

# PREDICTIVE MODELING

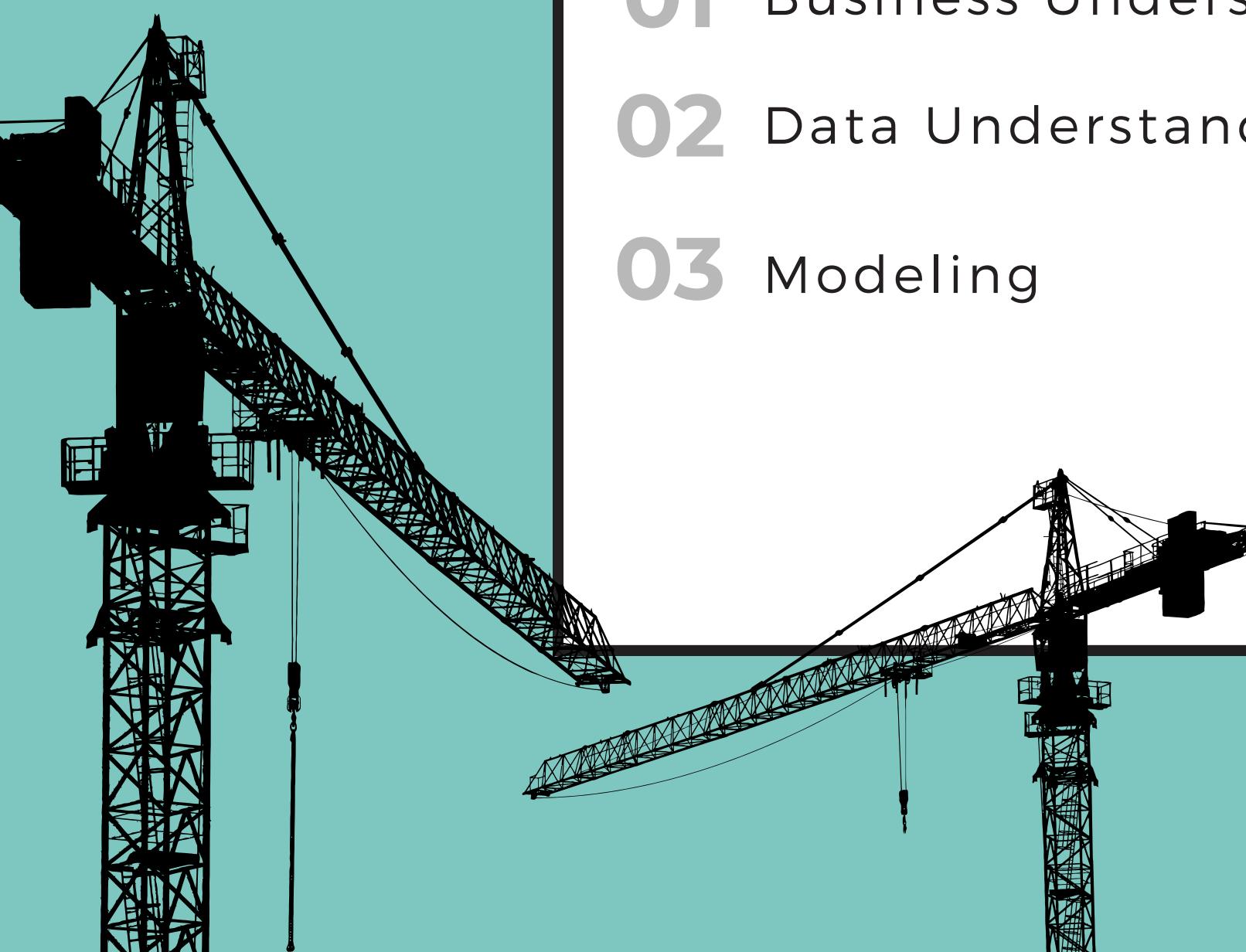
## ZILLOW TIME-SERIES FORECASTING

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# Overview

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# Business Understanding

- Real estate is a vital sector of the global economy, involving land, buildings, and physical properties.
- The US real estate industry is worth around 6% of the GDP, with various sub-sectors and applications.
- Zamara is a real estate investment firm that wants to leverage time series forecasting to predict future trends in real estate prices.





