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Assignment Report: Designing an Intelligent Algorithm to Predict Customer Needs in Delivery Applications

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Chapter 1

1.1 Introduction

Logistics services like food delivery and e-commerce have become fundamental services in contemporary digital economies. The platforms closely depend on artificial intelligence (AI), machine learning (ML), and predictive analytics to enhance customer satisfaction and efficiency of the services. The accurate prediction of the needs of the customers, the time of delivery, and the pattern of demand and optimization of the logistics processes is one of the greatest challenges in the delivery systems.

The recent research suggests that intelligent software is capable of its ability to analyze massive data, such as traffic status, customer actions, order trends, and environmental factors, to give useful predictions that enhance the efficiency of operations. The predictive models also assist the companies to minimize delays, streamline delivery routes, customer satisfaction, and overall quality of services.

This literature review discusses six studies referring to intelligent algorithms and predictive analytics in the context of delivery systems. The review will break down the objectives, methods and findings of each study and then provide the critical analysis of their strengths, and limitations to the same. Lastly, the links among the papers are established to bring out research trends and gaps that are pertinent in developing an intelligent algorithm to predict customer requirements in delivery apps.

1.2 Research Problem

In online platforms, particularly delivery apps, customer satisfaction is a key success driver of a company. Customer data has been extensively analyzed using AI to

predict their satisfaction levels. Random Forest, Gradient Boosting, and deep learning models (CNN-LSTM) with advanced algorithms demonstrated high predictive performance (Chakour et al., 2025). Nevertheless, the modern studies still have the limitation of practical use and data combination.

In the logistics and delivery systems, the research points to the fact that the models used in prediction are often concerned with the delays during the delivery or classification results, but not with correct prediction of customer needs (Müller et al., 2025). Also, AI methods are capable of extremely high accuracy in forecasting consumer behavior, including up to 89 percent with integrated data sources (Papia et al., 2025). Even with these developments, a gap exists in coming up with integrated models that can be used in customer behavior forecasting and real-time delivery optimization.

Research Question: How should a smart AI-based algorithm be structured to predict customer needs and satisfaction correctly as well as enhance efficiency in delivery in real-time systems?

1.3 Research Objectives

Main Objective

To model and construct a smart AI algorithm to predict customer requirements and satisfaction and improve the efficiency of the delivery in real-time applications.

Sub-Objectives

- To examine the trends in customer behavior with machine learning and predictive analytics.
- To determine the best AI models (e.g., Random Forest, Gradient Boosting, Deep Learning) to predict customer satisfaction.

- To incorporate real-time data sources (traffic, location and order history) to predictive models.
- To measure the performance of the proposed model in terms of accuracy, precision, and F1-score.
- To enhance the decision-making in the delivery systems based on the data-driven insights.

1.4 Scope of the Study

This paper is dedicated to the use of artificial intelligence in delivery platforms, especially when it comes to anticipating customer needs and satisfaction. It discusses machine learning and deep learning algorithms to analyse customer behaviour and optimisation of delivery operations. The study is confined to online delivery settings and based on structured and real-time data including user interactions, history of transactions and logistics data. It excludes non-digital service settings, or industries that are not related. The research highlights the model development, performance assessment, and practical implementation in the delivery systems.

Chapter 2

2.1 Literature Review of Selected Papers

Paper 1 Efficient Food Delivery Management: Predicting Delivery Times for Improved Customer Experience

(Kumar & Mishra, 2024)

This paper aims at enhancing the effectiveness of food delivery through forecasting the delivery time with the help of machine learning algorithms. The primary goal of the study is to improve the level of customer satisfaction through decreasing the error of estimating the delivery time. The authors also note that incorrect prediction of delivery may have a negative impact on the trust of the user and the experience of the whole service.

The steps used in the methodology include data preprocessing, feature engineering and exploratory data analysis (EDA) to find the relevant predictors that impact on the delivery time. A number of machine learning models were used, such as Linear Regression, Lasso Regression, Decision Trees, Random Forest, and XGBoost. The grid search CV was used to tune the hyperparameter and enhance the model.

