# Future Prices of Property

Forecasting with  Time Series
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Photo by Suzy Hazelwood from Pexels

- What's a better investment, a one-bedroom or a two-bedroom property in San Francisco ?

- A simple question that requires advanced modeling techniques.

Photo by Ahmed Rabea from Pexels

- The dataset is from the real estate company Zillow.
- Each month was its own column.
- However for doing time-series analysis, the months must all be in one column.
- Therefore the dataset had to be transformed via “melting”.
- This was achieved with a pandas function, pd.melt.

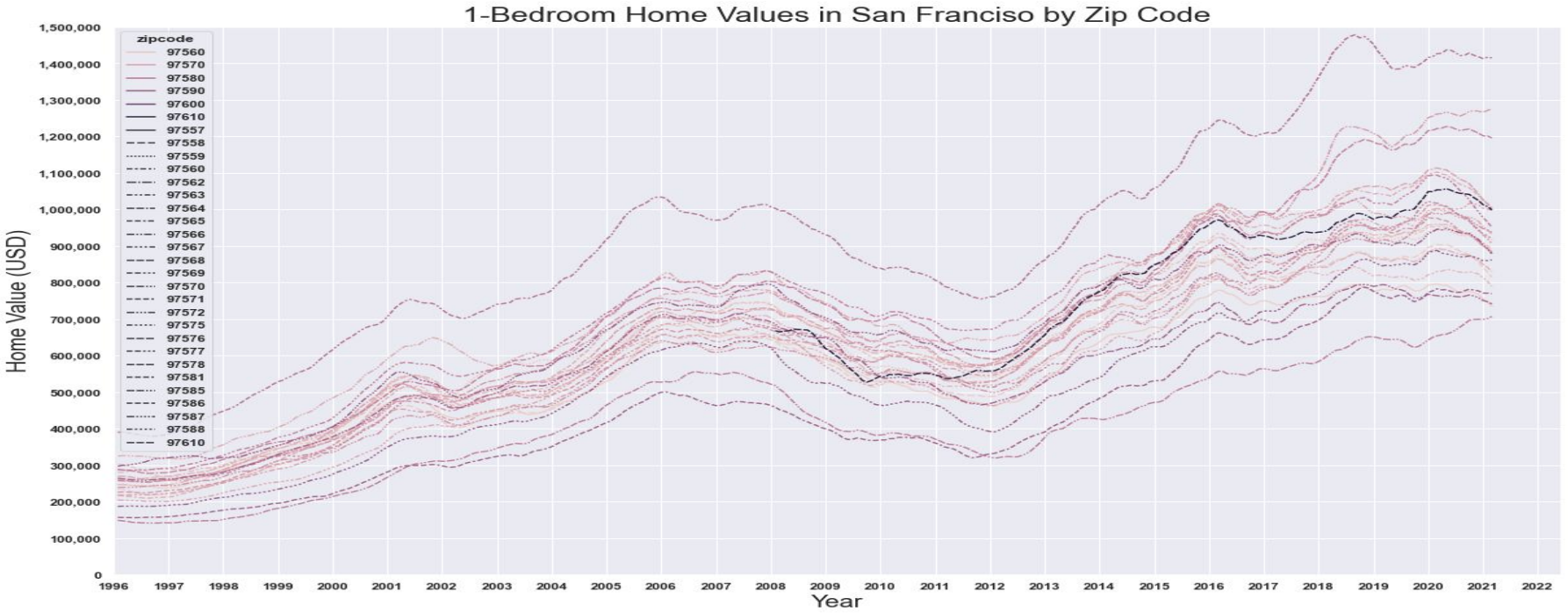

- Each listing of a real estate property listing on Zillow.com has monthly data on its market price.
- Each listing  gets its own forecast.
- A data structure known as a dictionary is very helpful, keeping workflow organized.