# Problem Statement

- Zamara is a real estate investment firm that wants to invest in the US residential market, which is worth around 6% of the GDP<sup>5</sup>
- However, real estate prices vary widely across different zip codes and are influenced by many factors, such as policies, demographics, affordability, access, location, cash flow, and economy<sup>5</sup>.
- This makes it difficult for Zamara to identify the best zip codes for investment, based on the expected future prices and returns.
- Solving this problem is important for Zamara, as it will enable them to optimize their investment portfolio, increase their profits, and gain a competitive edge in the market.

# Objectives

**01**

## **Seasonality**

Analyze how real estate prices fluctuate with seasons in various zip codes

**02**

## **Opportunity:**

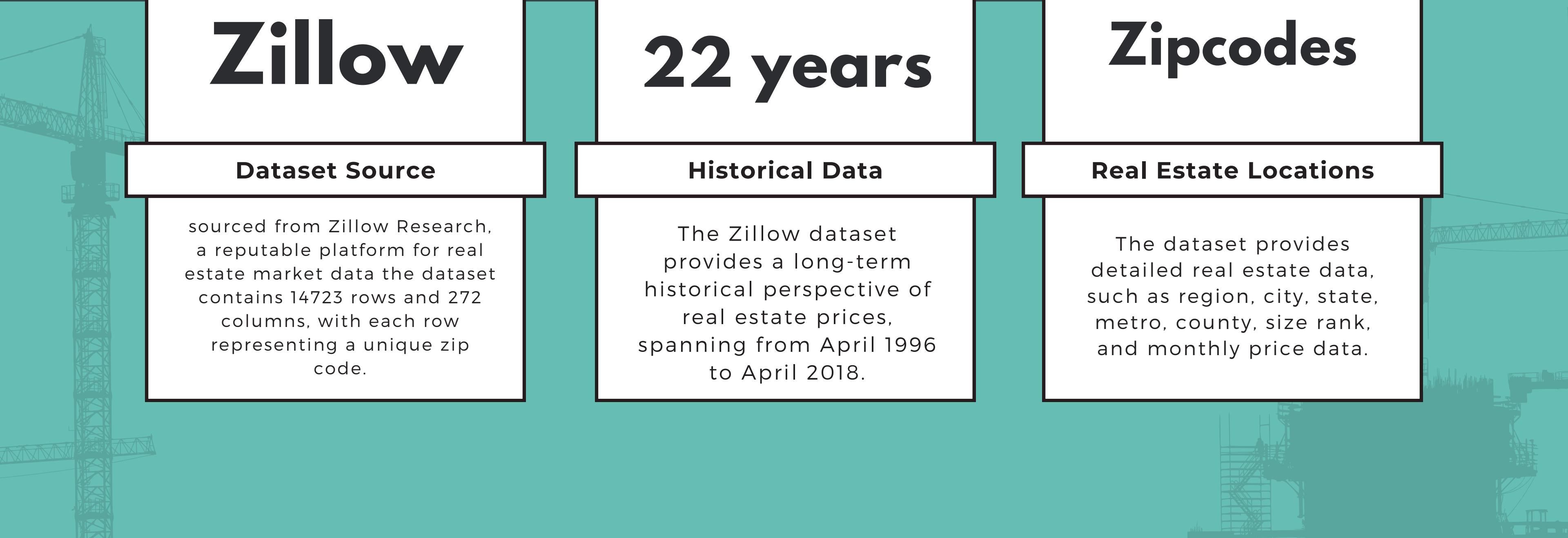
Assess which city offers the best potential for real estate investment.

**03**

## **Forecasting**

Estimate future property values and select the most profitable zip codes for investment.

# Data Understanding



Zillow

## Dataset Source

sourced from Zillow Research, a reputable platform for real estate market data the dataset contains 14723 rows and 272 columns, with each row representing a unique zip code.

