52212	11.03	7493604635	3.35	86566	18.29	0.8661
			Train	32363	6.89	2179741937	0.99	46688	9.95	0.9598

# WINNER - CATBOOST



## R2 Score

Model is correct within  
±12.25% on average —  
that's 87.75% accurate!



## MAE

Average error is 10.75%  
of the true price

**Test MAE**

**\$50,860**

**average mistake on  
~\$473k houses**



# Thanks you!