The findings indicated that the ensemble models (Random Forest and XGBoost) had a higher predictive accuracy than the simple regression-based models. The research finds that predictive models should be incorporated into delivery platforms as this will help enhance efficiency and consumer satisfaction.

Nevertheless, the study concentrates on prediction of the delivery time and not on the prediction of the general customer behavior. Also, it is possible that the dataset used does not reflect all the geographic or operational settings.

Paper 2 Improving Customer Satisfaction with Predictive Analytics in Logistics and Delivery Systems

(Yerra, 2024)

This paper discusses the role of using predictive analytics in improving customer satisfaction in logistics and delivery services. The study focuses on how artificial intelligence can be used to predict disruptions in delivery and enhance the efficiency of the supply chain.

The methodology incorporates historical logistics data, GPS tracking information, IoT sensors and ERP systems to create predictive analytics models. These models examine factors like traffic statistics, weather, performance of the vehicle and the demand of the customers.

According to the study, predictive analytics has a great influence on enhancing accuracy of delivery, minimizing operational delays, and allowing customers to update their services in real time. The AI-powered systems also enable the companies to notice anomalies like car breakdowns or disruptions to the supply chain.

The main strong point of this research is the fact that it integrates various sources of information. Nevertheless, the study is conceptual in a few ways and fails to give specific performance comparisons among machine learning models.

Paper 3 Designing an AI-Driven Intelligent Vehicle Routing Model for Real-Time Order Picking and Delivery Operations in Food Service Logistics

(Dutta, Sarddar & Ghosh, 2025)

The paper presents an artificial intelligence-based vehicle routing model that will optimize the order picking and delivery processes. The study will combine real-time information and machine learning to enhance routing in food delivery networks.

The authors use fall feature engineering and exploratory data analysis to determine important variables in predicting demand patterns. The models of machine learning were a number of regression based, such as Linear Regression, Ridge Regression, and Support Vector Regression (SVR).

The findings indicate that the combination of predictive demand models and vehicle routing algorithms in the delivery planning and operational efficiency process is enhanced. Nevertheless, the levels of accuracy of the predictive models were rather moderate, which reveals the necessity of some additional optimization.

One of the drawbacks is that the model is primarily concerned with routing optimization and not overall customer behavior prediction.

Paper 4 Optimizing Delivery Time with an Intelligent Forecasting Model: Leveraging AI and Machine Learning for Efficient Logistics

(Szymański et al., 2024)

This paper explores how data mining, machine learning and visual analytics could help optimize the logistics process and predict delivery time. The researchers emphasize the significance of exploratory data analysis (EDA) in interpreting big data prior to applying the predictive models.

The study highlights that visual analytics and dashboards aid organizations to convert unprocessed data to usable information. Patterns in the delivery operations are detected and logistical outcomes forecasted through machine learning algorithms.

The results indicate that smart forecasting systems can enable companies to track the performance indicators and enhance operational decision-making. Nonetheless, the research is centered primarily on analytics infrastructure and visualization and not on particular algorithm implementations.

Paper 5 Precision Delivery: Machine Learning Algorithms for Real-Time Food Delivery Estimates

(Geetha Sri et al., 2025)

This study suggests the prediction model of the delivery time in real-time using the sophisticated methods of ensemble learning. The paper combines Google Maps API measurements of traffic and machine learning algorithms to enhance prediction accuracy.

The authors apply the Random Forest, XGBoost, LightGBM, and a Stacking Regressor model. The stacking method is a combination of several models to obtain a good prediction performance.

The outcomes of the evaluation show that the predictions are very accurate with the R^2 at 0.8389. SHAP analysis is also used in the model to explain the importance of features and enhance the transparency of the model.

The primary weakness of the research is that it mainly works on the estimation of delivery time as opposed to customer needs or preferences.

Paper 6 AI-Driven Optimization Models for E-Commerce Supply Chain Operations

(Kaul & Khurana, 2022)

The present paper discusses how artificial intelligence can be used to streamline the supply chain in e-commerce, such as demand forecasting, inventory control, and minimization of delivery time.

