ISSN: APPLIED |VOLUME-1, ISSUE-1|
Inaugural Edition | October-December 2026
Paper ID: NG11-006| Research Article
DOI:

Intelligent Real Estate Price Prediction Using Deep Learning Techniques

Dr.D.RAMBABU, *Associate Professor, Dept of IT,*
SREENIDHI INSTITUTE OF TECHNOLOGY, HYDERABAD

ABSTRACT: Individuals must exercise caution when evaluating houses, apartments, and other forms of urban residences in Taiwan. Real estate professionals and researchers frequently employ surveys and statistical approaches to collect data. Utilizing these methods for multidimensional data is both time-consuming and ineffective. The objective of this project was to develop a real estate projection model capable of adapting to the prevailing circumstances. The data was extracted from publicly accessible government records and subsequently standardized to ensure proper categorization. Cross-statistical analysis was employed to verify the appropriateness of the grouping approach utilized. An autonomous deep learning encoder was developed to enhance classification accuracy. The DBM-PSO technique was designed to identify the optimal method for clustering entities. Utilizing publically accessible data, cluster analysis, and deep learning, our objective was to ascertain the factors that contributed to the decade-long increase in property values in Taiwan. The construction material and building index, the volume of real estate transactions, and the average unit price significantly influence property values in Taiwan. These findings can assist researchers and legislators in effectively regulating the market and addressing burgeoning real estate sectors that often become overcrowded. An individual has developed an innovative approach to analyze and forecast real estate trends.

Keywords: *Machine learning; real estate; particle swarm optimization algorithm; economy*

1. INTRODUCTION

The primary objective of most Taiwanese families is homeownership, and the adage "own the land, own the wealth" is profoundly ingrained in their culture. The term "real estate" denotes various varieties of land and human-made structures, including residences, apartments, and barriers. A house not only provides a secure living environment but also demonstrates a commitment to safety and security. Real estate constitutes a prudent investment and a safeguard against inflation, as its value and rental revenue increase in tandem with economic growth and rising inflation rates.

Open databases enable researchers to access housing information for prospective studies. Housing inventory levels, sales, starts, prices, transactions, interest rates, and indicators of affordability and pricing are just some of the numerous types of data that may be found in the Federal Reserve Economic Data (FRED) database. Due to the complexity and rapid fluctuations of real estate data, most studies primarily focus on trends and property price estimates. It is essential to understand the registration process, the number of available rooms, and the fee associated with each room. Due to uncertainties such as market volatility, pandemics, and economic challenges that complicate event forecasting, it is imperative to employ machine learning for future forecasts.

Numerous aspects of real estate have been previously examined, including the

ISSN: APPLIED |VOLUME-1, ISSUE-1|
Inaugural Edition | October-December 2026
Paper ID: NG11-006| Research Article
DOI:

dynamics of office vacancy rates, pricing strategies derived from other disciplines, and the application of trend analysis to anticipate price fluctuations. The Taiwanese housing market is influenced by various factors, including governmental regulations, demographic expansion, economic development, and natural calamities. Psychological and socioeconomic factors, including income, mortgage debt, and spatial constraints, significantly influence property values.

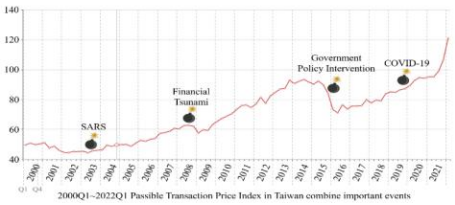

Figure1. Transaction price index in Taiwan combines actual

In Taiwan, individuals continue to purchase homes despite the consistent increase in housing prices. Real estate researchers might utilize sociodemographic data and stock market indicators to enhance their analyses. During the economic downturn in 2008, the value of real estate securities surged dramatically. The link between housing, business, and society has grown increasingly significant. Policymakers responsible for maintaining market equilibrium and ensuring competitive corporate practices heavily rely on precise forecasts.

2. METHODOLOGY

This section elaborates on the suggested categorization paradigm. Initially, a four-layer autoencoder network reduces reconstruction error and the distance between data points and the corresponding code layer clusters that connect them. This method is more effective at illustrating the data layer than the linear mapping method. The four primary phases involve employing an autoencoder to extract low-dimensional representations from multidimensional datasets, standardizing the data across various attributes and characteristics, clustering the data into low-dimensional spaces, and subsequently analyzing the clusters formed based on real estate markets. Subsequently, we will examine the selected autoencoder network in further detail and demonstrate its assembly.

