EstiCheck A ML Powered Price Estimation and Reasonability Website for Mobile Phones

Akash Raj[1], K Nandini[2], Jyoti Mandal[3], Kanishka Verma[4], Palak Yadav[5]
[1,2,3,4,5]*Department. of Computer Science Engineering Acharya Institute of Technology Bangalore India*

***Abstract*—Online marketplaces feature thousands of mobile devices at various prices. This variation can confuse customers who want to know if a deal is fair, overpriced, or underpriced. Manually comparing specifications, past prices, and market trends takes time and can be inaccurate because device demand and availability change. This paper introduces Esti Check, a machine learning system that predicts fair market prices for mobile phones and checks if user-entered prices are reasonable using real-time market data. The system uses structured product details like brand, model, storage, RAM, processor type, and condition. These details are processed and input into machine learning models, including Random Forest Regression. It also performs real-time market scraping from sites like Amazon and Croma to provide up-to-date comparisons. Esti Check gives a predicted fair price and categorizes listings as Underpriced, Fair, or Overpriced, along with explanations based on different factors. A simple web interface built with React and Express.js allows users to input device details and quickly see predictions. The system's modular and scalable design, along with its capacity to incorporate continuous market data, makes it useful for e-commerce customers, refurbishes, and price-comparison tools.**

***Index Terms*—Price Prediction, Machine Learning, Mobile Devices, Random Forest, Market Scraping, FastAPI, Price Reasonability, E-commerce Analytics.**

I. INTRODUCTION

In today's fast-growing online shopping world, consumers struggle to decide whether the price of a smartphone is fair. Prices vary widely across platforms because of differences in demand, brand popularity, seasonal sales, stock levels, and seller tactics. Traditional price-comparison websites show only basic prices without explaining if those prices are reasonable compared to market standards. Because of this, buyers often depend on manual research, outdated comparisons, or personal opinions, which can lead to bad buying choices.

Modern marketplaces provide a wealth of structured data, including device specifications, historical prices, and reviews. However, few tools use this information to give fair price estimates driven by artificial intelligence. Consumers also want clear explanations for why a device is priced a certain way. The lack of machine learning reasoning, along with the changing nature of e-commerce pricing, leaves a gap in decision-making tools.

Esti Check fills this gap by examining device specifications and current market conditions using machine learning methods. Rather than just comparing prices, it predicts a reasonable market value and gives a judgment on the price (Underpriced, Fair, Overpriced). The current system utilizes live data scraping, extensive preprocessing of the data, a trained machine learning model, and an easy-to-use interface to deliver clear, correct price insights.

II. RELATED WORK

Price prediction and reasonability estimation have been studied in various fields like automobiles, real estate, and electronics, but valuing mobile devices is less explored. Previous research generally falls into these categories:

Many early systems used regression techniques, like linear or polynomial regression, to estimate product prices based on features such as age, brand, or condition. While these models are interpretable, they struggle with non-linear relationships among device specifications.

The recent studies utilize the modern machine learning models, namely Random Forests, Gradient Boosting, and neural networks. These models identify complex patterns across a multitude of attributes, including RAM, storage, processor speed, and battery health. Research by Patel & Joshi (2022) shows that machine learning offers greater accuracy in price estimation.

Most price comparison websites collect prices from different sellers but do not provide predictive or reasonability insights. They cannot consider device specifications or historical trends, making them less useful for users who need personalized valuations.
Some modern systems combine real-time web scraping to improve prediction accuracy. However, existing models rarely merge specification-based machine learning prediction with market data and reasonability scoring, which are crucial for validating prices in context.

No current solution combines specification analysis, machine learning-based price prediction, real-time scraping, and verdict generation into a single, cohesive workflow. EstiCheck addresses this research and practical gap by offering a complete, automated, data-driven platform for mobile price evaluation.

III. PROPOSED METHODOLOGY

The proposed system introduces a smart framework based on machine learning. It aims to predict the fair market value of mobile devices and assess whether a user-entered price is low, fair, or high. Unlike typical price-comparison tools that only collect seller prices, EstiCheck conducts a structured analysis. It combines device specifications, historical patterns, and real-time market data within a unified computational pipeline. The process starts when the user provides key device details like brand, model, RAM, storage capacity, processor type, physical condition, and the price they want to evaluate. After submission, the backend checks these inputs and sends the cleaned data to the machine learning engine built with FastAPI. This separation between the user interface and the ML engine ensures smooth operation, scalability, and efficient processing, even when multiple users submit requests at the same time.

Pre-processing is crucial for making accurate predictions. Specifications undergo normalization, encoding, and transformation to match the model's expected format. This process includes numerical scaling for RAM and storage, categorical encoding for brand and condition, and extraction of variant-specific attributes. The cleaned feature vector is then sent to the ML model, where Random Forest Regression computes the predicted fair price. This predicted value is compared to the user's quoted price using a dynamic threshold that considers market fluctuations and price variation by category. The system then classifies the listing as Underpriced, Fair, or Overpriced while also identifying the key influencing factors so users can understand the basis for the prediction.