The study tells about some of the more developed AI methods like Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, and Transformer models. These are demand forecasting and supply chain optimization models.

The research finds that AI-based systems can help logistics be more efficient and cost-effective in terms of operations. Inventory levels and the delivery routes can also be optimized using reinforcement learning techniques.

Though the article has significant information on AI-based logistics optimization, it is more theoretical and does not include the detailed empirical analysis.

Paper 7 The Design of Consumer Behavior Prediction and Optimization Model by Integrating DQN and LSTM

(Liu & Hu, 2025)

The purpose of this study is to create a more sophisticated consumer behavior prediction model that combines deep reinforcement learning (DQN) and Transformer networks. The key aim is to improve the precision in determining consumer interests and facilitating the individual marketing approaches.

The methodology is based on combining multiple AI techniques. Transformer network is employed to run consumer behavioural data with multi-head attention mechanisms and DQN is employed to optimize the performance of predictions

dynamically. The model is based on consumer profiles and transactional data to make predictions.

The results show that the suggested RL-Trans framework performs better than standard LSTM-based frameworks and can compete with the state-of-the-art approaches. Another ability that has been exhibited by the model is the ability to adapt to the changing behavioral patterns of the consumers.

Nevertheless, this paper places a lot of emphasis on predicting consumer behavior in e-commerce, but not on how to integrate it with delivery networks and optimization of logistics.

Paper 8 Artificial Intelligence Algorithms to Predict Customer Satisfaction: A Comparative Study

(Chakour et al., 2025)

This paper seeks to make a comparison of various artificial intelligence algorithms that are applied in the prediction of customer satisfaction in different business scenarios. The study is aimed at determining the best models in regards to predictive performance.

This methodology is based on comparing the machine learning and deep learning algorithms that include the Random Forest, Gradient Boosting, and CNN-LSTM models. The accuracy and F1-score are some of the metrics used to assess the performance of these models.

The findings indicate that the ensemble learning model and the deep learning model have the highest prediction accuracy with the deep learning models performing better than the traditional machine learning models in most instances. The article highlights the role of AI in enhancing retention and performance of businesses.

Although it has a good comparative analysis, the study lacks practical implementation and integration with real-time delivery systems.

Paper 9 An Analytical Review of Predictive Methods for Delivery Delays in Supply Chains

(Müller et al., 2025)

The purpose of the paper is to conduct a review of current predictive techniques applicable in delivery delays forecasting in supply chains, as well as to determine the gaps in research on the subject.

The paper follows the systematic literature review approach, examining different machine learning methods and data sources that are utilized to forecast delays. It also determines the suitability of these models in the real world.

The results indicate that the existing studies emphasize primarily on enhancing the predictive accuracy as opposed to practical applicability. Also, the majority of models do not estimate the delay time; they merely categorize the deliveries as being delayed or on time. There is also a shortage of environmental and location data which is also mentioned in the study.

One of the weaknesses is that the research is theoretical without presenting a practical predictive model to be used in practical application.

Paper 10 Leveraging Artificial Intelligence to Analyse and Predict Consumer Behaviour in the Digital Marketplace

(Papia et al., 2025)

This paper is an attempt to evaluate and forecast consumer behavior in online markets through the application of artificial intelligence. It is concerned with the buying behavior and enhancing marketing.

The approach includes gathering information about 105 consumers and using machine learning models like Random Forest and Gradient Boosting and natural language processing (NLP) methods. The data analyzed consists of clickstream data, transaction data and customer feedback.

The findings show good predictive power of up to 89 percent in purchasing behavior. The implications of individualized recommendations, dynamic pricing and targeted advertising on customers are also discussed in the study.

Nevertheless, the study does not involve the integration with delivery systems and real-time optimization of the operation but only studies consumer behavior.

2.2 Critical Analysis of the Selected Papers

The articles reviewed altogether prove the significance of artificial intelligence and machine learning in providing better delivery systems. The majority of works focus on predictive analytics as a means of determining the time of delivery and ensuring the effective work of logistics processes. Random Forest, XGBoost, regression models, and neural networks are just some of the machine learning tools that are common in the literature.