- Each listing is its own beast and requires a separate model built.
- It’s a reasonable expectation each model could have different parameters.
- A triple for loop and the AIC score were used to get the best model for each listing.

| | zipcodes | param | param_seasonal | aic |
|---|---|---|---|---|
| **2** | sf_cheese_df_97557 | (2, 1, 0) | (2, 1, 0, 12) | 3998.759299 |
| **10** | sf_cheese_df_97558 | (2, 1, 0) | (2, 1, 0, 12) | 3948.383894 |
| **19** | sf_cheese_df_97559 | (2, 1, 0) | (2, 1, 1, 12) | 77.482705 |
| **30** | sf_cheese_df_97560 | (2, 1, 1) | (2, 1, 0, 12) | 4175.313490 |
| **34** | sf_cheese_df_97562 | (2, 1, 0) | (2, 1, 0, 12) | 4007.670405 |
| **46** | sf_cheese_df_97563 | (2, 1, 1) | (2, 1, 0, 12) | 4239.922611 |
| **50** | sf_cheese_df_97564 | (2, 1, 0) | (2, 1, 0, 12) | 4069.590765 |
| **58** | sf_cheese_df_97565 | (2, 1, 0) | (2, 1, 0, 12) | 3983.729651 |
| **66** | sf_cheese_df_97566 | (2, 1, 0) | (2, 1, 0, 12) | 4187.239302 |
| **74** | sf_cheese_df_97567 | (2, 1, 0) | (2, 1, 0, 12) | 3889.507286 |
| **82** | sf_cheese_df_97568 | (2, 1, 0) | (2, 1, 0, 12) | 4102.220443 |
| **90** | sf_cheese_df_97569 | (2, 1, 0) | (2, 1, 0, 12) | 4070.684184 |
| **98** | sf_cheese_df_97570 | (2, 1, 0) | (2, 1, 0, 12) | 3904.342562 |
| **110** | sf_cheese_df_97571 | (2, 1, 1) | (2, 1, 0, 12) | 4099.737274 |

- The results of a triple loop searching for the best SARIMAX model parameters.

- The AIC scores are different across models, but they were the lowest scores within the model.


1-Bedroom Home Values in San Franciso by Zip Code
Home Value (USD)
Year
zipcode
97560
97570
97580
97590
97600
97610
97557
97558
97559
97560
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97570
97571
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97585
97586
97587
97588
97610
1,500,000
1,400,000
1,300,000
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
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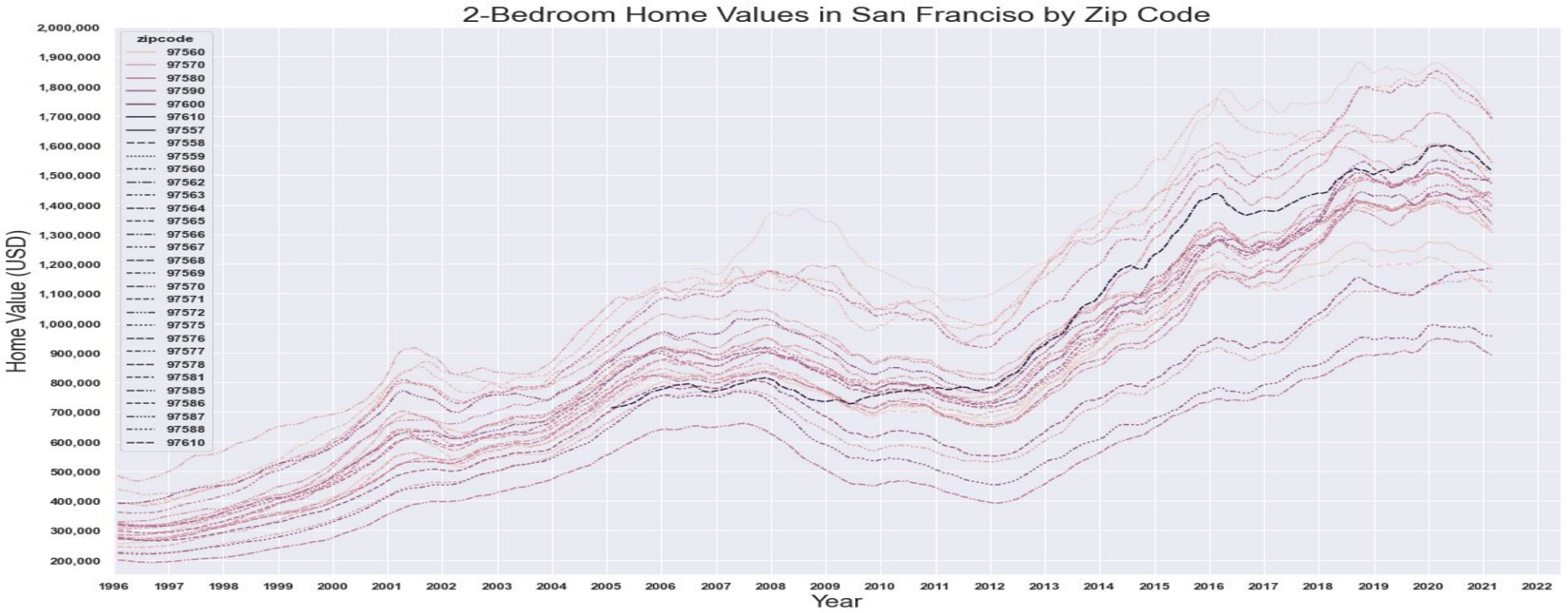
2022