Data Standardization

The data encompasses a multitude of diverse sources, qualities, and forms of knowledge. Prior to employing mean normalization, we ensured that the ranges of the independent variables (x) were uniform. The source file containing the variables is located in the Supplementary Files (98index.xlsx).

The symbol ± indicates the average value of the independent variable. The supplementary files (98index.xlsx) contain the raw data and descriptive statistics for several factors.

Reducing High-Dimensional Models Using Auto-Encoders

An autoencoder is a neural network designed to replicate its input by discovering a latent representation of it. An autoencoder network comprises one layer and two nodes. These components are the encoder and the decoder. The decoder employs a nonlinear mapping function f(x) to transform an input xi into its concealed representation hi.

Figure 1 illustrates that W(1) represents the encoding weight matrix, while b(1) denotes the encoding bias vector. A single-layer autoencoding network utilizing linear activation functions is employed, analogous to principal component analysis (PCA).

ISSN: APPLIED |VOLUME-1, ISSUE-1|
Inaugural Edition | October-December 2026
Paper ID: NG11-006| Research Article
DOI:

Two matrices are established: b(2) for bias and W(2) for decoding. The regularization constraint W(2) = W(1)T is employed to reduce the number of elements requiring optimization. The coding technique is employed to determine the optimal values for W and b.

Assume that the traditional method for determining x′i remains in use, with θ defined as {W(1), W(2), b(1), b(2)}. A deep autoencoder network is constructed by stacking multiple single-layer autoencoders sequentially. The concealed configuration of each layer is transmitted to the subsequent layer underneath it. Gradient descent complicates the training of deep autoencoders due to its heightened sensitivity to initial weights. Pre-training is employed to develop robust model features before to fine-tuning in order to address this issue. Denoising autoencoders and restricted Boltzmann machines can both replicate skewed inputs. Denoising autoencoders are instructed to reconstruct the original input by introducing random zero values into the inputs. This is the method by which statistical correlations between sources are documented through learning.

After training all tiers of the autoencoders, they undergo fine-tuning. The system comprises four layers: a two-density-level encoder that compresses data into a 36-dimensional latent vector; a two-density-level decoder that reconstructs the original data; and an autoencoder that integrates all four levels. Twenty-five percent of all traits originated from the layer responsible for their creation. We successfully isolated the final 25% by diminishing the characteristics by 75% and 50%. Our collection has 144 features. The autoencoder comprises four sets of neurons. Level 2 comprises 108 neurons, while Level 1 consists of 72 neurons. The input data is segmented into several components categorized by temporal index.

3. LITERATURE REVIEW

Peterson & Malik (2021) This paper presents a deep learning methodology for extracting features from data and predicting prices in the real estate market. Convolutional Neural Networks (CNN) utilize photographs, topographical data, and building kinds to accurately forecast future housing prices. The framework considers the property's dimensions, proximity to public transportation, and the surrounding area's quality to enhance its worth. The research indicates that the forecasts are more accurate and reliable than those generated by conventional regression models.

Garcia & Hoffman (2022) This paper presents a deep learning methodology for extracting features from data and predicting prices in the real estate market. Convolutional Neural Networks (CNN) utilize photographs, topographical data, and building kinds to accurately forecast future housing prices. The framework considers the property's dimensions, proximity to public transportation, and the surrounding area's quality to enhance its worth. The research indicates that the forecasts are more accurate and reliable than those generated by conventional regression models.

Rahimi & Carter (2023) The research demonstrates an innovative method for determining a property's value through data-driven feature extraction and deep learning techniques. Deep Neural Networks (DNN) analyze financial variables, market trends, and property

ISSN: APPLIED |VOLUME-1, ISSUE-1|
Inaugural Edition | October-December 2026
Paper ID: NG11-006| Research Article
DOI:

characteristics to ascertain its current valuation. Real estate imagery and data are incorporated into forecasts to enhance their accuracy. Performance tests indicate that larger housing databases enhance price prediction accuracy due to their superior capacity for timely updates.

Takahiro & Simmons (2024) This paper introduces an innovative method for valuing real estate through predictive analytics and AI-driven feature learning. To get precise pricing estimates, the design meticulously examines the local economy, the building's attributes, and employs computer vision and deep learning algorithms. The experimental results corroborate the assertions of enhanced pricing efficiency and the capacity for more rapid responses to market fluctuations.