22 years

## Historical Data

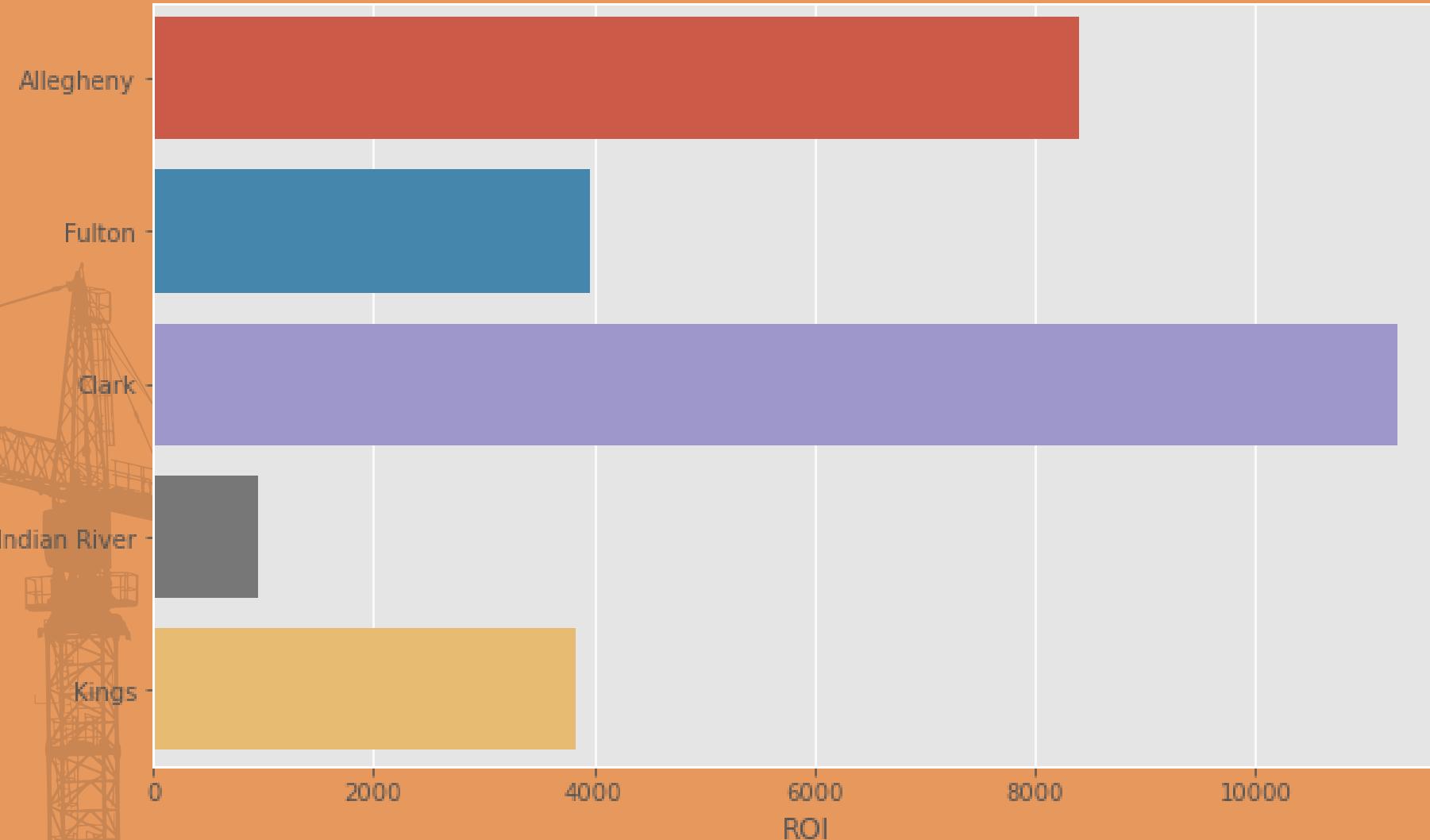
The Zillow dataset provides a long-term historical perspective of real estate prices, spanning from April 1996 to April 2018.