One of the strong points of the papers reviewed is that they employ data-driven solutions, feature engineering, exploratory data analysis, as well as real-time data integration. These methods allow to make better predictions and work more effectively.

Yet, there are a number of limitations that are noted. To begin with, a significant number of investigations are devoted to prediction of the delivery time and not to the overall customer behavior prediction. Second, not all studies have large-scale real world datasets, and such a limitation may affect the external validity of the

findings. Lastly, the problem of integrating predictive models and real-time delivery platforms is not comprehensively discussed in some studies.

2.3 Relationships among the Studies.

There are a number of similar themes that can be identified in the literature reviewed.

1. Application of Machine Learning Algorithms.

Machine learning algorithms like random forest, XGBoost as well as regression models are most commonly used in most studies to predict the delivery outcomes.

2. Relevance of Data Preprocessing and Feature Engineering.

Preprocessing of the data and feature engineering have been found to be important processes in enhancing the accuracy of the prediction.

3. Assimilation of Real-Time Data Sources.

The availability of real time data like traffic data, weather and GPS tracking has a great impact on predictive performance.

4. Concentrate on Operational Effectiveness and Customer Contentment.

Every research points out that predictive analytics can lead to the increased performance of delivery and the better customer experience.

Regardless of these similarities, a research gap remains to be closed by coming up with intelligent algorithms that can be used to forecast customer needs, demand patterns, and delivery logistics in a coherent framework.

2.4 Synthesis of the Literature

The literature reviewed indicates that machine learning technology and predictive analytics are critical in the current delivery systems. The current literatures emphasize mainly on the enhancement of delivery time prediction, route optimization, and logistics efficiency. Nevertheless, there are comparatively fewer research works that cover the greater issue of anticipating customer needs and conduct in the context of delivery apps.

To fill this research gap, future systems are recommended to combine the customer behavior analysis, demand forecasting and delivery optimization in a single smart algorithm. These systems might integrate machine learning models with real-time sources of data in order to offer customized recommendations, improved delivery paths, and precise service forecasts.

The creation of such an integrated approach will improve the performance of the delivery platforms in a major way and it will also increase customer satisfaction.

Chapter 3

3.1 Research Methodology

This study adopts a descriptive-analytical approach, aiming to analyze customer behavior in delivery applications and utilize artificial intelligence techniques to predict customer needs and satisfaction. The paper uses machine learning and deep learning techniques to create an intelligent predictive model that improves decision-making and efficiency of services.

The study is based on data collection through a variety of sources, among them being order history, user interaction records, location based data on top of external factors, including traffic conditions and weather data. The obtained data is preprocessed and cleaned to guarantee quality and consistency and then explored using the exploratory data analysis (EDA) to reveal the main characteristics that affect customer behavior.

A number of machine learning models are used, such as Random Forest, Gradient Boosting, and Long Short-Term Memory (LSTM). The effectiveness of these models is measured on the basis of Accuracy, Precision and F1-score to determine the best model to predict customer satisfaction and needs.

3.2 Expected Results

This project will come up with a smart AI model that can effectively predict customer requirements and satisfaction during delivery applications. The adoption of such a model is expected to provide better efficiency in delivery, less delay and overall better service provision.

Moreover, the anticipations are:

- Increasing customer satisfaction and loyalty.
- Improving quality of services in delivery platforms.

- Enabling better decision-making based on data.
- Lessening operational errors and enhancing resource management.

Besides this, the study seeks to fill the existing gaps by proposing a comprehensive model that integrates the customer behavior forecasting and delivery optimization in real-time setting.

3.3 Gantt Chart (Research Timeline)

Phase	Description	Duration
Topic Selection	Define research problem and title	1 week
Literature Review	Collect and analyze previous studies	2 weeks
Theoretical Framework	Develop research background	1 week
Model Design	Develop the proposed algorithm	2 weeks
Data Collection	Gather required data	1 week
Data Analysis	Apply models and evaluate results	2 weeks
Results Writing	Interpret and discuss findings	1 week
Final Report	Final editing and submission	1 week

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