2-Bedroom Home Values in San Franciso by Zip Code
Home Value (USD)
2,000,000
1,900,000
1,800,000
1,700,000
1,600,000
1,500,000
1,400,000
1,300,000
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
zipcode
97560
97570
97580
97590
97600
97610
97557
97558
97559
97560
97562
97563
97564
97565
97566
97567
97568
97569
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2019
2020
2021
2022
Year



- The blue line is historical data. The orange line is the prediction going out a year.

- Would you be able to guess using only your eyes, that one property will decline in value while the other will stay the same?

| | zipcode | current_value | forecasted_value | percent_change |
|---|---|---|---|---|
| 15 | 97575 | 1443658.0 | 1.507369e+06 | 4.41 |
| 12 | 97570 | 1395930.0 | 1.438780e+06 | 3.07 |
| 23 | 97588 | 956182.0 | 9.848421e+05 | 3.00 |
| 16 | 97576 | 1439525.0 | 1.475448e+06 | 2.50 |
| 19 | 97581 | 1488832.0 | 1.520768e+06 | 2.15 |
| 14 | 97572 | 1421186.0 | 1.449162e+06 | 1.97 |
| 3 | 97560 | 1706714.0 | 1.738443e+06 | 1.86 |
| 9 | 97567 | 1137737.0 | 1.153425e+06 | 1.38 |
| 21 | 97586 | 1182842.0 | 1.191954e+06 | 0.77 |
| 7 | 97565 | 1398923.0 | 1.404549e+06 | 0.40 |
| 20 | 97585 | 1473693.0 | 1.476384e+06 | 0.18 |
| 17 | 97577 | 1689377.0 | 1.690850e+06 | 0.09 |
| 2 | 97559 | 1695012.0 | 1.691531e+06 | -0.21 |
| 24 | 97610 | 1513017.0 | 1.499417e+06 | -0.90 |
| 11 | 97569 | 1372370.0 | 1.355932e+06 | -1.20 |
| 13 | 97571 | 1395879.0 | 1.359595e+06 | -2.60 |
| 18 | 97578 | 891894.0 | 8.683226e+05 | -2.64 |
| 10 | 97568 | 1541337.0 | 1.481251e+06 | -3.90 |
| 5 | 97563 | 1502923.0 | 1.434333e+06 | -4.56 |
| 22 | 97587 | 1334650.0 | 1.271719e+06 | -4.72 |
| 0 | 97557 | 1185630.0 | 1.117291e+06 | -5.76 |
| 6 | 97564 | 1308934.0 | 1.228340e+06 | -6.16 |
| 4 | 97562 | 1304574.0 | 1.221666e+06 | -6.36 |
| 8 | 97566 | 1466530.0 | 1.372398e+06 | -6.42 |
| 1 | 97558 | 1100702.0 | 1.012911e+06 | -7.98 |

- There's a 1BR property valuation forecasted to rise 4 % in 2022.
- There's a 1BR property valuation forecasted to drop 8 % in 2022.
- If you picked randomly, there's a 50% chance you will lose money.