Zipcodes

## Real Estate Locations

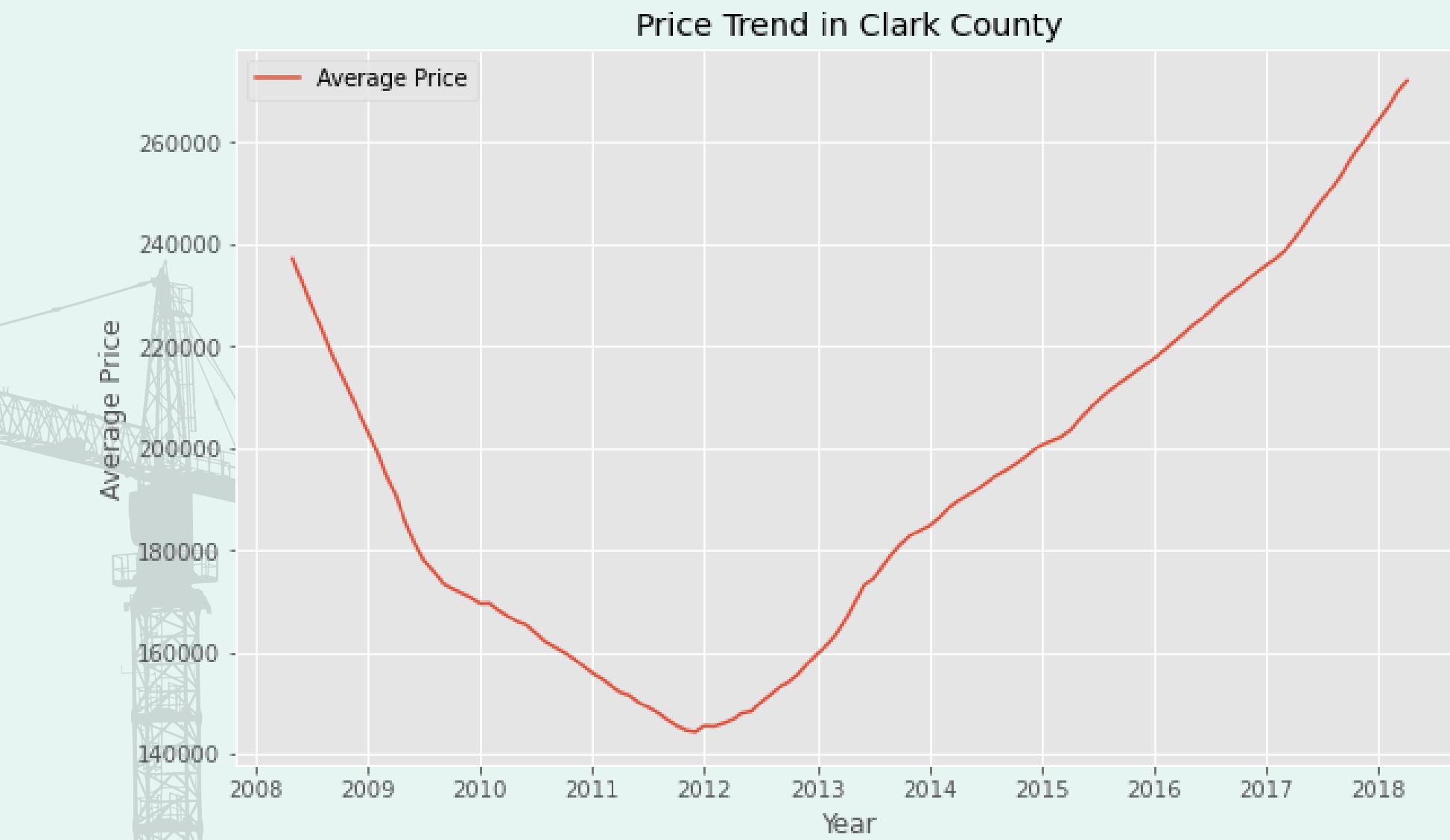
The dataset provides detailed real estate data, such as region, city, state, metro, county, size rank, and monthly price data.