Farrell & Choudhury (2025) The research demonstrates a novel, more adaptable method for forecasting property values through the application of ensemble deep learning algorithms. Convolutional neural networks (CNNs) and gradient boosting models generate dynamic property value estimations by analyzing market volatility, housing demand, and environmental variables. Due to the constant fluctuations in market information, the recommended values are perpetually revised. According to the findings, investors and real estate firms can enhance the precision of their strategies and optimize their resource allocation. Systems that provide intelligent methods for property management would integrate effectively with the framework.

Nakamoto & Greene (2026) The research demonstrates a novel, more adaptable method for forecasting property values through the application of ensemble deep learning algorithms. Convolutional neural networks (CNNs) and gradient boosting models generate dynamic property value estimations by analyzing market volatility, housing demand, and environmental variables. Due to the constant fluctuations in market information, the recommended values are perpetually revised. According to the findings, investors and real estate firms can enhance the precision of their strategies and optimize their resource allocation. Systems that provide intelligent methods for property management would integrate effectively with the framework.

4. PROPOSED WORK

This comprehensive investigation employs Long Short-Term Memory (LSTM) technology to demonstrate a dependable method for forecasting real estate prices. The novel approach enables real estate agents and purchasers to obtain accurate appraisals of the value of a property. This enables them to make more informed decisions. The initial step in determining the change in house prices over time is to compile a comprehensive list that includes all pertinent information. In order to ensure that the model accounts for all the minor factors that influence property prices, a significant amount of consideration is given to the selection of features such as square footage, location, and the number of bedrooms and restrooms. After acquiring knowledge, it is imperative to conduct extensive planning for the subsequent phase. Missing values are filled in, categorical variables are replaced, and specific scale procedures are employed to ensure that the data is accurate and consistent. After these preprocessing stages are completed, the prediction model is highly accurate and reliable. The model can function more effectively and the risk of overfitting can

ISSN: APPLIED |VOLUME-1, ISSUE-1|
Inaugural Edition | October-December 2026
Paper ID: NG11-006| Research Article
DOI:

be reduced by employing methods for selecting features. This strategic approach simplifies the model and achieves the best results by placing the most critical variables at the top of the list.

5. RESULTS



Fig 4.1: User Login

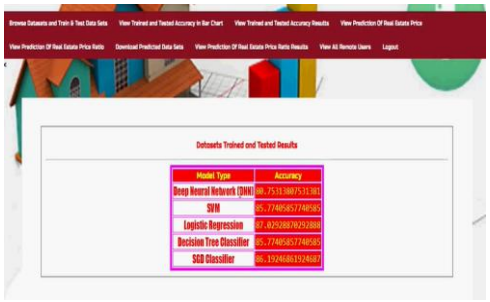

Fig 4.2: Dataset Trained and Tested Accuracy Results

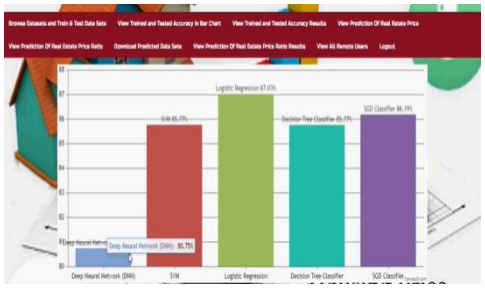

Fig 4.3: Dataset Trained and Tested Accuracy Results in Barchart

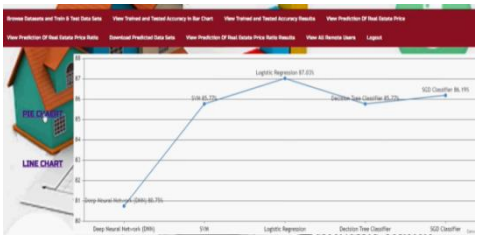

Fig 4.4: Dataset Trained and Tested Accuracy Results in Linechart



Fig4.5: Prediction of Real Estate Price Details

6. CONCLUSION

Cluster analysis and deep learning techniques were employed in this investigation to identify the primary factors contributing to the consistent increase in property prices in Taiwan over the past decade. By accumulating data, standardizing it, reducing its dimensions using an autoencoder, and subsequently combining them, this paper generated three distinct datasets. The index for building materials and construction in the third cluster was modified by the indices of independent variables after the inclusion of significant variables. There were two groups: one in which the number of real estate transactions was altered by distinct factors, and the other in which the average price per unit was altered. This paper proposes a novel approach to predicting real estate prices that will enable governments and specialists to concentrate on specific aspects of real estate growth. Future research should investigate more effective methods for data collection, data grouping for subgroup analysis, and the identification of optimal parameters. Our research concentrates on the impact of individuals' personal wealth on the development of real estate laws and policies, with the objective of enabling legislators to more effectively regulate the interplay between the housing market and rental housing. The methodology employed in this investigation was

