

Irish Housing Market Assessment

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Programming for AI Assignment

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I. INTRODUCTION

This article provides an overview of Irish housing market by assessing the average housing price and sales volume by county. Housing prices indicate the living cost in a region; and for property investment purpose, a high transaction volume is favoured due to the ease of resale. Furthermore, the average monthly price for Dublin is predicted, offering insights for the property investment decisions.

II. RELATED WORK

In 2023, Shi [1] developed a housing price prediction model for second-hand housing prices from 2011 to 2017 in Beijing. This study compares the prediction performance of LightGBM and LSTM models for both pure time series data and multi-factor data, which incorporates spacial sequence information. The evaluation metrics are R squared and MAE, and RMSE. For the multi-factor model, LGBM exhibits better performance, whereas LSTM model is more accurate for pure time series data. One limitation of the study is that, the multi-factor model only considers geographic locations without incorporating other spacial information, such as clustering effect and adjacency distribution. Moreover, it does not compare combined model designs. However, the results of this paper demonstrate that the LSTM model can provide good results for predicting monthly housing prices with pure time series data, which motivates us to develop an Irish housing price forecast model using this methodology.

III. PREPARATION AND EXPLORATION OF DATA SOURCE

The Property Services Regulatory Authority (PSRA) is an Irish property regulating body. Their official website [2] provides access to the Residential Property Price Register data to the public. Daily transaction data has been available since January 2010 to the present date (last updated in May 2024), with columns including Address, County, Eircode, Price, Description of Property and others.

Yearly datasets were downloaded, merged into a CSV file with over 65 000 rows, and uploaded into the relational database MySQL. Subsequently, the dataset was retrieved from the database and preprocessed using techniques such as adjusting data types, renaming columns and standardising formats. After cleaning up, a new dataset was saved in the database available for data analysis.

Irish Property Transaction by County (Jan 2010 - Apr 2024)

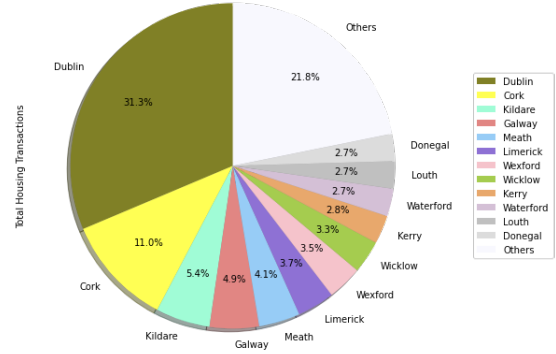


Fig. 1: Irish Property Transaction by County (Jan 2010 - Apr 2024)

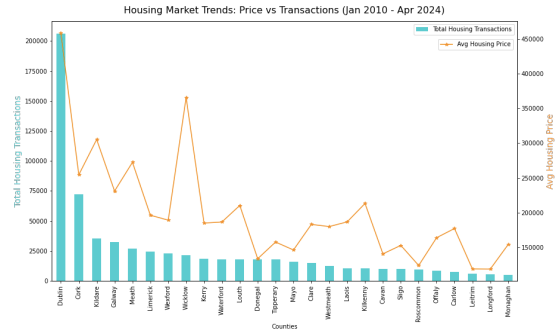


Fig. 2: Housing Market Trends

IV. DATA VISUALISATION AND ANALYSIS

The total housing transactions and average prices by country for the entire period are presented in the charts in Fig. 1 and Fig. 2. We can observe that Dublin constitutes more than 30 percent of transactions and has the highest average housing price. Wicklow has the second-highest average housing price, followed by Cork, Kildare, and Meath. Regarding transaction volume, Cork, Kildare, Galway, Meath and Limerick follow Dublin.

The housing price trends for the top 9 counties with the highest prices are presented in Fig. 3. According to the graph, all counties experienced a decline in prices from 2010 to around 2012, attributed to the global financial crisis of 2008-2009 [3]. Prices then steadily recovered until 2022, when the

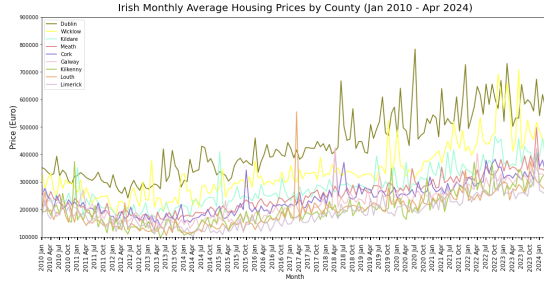


Fig. 3: Irish Monthly Average Housing Price by County

increasing trend slowed down. Among them, Wicklow and Kildare experienced slight declining trends after peaking at the end of 2022. Dublin's average price witnessed peaks in the summer of 2018 and 2020, followed by a slight declining trend, although it still maintains the highest value.