ROI for Top 5 Counties



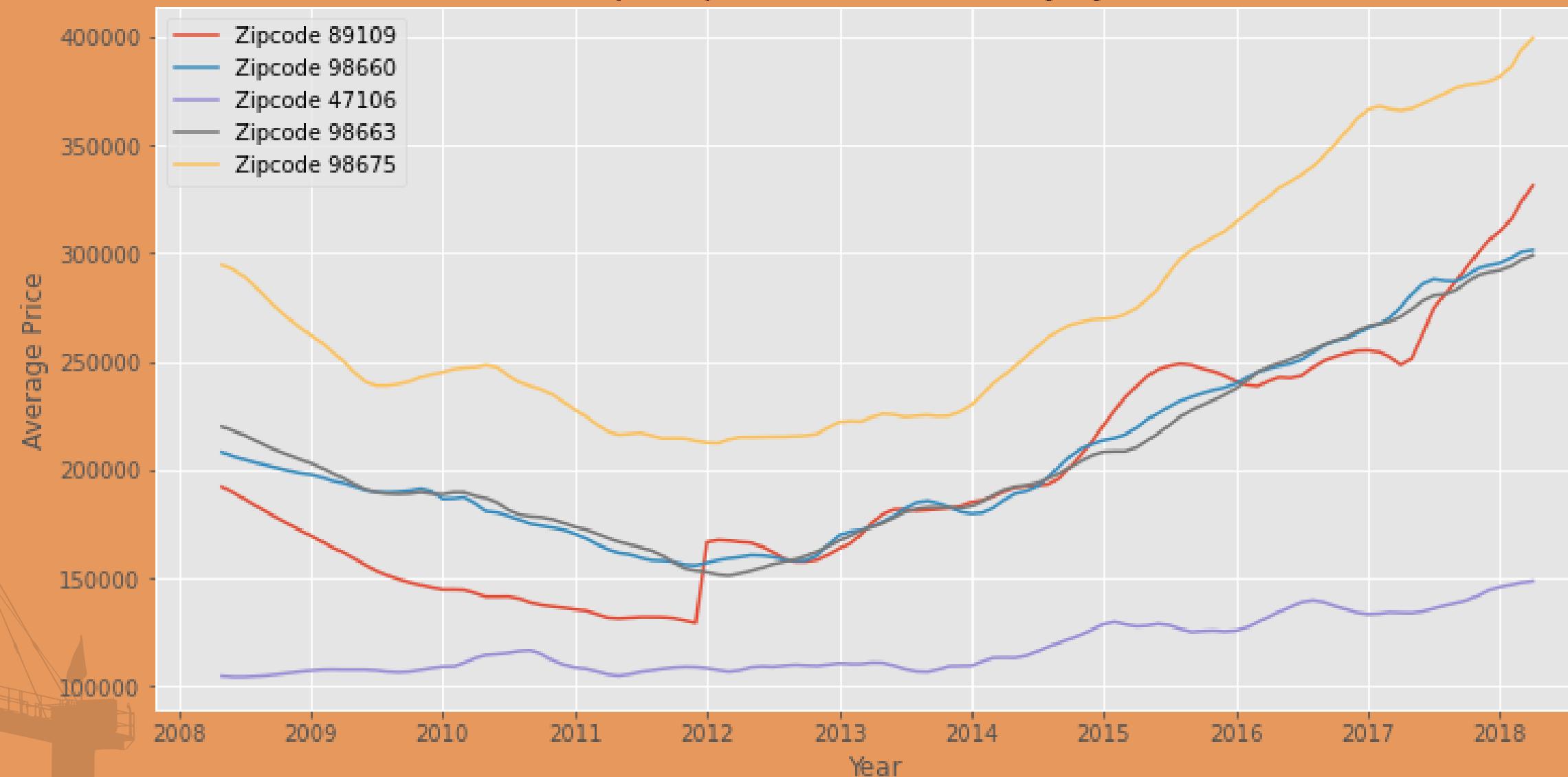
## Clark County: The Prime Location for Investment

- Clark County has the highest ROI among the top five counties, making it the most profitable county to invest in.
- Clark County's ROI is nearly double that of Fulton County, and more than four times that of Kings County, showing a large variation in profitability among the counties.
- Clark County offers the best opportunity for investors to maximize their returns and minimize their risks.



