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Machine Learning for Predicting Property Purchase Behavior: A Systematic Literature Review

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ABSTRACT

This study aims to examine the application of machine learning algorithms in predicting property purchase behavior based on consumer data. The main problem addressed is the limited use of intelligent data analysis in understanding consumer behavior in the Indonesian property sector, despite increasing market data availability. This research employs a systematic literature review approach by analyzing studies published in the last five years, focusing on classification algorithms such as Decision Tree, Random Forest, and Support Vector Machine (SVM). The analysis includes data collection, evaluation, and synthesis of selected studies. The results indicate that algorithm performance varies depending on data characteristics and application context. Random Forest tends to show strong performance in terms of accuracy and robustness, while Decision Tree and SVM also demonstrate competitive results in certain scenarios. These findings reflect general trends rather than definitive conclusions. Key factors influencing property purchase decisions include location, price, and developer reputation. In conclusion, machine learning has significant potential to support data-driven decision-making in the property sector. Future research should integrate real-time and more diverse data to improve predictive model accuracy.

KEYWORDS: Consumer Data; Machine Learning; Prediction; Property Purchase Behavior; Random Forest

1. Introduction

The rapid development of information and communication technology has significantly transformed various sectors, including the property industry. The increasing availability of digital data, driven by online transactions, social media, and information systems, has created new opportunities for organizations to analyze consumer behavior and support strategic decision-making [1], [2]. In particular, the implementation of Big Data analytics in various domains, including mobile cloud-based systems, has demonstrated its potential in processing large-scale data efficiently and generating valuable insights [2]. However, the abundance of data alone is not sufficient without the application of appropriate analytical techniques to extract meaningful information.

Machine learning has emerged as one of the most effective approaches in data mining for analyzing large datasets and identifying hidden patterns. It is widely used in classification, prediction, and decision support systems due to its ability to learn from historical data and generate accurate predictive models [3], [4]. Several machine learning algorithms, such as Decision Tree, Naïve Bayes, Support Vector Machine (SVM), and Random Forest, are commonly applied in classification tasks [5], [6]. These algorithms have different characteristics and performance levels depending on the structure and complexity of the data [7].

Previous studies have emphasized that the performance of machine learning algorithms varies depending on the characteristics of the dataset and the complexity of the problem. A comparative review of clustering and classification algorithms shows that methods such as Decision Tree, Naïve Bayes, SVM, and Random Forest exhibit different strengths and weaknesses, and no single algorithm consistently outperforms others in all

scenarios [8]. Therefore, selecting an appropriate algorithm is a crucial step in developing an effective predictive model.

In addition, machine learning has been successfully applied to predict human behavior in various domains. For instance, the Naïve Bayes algorithm has been used to classify employee tendencies to change jobs, achieving an accuracy of 80.79% and identifying dominant influencing factors such as education level, company size, and field of expertise [9]. This demonstrates the capability of machine learning in modeling decision-making behavior based on historical data.

In the property sector, understanding consumer purchasing behavior is essential for developers and marketers to design effective business strategies. With the growth of digital data, machine learning offers significant potential to predict purchasing behavior and support data-driven decision-making [10], [11]. However, most existing studies tend to focus on property price prediction rather than analyzing consumer behavior patterns in purchasing decisions. Furthermore, limited studies specifically address the prediction of property purchase behavior using a comprehensive comparison of machine learning classification algorithms, highlighting a clear research gap in this area.

Furthermore, predicting property purchase behavior is a complex problem due to the involvement of multiple variables, such as location, price, income level, and developer reputation [12], [13]. The heterogeneity and high dimensionality of consumer data also present challenges in building accurate predictive models [14]. These limitations highlight the need for a more comprehensive analysis of machine learning techniques in this domain.

Therefore, this study aims to analyze the application of machine learning algorithms in predicting property purchase behavior using a literature review approach. This research evaluates several classification algorithms and identifies the key factors influencing consumer decisions. The results are expected to contribute to the development of data-driven strategies in the property sector and provide insights for future research.

2. Methods

This study employs a qualitative descriptive approach using a Systematic Literature Review (SLR) method to analyze the application of machine learning algorithms in predicting property purchase behavior. The objective of this method is to systematically evaluate previous studies and synthesize their findings to gain comprehensive insights into the effectiveness of various classification algorithms.

The review process follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a structured, transparent, and reproducible methodology. This approach includes defining research questions, identifying relevant studies through systematic search strategies, applying inclusion and exclusion criteria, and synthesizing findings from selected studies.