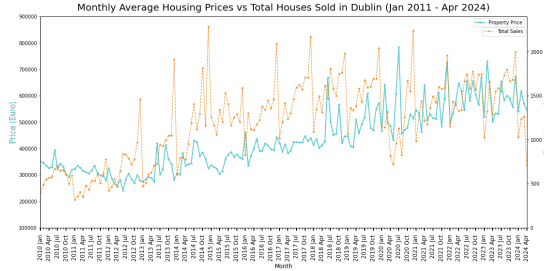


Fig. 4: Monthly Average Housing Prices vs Total Sold in Dublin (Jan 2011 - Apr 2024)

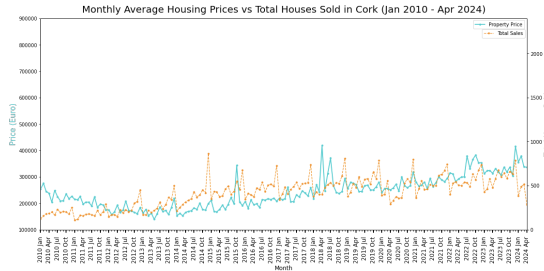


Fig. 5: Monthly Average Housing Prices vs Total Sold in Cork (Jan 2011 - Apr 2024)

The monthly average housing prices and total house sales are plotted for several popular counties in Ireland, Dublin, Cork and Galway in Fig 4, 5, 6. The transaction volume climbed up until end of 2014 and maintained steady afterwards. However, there is a signal indicating a decrease in transaction volumes and prices starting from 2024.

V. DUBLIN HOUSING PRICE FORECAST AND EVALUATION

Dublin shows highest average property price and sales volume, and it attracts more attention from immigrants and investors. Therefore, I create a deep learning forecast model based on time series analysis to predict Dublin Property Price.

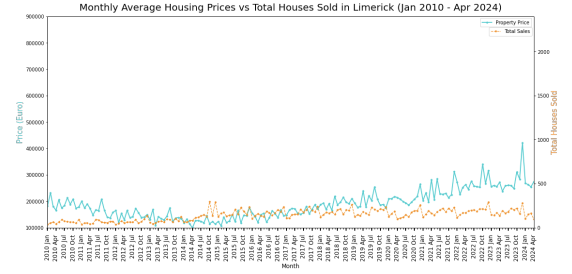


Fig. 6: Monthly Average Housing Prices vs Total Sold in Limerick (Jan 2011 - Apr 2024)

The analysis applies MinMax Scaler to preprocess monthly prices. The data in a fixed moving window is used as features to predict the subsequent value. 85 percent of the data is used for training, which is sliced before a timestamp, and the data afterwards is for validation. Forecasting series starts at the timestamp minus the window size and ends at the second last datapoint.

The top performing model's architecture combines LSTM, Dropout, LayerNormalization and Dense layers, achieves a average Mean Absolute Percentage Error of 7.8, which indicates a high accurate forecasting [4]. The training loss versus epochs is shown in Fig. 7.

```
Epoch 91/100
12/12 [=====] - 8s 7ms/step - loss: 0.0061 - nme: 0.0785 - mape: 957828.8125 - mse: 0.0123
Epoch 92/100
12/12 [=====] - 8s 7ms/step - loss: 0.0063 - nme: 0.0884 - mape: 1862368.1250 - mse: 0.0125
Epoch 93/100
12/12 [=====] - 8s 5ms/step - loss: 0.0069 - nme: 0.0823 - mape: 1184584.8750 - mse: 0.0138
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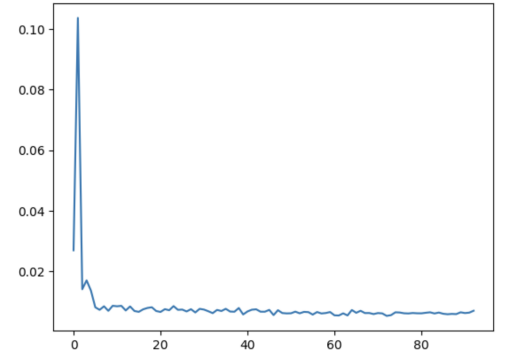


Fig. 7: Training Losses Versus Epochs

In Fig. 8, The green line represents the actual monthly average price, the blue line depicts predictions made on the training data, and the yellow line shows predictions on the testing data. The red line is one month ahead prediction, which is for May 2024 whose predicted average housing price is 592928 euros, slightly lower compared to previous month.

VI. CONCLUSION

In conclusion, the increase in housing prices and volumes has slowed down, and for some counties, they have even witnessed downward trends since 2024. Therefore, we may suggest that current housing prices are high and may witness a decline in the following month.

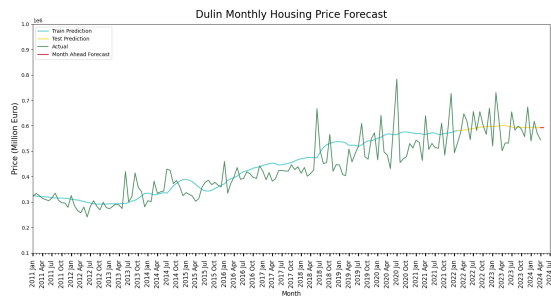


Fig. 8: Dublin Monthly Housing Price Forecast

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- [1] Shi, Songyi. (2023). Comparison of Real Estate Price Prediction Based on LSTM and LGBM. *Highlights in Science, Engineering and Technology*. 49. 294-301. 10.54097/hset.v49i.8521.
- [2] National Property Services Regulatory Authority (2024) Residential Property Price Register. Available at: <https://www.propertypriceregister.ie/website/npsra/pprweb.nsf/PPR?OpenForm> [Accessed: 29 April 2024].
- [3] Thomas, C. (2018) Here's the impact of Ireland's economic crisis on housing in graph form, *TheJournal.ie*. Available at: <https://www.thejournal.ie/heres-the-impact-of-irelands-economic-crisis-on-housing-in-graph-form-2-4380759-Dec2018/> [Accessed: 29 April 2024].
- [4] Interpretation of typical MAPE values — download table, https://www.researchgate.net/figure/nterpretation-of-typical-MAPE-values_t1257812432 [Accessed : 29 April 2024].