- The line plot shows the average price trend in Clark County from 2008 to 2018. The trend is negative from 2008 to 2012 and positive from 2012 to 2018. This means that the average price decreased in the first period and increased in the second period.
- The trend can be described by a piecewise linear function, which is a function that consists of two or more linear segments
- The average price in Clark County was affected by the global financial crisis of 2008-2009, which caused a severe drop in the housing market.

## Top 5 Zipcodes in Clark County by ROI



- Zip code 89109 (Las Vegas) has the highest ROI of 72.51%. It also shows a significant increase in average property prices over the years, especially from 2016 onwards. This suggests that Las Vegas is a very attractive and lucrative market for real estate investment, as the property value has grown rapidly and substantially.
- Zip code 98660 (Vancouver) has an ROI of 44.90%. The average property prices have been steadily increasing since around 2012. This indicates that Vancouver is a stable and profitable market for real estate investment, as the property value has increased consistently and moderately.
- Zip code 47106 (Borden) with an ROI of 41.97% shows a consistent increase in property prices but at a slower pace compared to Las Vegas and Vancouver. This implies that Borden is a reliable and decent market for real estate investment, as the property value has increased gradually and slightly.

# Modeling

## ARIMA

Autoregressive Integrated Moving Average. It can handle data with a trend, but not with a seasonal component

RMSE ;13.3%

## SARIMA

Seasonal Autoregressive Integrated Moving Average. An extension of ARIMA that can handle data with a seasonal component. It adds seasonal terms to the ARIMA model to capture the periodic patterns in the data2

RMSE ;13.2%

## PROPHET

A model that uses an additive approach to fit non-linear trends with yearly, weekly, and daily seasonality, plus holiday effects. It works best with data that have strong seasonal effects and several seasons of historical data

RMSE ;5.7%

# Conclusion

- The study identified the most promising zip codes and counties for real estate investment. The data indicated a positive trend in real estate value over time, but no clear seasonal pattern was observed
- The project concluded that the best zip codes to invest in are 89034, 98684, 89146, 89015, and 89124. The best counties to invest in are Clark County, Allegheny, Fulton County, Kings County, and Indian River County.
- The data showed an upward trend in real estate value over time, but there was no clear seasonality pattern to determine the best time period to invest in real estate. A predictive time series model was created to help predict future real estate values.



# Recommendations



**Optimal Zip Codes for Investment:** If you are looking for the best zip codes to invest in, you should consider 89034 in Mesquite, Nevada, 98684 in Vancouver, Washington, 89146, 89124, and 89015 in Las Vegas, Nevada. These zip codes have the highest ROI and offer the most promising opportunities for investors who want to maximize their profits.



**Preferred Counties for Investment:** If you want to diversify your portfolio and explore different markets, you should invest in real estate within Clark County, Allegheny County, Fulton County, Kings County, and Indian River County. These counties have a variety of properties and locations that can suit your preferences and goals. They also have a strong potential for high returns and growth in the future.



**Strategic Timing:** The real estate market does not show any clear seasonal patterns, but it does show a consistent upward trend. This means that the market is favorable for investment and you can expect the prices to increase over time. Therefore, you should focus on the long-term potential of your investments rather than the specific timing of your transactions.

# Next steps

- **Model Development and Deployment:** Train and deploy a neural network for time series forecasting.
- **Data Acquisition and Enrichment:** Collect and use more data to improve the model and capture market factors.
- **Investment Optimization:** Use the model and due diligence to select and refine investment opportunities.
- **Portfolio Diversification:** Invest in different properties and neighborhoods to enhance portfolio resilience.
- **Market Monitoring and Adaptation:** Track and adapt to market trends and patterns using the updated model.



# Thank You