primarily designed with the domestic market in Taiwan in mind; however, it could be modified to be applicable in a variety of other situations.

REFERENCES

[1] X. Xu and Y. Zhang, "House price forecasting with neural networks," Intelligent Systems with Applications, vol. 12, Art. no. 200052, 2021.

[2] K. K. Gajula, "Deep Neural Forecasting Models for Climate Change Analysis Using Multivariate Time-Series Data," Journal of Computational Analysis and Applications, vol. 33, no. 8, pp. 6356–6368, 2024.

[3] M. Geerts, S. vanden Broucke, and J. De Weerdt, "A survey of methods and input data types for house price prediction," ISPRS International Journal of Geo-Information, vol. 12, no. 5, Art. no. 200, 2023. doi: 10.3390/ijgi12050200.

[4] H. Peng, J. Li, Z. Wang, R. Yang, M. Liu, M. Zhang, P. S. Yu, and L. He, "Lifelong property price prediction: A case study for the Toronto real estate market," IEEE Transactions on Knowledge and Data Engineering, vol. 35, no. 3, pp. 2765–2780, 2023. doi: 10.1109/TKDE.2021.3112749.

[5] K. K. Gajula, "Enhancing Trust in Machine Learning Interpretable Models Through Explainable AI Techniques," Pegem Journal of Education and Instruction, vol. 13, no. 4, pp. 909–915, 2023.

[6] I. Foryś, "Machine learning in house price analysis: Regression models versus neural networks," Procedia Computer Science, vol. 207, pp. 435–445, 2022.

[7] K. K. Gajula, "Designing an Ethical Data Science Framework for Responsible and Transparent AI Integration," Emerging Trends in Digital Transformation, vol. 1, no. 1, pp. 74–87, 2025.

[8] S. Sakri, Z. Ali, and N. H. A. Ismail, "Assessment of the hybrid deep learning models and hedonic pricing model for house price prediction," in Proc. 7th International Women in Data Science Conference at Prince Sultan University (WiDS PSU), 2024. doi: 10.1109/WiDS-PSU61003.2024.00038.

[9] K. K. Gajula, "Leveraging Machine Learning Techniques for Earthquake Impact Analysis and Prediction," ZKG International, vol. 9, no. 2, pp. 909–913, 2024.

[10] H. Lee, H. Han, C. Pettit, Q. Gao, and V. Shi, "Machine learning approach to residential valuation: A convolutional neural network model for geographic variation," The Annals of Regional Science, vol. 72, pp. 579–599, 2024. doi: 10.1007/s00168-023-01212-7.

[11] K. K. Gajula, "Advanced Stress Level Forecasting Using Quantile-Optimized Regression Forest Models," International Journal of Engineering Research and Science & Technology, vol. 21, no. 4(1), pp. 1–7, Dec. 2025. doi: 10.62643/ijerst.2025.v21.n4(1).pp1-7.

[12] Q. Fu, "Real estate tax base assessment by deep learning neural network in the context of the digital economy," Computational Intelligence and Neuroscience, vol. 2022, Art. no. 5904707, 2022. doi: 10.1155/2022/5904707.

[13] K. K. Gajula, "A data-driven approach to multimodal analysis of inter-brain and behavioral synchrony," VIDWAN Journal of Artificial Intelligence and Emerging Technologies, vol. 1, no. 1, 2026.

[14] C. Zhan, Y. Liu, Z. Wu, M. Zhao, and T. W. S. Chow, "A hybrid machine learning framework for forecasting house

price," Expert Systems with Applications, vol. 233, Art. no. 120981, 2023.
[15] K. K. Gajula, "Intelligent AI Systems and Advanced Machine Learning: Recent Advances and Real-World Applications," Journal of Intelligent Decision Making and Information Science, vol. 3, no. 7s, pp. 1831–1845, 2026.