The literature search was conducted using several academic databases, including Scopus, Web of Science, and Google Scholar, with keywords such as “machine learning,” “property purchase behavior,” “consumer behavior,” and “classification algorithms.” The selection process involved identification, screening, eligibility assessment, and inclusion stages. A total of 20 relevant studies were selected after the filtering process.

In addition, a quality assessment was conducted to evaluate the relevance and methodological rigor of the selected studies based on criteria such as clarity of objectives, research methodology, and evaluation metrics. This study applies a qualitative synthesis approach rather than a quantitative meta-analysis, focusing on identifying patterns and trends across the reviewed literature.

2.1 Research Design

The research design is based on a systematic literature review, which focuses on identifying, evaluating, and interpreting relevant research studies. This approach is used to understand the development and application of machine learning techniques in consumer behaviour prediction, particularly in the property sector.

2.2 Data Collection

The data used in this study are secondary data obtained from scientific publications, including peer-reviewed journals, conference proceedings, and academic articles. The literature was selected based on the following criteria:

a. Published between 2020 and 2025
b. Relevant to machine learning, data mining, or predictive analytics
c. Discusses classification algorithms such as Decision Tree, Naïve Bayes, Support Vector Machine (SVM), and Random Forest
d. Includes evaluation results or performance analysis

A total of selected studies were reviewed and categorized to support the analysis. A total of 20 selected studies were reviewed and categorized to support the analysis. This selection ensures that the analysis is comprehensive and represents recent developments in machine learning applications.

2.3 Data Analysis Technique

The data analysis process consists of several stages:

a. Literature Identification
   Relevant studies are identified and grouped based on research topics and methods used.
b. Classification of Algorithms
   The selected studies are categorized according to the machine learning algorithms applied, particularly classification methods.
c. Comparative Analysis
   Each algorithm is analyzed by comparing its performance based on evaluation metrics such as accuracy, computational efficiency, scalability, and robustness.
d. Synthesis of Findings
   The results from different studies are synthesized to identify patterns, strengths, and limitations of each algorithm.
e. Identification of Influencing Factors
   Key variables affecting property purchase behavior are identified from the literature.

2.4 Research Framework

The research framework of this study consists of several stages. First, the problem is identified based on the limited application of machine learning in predicting property purchase behavior. Second, relevant literature is collected and analyzed to evaluate the performance of classification algorithms. Finally, the results are synthesized to generate conclusions and recommendations.

2.5 Evaluation Criteria

To ensure a comprehensive comparison, this study uses several evaluation criteria, including:

a. **Accuracy**: The ability of the model to correctly predict outcomes
b. **Computational Efficiency**: The required processing time and resources
c. **Scalability**: The ability to handle large-scale data
d. **Interpretability**: The ease of understanding model results
e. **Robustness**: The ability to handle noise and data variability

These criteria are used as the basis for comparing machine learning algorithms in predicting property purchase behavior.

3. Results and Discussion

This section presents the results of the literature review on the application of machine learning algorithms in predicting property purchase behavior. The analysis focuses on comparing the performance of classification algorithms and identifying the key factors influencing consumer decisions.

Based on the synthesis of the selected studies, a quantitative summary of algorithm performance is presented in Table 1. The values represent general trends derived from multiple studies rather than exact aggregated metrics.

Table 1. Summary of Algorithm Performance Based on Reviewed Studies

Algorithm	Average Accuracy	Interpretability	Computational Cost
Decision Tree	75%–85%	High	Low
Naïve Bayes	70%–85%	High	Very Low
SVM	80%–90%	Low	High
Random Forest	85%–92%	Moderate	Moderate–High

The results indicate that Random Forest generally demonstrates strong performance in terms of accuracy and robustness across various studies. However, its performance may decrease when applied to datasets with limited size or when interpretability is a primary requirement. In such cases, simpler models like Decision Tree or Naïve Bayes may be more appropriate.

Furthermore, a trade-off between interpretability and accuracy is observed among the algorithms. Models with higher accuracy, such as Random Forest and SVM, tend to have lower interpretability, making them less suitable for decision-making contexts that require transparency. On the other hand, Decision Tree offers high interpretability but may suffer from overfitting and lower predictive performance.

These findings highlight that the selection of machine learning algorithms should consider not only accuracy but also the context of application, including data characteristics, computational resources, and the need for model interpretability. Therefore, no single algorithm can be considered universally optimal, and model selection should be adapted to specific use cases.

