Related Work  
  
This study proposes a rental apartment monitoring system for Kuala Lumpur, Malaysia, focusing on price prediction and decision-making support for renters. Utilizing the CRISP-DM framework, the project employs Python for data processing and visualization. Models such as **Linear Regression**, **Decision Trees**, **Random Forests**, and **Support Vector Machines (SVM)** are incorporated to predict rental prices based on features like location, amenities, and apartment specifications. The study emphasizes creating a user-friendly dashboard to enhance the rental decision process by providing visual insights and accurate rental estimations [1]  
  
This research compares the performance of **Convolutional Neural Networks (CNN)** and **Naïve Bayes (NB)** in predicting rental prices in metro cities. The study utilizes a dataset of house features and rents, achieving a 96% accuracy rate with CNN, significantly higher than NB's 93%. The findings emphasize CNN's suitability for handling complex rental market data, surpassing traditional classification algorithms​ [2]  
  
This research applies machine learning methods like **Ordinary Least Squares (OLS)**, **LASSO Regression**, **Decision Trees**, **Random Forests**, and **K-Nearest Neighbors (KNN)** to estimate apartment prices in the Czech Republic. Using a dataset of 15,848 listings, the Random Forest algorithm demonstrates the highest accuracy in predicting offering prices. The inclusion of text mining enhances the linear models, reducing prediction errors. The analysis further explores determinants of property value in Prague versus other regions​[3]

This research evaluates the pricing of apartments in major Swedish cities using geospatial and population data. Employing machine learning models such as **Multiple Linear Regression (MLR)**, **Random Forests**, and **Multi-layer Perceptron (MLP)**, the study achieves prediction accuracies of 8.68% and 8.76% mean absolute percentage error (MAPE) for the MLP and Random Forest models, respectively. Results indicate that integrating geospatial data can improve prediction performance, though challenges arise in predicting prices for cities not included in the training set​[4]

This study compares the performance of **Random Forest (RF)** and **Ordinary Least Squares (OLS) Regression** in predicting apartment prices in Ljubljana, Slovenia. Employing GIS data, the research demonstrates that Random Forest achieves superior results across all evaluation metrics, including R² values and Mean Average Percentage Error (MAPE). The findings affirm the effectiveness of Random Forest in modeling nonlinear relationships inherent in real estate datasets[5]

This research focuses on predicting rental prices for apartments in Greater Helsinki using machine learning techniques. Methods such as **XGBoost**, **Random Forests**, and **Gradient Boosting Machines (GBM)** were evaluated for their performance. The study identifies XGBoost as the most accurate method, benefiting from its ability to model complex relationships and incorporate engineered features like inverse distance weighting. The research underscores the significance of integrating spatial data for enhancing the predictive accuracy of rental price models[6]

This study applies various machine learning methods, including **Linear Regression**, **Decision Trees**, **Random Forests**, **K-Nearest Neighbors (KNN)**, and **Support Vector Regression (SVR)**, to predict apartment prices in Dubai. Utilizing data from the Dubai real estate market, the research demonstrates that ensemble-based models, such as Random Forest, consistently outperform simpler models in accuracy. The study highlights the potential of advanced regression techniques for modeling real estate prices in regions with volatile market dynamics​[7]

This research examines the performance of three methods—**Random Forest**, **Multiple Regression**, and **Backpropagation Neural Networks**—to predict apartment price indices in Indonesia. Among these, the Backpropagation method achieves the highest accuracy (R² = 0.996), followed by Random Forest (R² = 0.977). The study highlights the suitability of Backpropagation for handling smaller datasets due to its iterative learning approach, which minimizes prediction errors​[8]

This study investigates rental price prediction in Cluj-Napoca, Romania, leveraging machine learning techniques. Models such as **Linear Regression (LR)**, **Ridge Regression**, **Decision Trees**, **K-Nearest Neighbors (KNN)**, **Random Forest**, and **Support Vector Regression (SVR)** were evaluated. The research identifies Random Forest as the most accurate model for predicting fair rental prices, considering key determinants like location, amenities, and demographic trends. The study emphasizes the importance of ML-driven analytics in improving market transparency and aiding stakeholders in decision-making processes[9]

This paper presents a systematic review of machine learning applications in predicting real estate prices and rentals. Commonly utilized algorithms include **Random Forest (RF)**, **Decision Tree (DT)**, **Linear Regression (LR)**, and **Support Vector Machine (SVM)**. The study synthesizes findings from multiple datasets and highlights the growing relevance of machine learning in addressing valuation challenges in the real estate sector. These techniques offer improved accuracy over traditional methods, underscoring their potential to transform property market analysis[10]

This study employs three machine learning algorithms—**Random Forest Regression**, **Linear Regression**, and **Decision Tree Regression**—to predict rental costs for student housing in Lokoja, Nigeria. Random Forest achieved the highest accuracy with an R² value of 95.2%, outperforming the other models. The study underscores the importance of incorporating features like room count and furniture in predictive analytics, contributing to better-informed decisions for students and real estate stakeholders​[11]

This research explores advanced machine learning (ML) and deep learning (DL) techniques for predicting rental prices in Munich, Germany. It applies models such as **Linear Regression (LR)**, **Random Forest Regression (RFR)**, **Gradient Boosting Regressors (GBR)**, **XGBoost**, and **PyTorch-based Neural Networks (PNNs)**. The study highlights the integration of CatBoost and PSO for feature selection to enhance model accuracy. The results demonstrate that PNNs combined with other ML models improve predictive performance, achieving an average accuracy of 90%. The findings emphasize PyTorch's capability in predictive tasks and advocate for its application in other real estate markets​[12]

This research investigates property price classification in Florida's Volusia County using machine learning techniques. The study integrates socio-economic factors such as GDP, CPI, and HPI with real estate attributes. Models like **Logistic Regression**, **Random Forest**, **Voting Classifier**, and **XGBoost** were applied, with XGBoost achieving the highest accuracy. The findings demonstrate the robustness of ensemble methods in real estate market predictions​[13]

This research compares the performance of **Convolutional Neural Networks (CNN)** and **Naïve Bayes (NB)** in predicting rental prices in metro cities. The study utilizes a dataset of house features and rents, achieving a 96% accuracy rate with CNN, significantly higher than NB's 93%. The findings emphasize CNN's suitability for handling complex rental market data, surpassing traditional classification algorithms[14]

This study aims to predict residential real estate prices in Wroclaw's primary market using machine learning methods. Techniques such as **Simple Linear Regression**, **Gradient Boosting Regression**, **Multiple Linear Regression**, **LASSO**, and **Random Forest Regression** are applied, achieving up to 90% accuracy. The study underscores the utility of integrating web scraping with predictive models to enhance market analysis for real estate professionals[15]

This study employs data mining techniques, particularly the **Decision Tree Algorithm**, to examine factors influencing rental housing demand in Turkey. Using the 2015 Household Budget Survey dataset comprising 2341 households, the research analyzes 49 variables including housing characteristics, household size, and income. The findings indicate that Decision Tree models outperformed other methods in identifying correlations and predicting rental housing values based on diverse socio-economic and physical attributes​[16]

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