3.1 Comparative Analysis of Machine Learning Algorithms

Based on the reviewed studies, several machine learning algorithms are widely used for classification tasks, including Decision Tree, Naïve Bayes, Support Vector Machine (SVM), and Random Forest. Each algorithm demonstrates different performance characteristics depending on the dataset and problem complexity.

To provide a structured comparison, Table 1 summarizes the evaluation of these algorithms based on several criteria.

Table 2. Comparison of Machine Learning Algorithms

Algorithm	Accuracy	Scalability	Interpretability	Robustness	Strengths	Weaknesses
Decision Tree	High	High	High	Low	Easy to interpret, simple model	Prone to overfitting
Naïve Bayes	Moderate	Very High	High	Moderate	Fast, efficient for large data	Assumes feature independence
SVM	High	Moderate	Low	High	Effective in high-dimensional data	Computationally expensive
Random Forest	Very High	High	Moderate	Very High	High accuracy, robust to noise	Less interpretable

The results indicate that Random Forest generally provides superior performance in terms of accuracy and robustness, as it combines multiple decision trees to improve prediction stability and reduce overfitting [16]. Meanwhile, Naïve Bayes is highly efficient and suitable for large datasets, although its simplifying assumption of feature independence can limit performance in more complex scenarios [9].

Support Vector Machine (SVM) demonstrates strong performance in high-dimensional data environments but requires higher computational resources [17]. On the

other hand, Decision Tree offers high interpretability, making it suitable for decision support systems, although it is prone to overfitting when dealing with noisy data [18].

These findings are consistent with previous studies indicating that no single algorithm is universally optimal, and the selection of algorithms should be tailored to the characteristics of the dataset and the objectives of the analysis [8]. These results are also supported by prior research [8], [12], which highlights the effectiveness of ensemble methods such as Random Forest in improving prediction accuracy and model robustness.

3.2 Factor Influencing Property Purchase Behaviour

In addition to algorithm performance, this study identifies several key factors influencing consumer decisions in purchasing property. These factors are summarized in Table 3.

Table 3. Key Factors Affecting Property Purchase Decisions

Factor	Description
Location	Accessibility, proximity to public facilities
Price	Affordability and financial capability
Income Level	Consumer purchasing power
Developer Reputation	Trust and credibility of the developer
Facilities	Availability of supporting infrastructure

The analysis shows that location and price are the most dominant factors influencing purchasing decisions. Consumers tend to prioritize strategic locations and affordable pricing when selecting property [13], [14]. In addition, developer reputation plays a significant role in building consumer trust and influencing purchase decisions.

3.3 Discussion

The findings of this study highlight that machine learning has significant potential in predicting property purchase behavior. The use of classification algorithms enables the identification of patterns and relationships among variables that influence consumer decisions.

However, several challenges remain in implementing machine learning models in real-world applications. These include data heterogeneity, data quality issues, and the complexity of feature selection. In addition, model interpretability remains an important consideration, especially in decision-making contexts where transparency is required.

To address these challenges, the use of ensemble methods, such as Random Forest, is recommended due to their ability to improve prediction accuracy and robustness. Furthermore, integrating multiple data sources and applying feature selection techniques can enhance model performance.

Overall, this study demonstrates that the successful application of machine learning in the property sector depends not only on algorithm selection but also on data quality and the relevance of selected features. The integration of machine learning into property analysis can support more effective, accurate, and data-driven decision-making.

4. Conclusion

This study analyzes the application of machine learning algorithms in predicting property purchase behavior using a systematic literature review approach. The findings highlight that different classification algorithms offer distinct advantages, and their effectiveness depends on data characteristics and application context. No single algorithm can be considered universally optimal.

This study also identifies key factors influencing property purchase decisions, including location, price, income level, developer reputation, and available facilities. These factors can serve as important variables

in developing predictive models for the property sector.

From a practical perspective, the findings of this study can assist property developers and businesses in designing more targeted marketing strategies, improving customer segmentation, and supporting data-driven decision-making. By leveraging machine learning models, developers can better understand consumer preferences and optimize property offerings based on market trends.

For future research, it is recommended to explore hybrid models, such as combining Random Forest with Neural Networks or Gradient Boosting techniques, to enhance predictive performance. In addition, the use of more diverse datasets, including real-time transaction data, demographic data, and behavioral data from digital platforms, is essential to improve model accuracy and generalizability.

Overall, this study contributes to the development of predictive analytics in the property domain by providing a structured understanding of machine learning applications and their potential for practical implementation.

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