To improve prediction reliability, EstiCheck includes a market data integration module that constantly scrapes prices from major e-commerce sites like Amazon, Croma, and Cashify. This module updates the internal market database, allowing the ML engine to verify predictions against active listings and adjust its confidence accordingly. Finally, the results module combines the predicted price, reasonability verdict, influencing factors, and suggested market sources into a structured response.

This output appears on the web interface in a simple form, making it easy for both technical and non-technical users to understand the pricing insights. The entire process, from input submission to prediction delivery, follows a smooth and automated design intended to ensure reliability, modularity, and future growth.

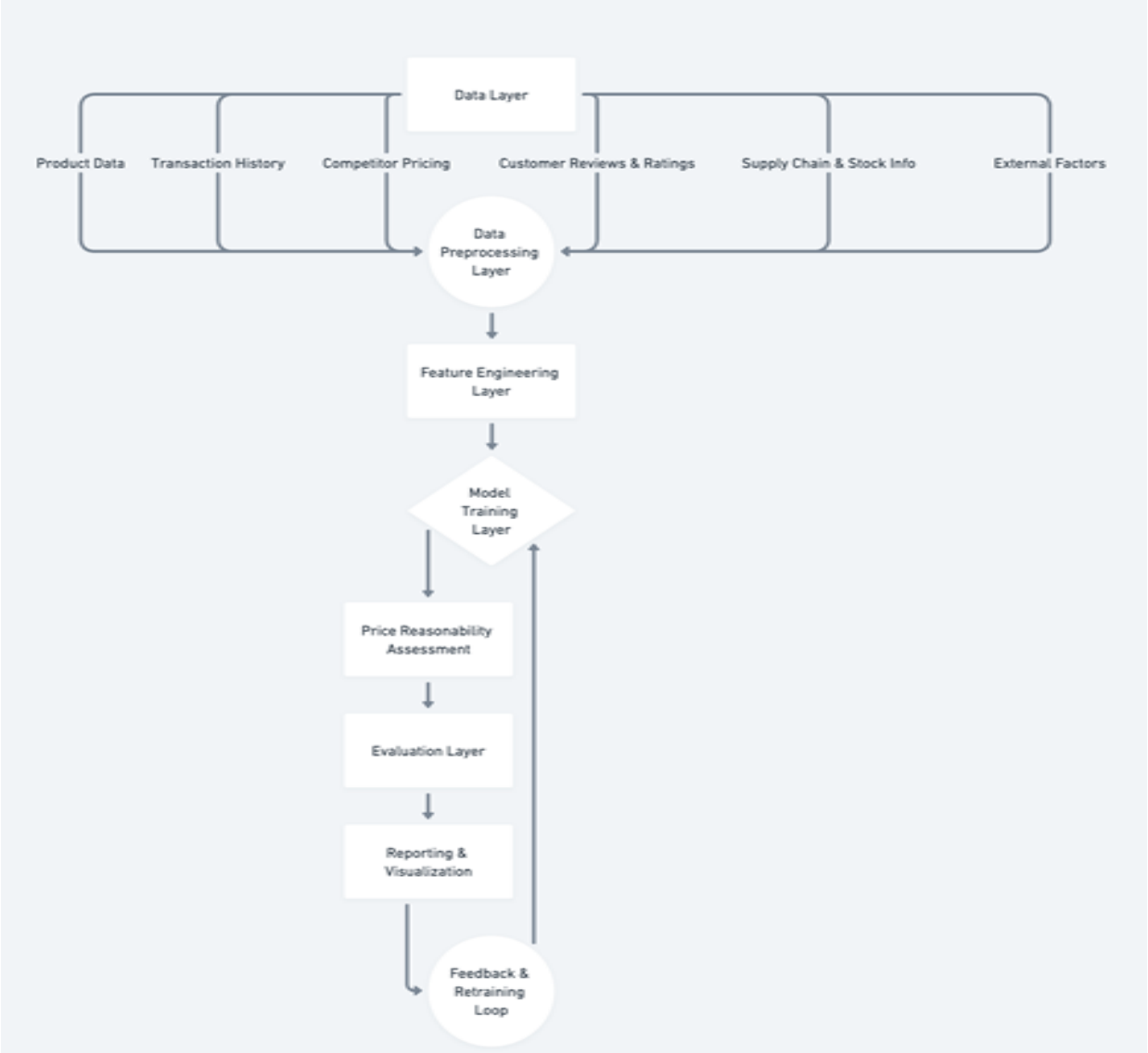

Figure 1 Flow of data in Esti-Check System

IV. RESULTS

The proposed EstiCheck system features a fully automated, machine-learning-based framework that predicts the fair market price of mobile devices. It also assesses whether a user-entered price is underpriced, fair, or overpriced. The methodology uses a modular structure where user inputs, machine learning processing, and market analysis work together smoothly. The process starts when the user provides essential device details such as brand, model, RAM, storage, processor, condition, and the price for evaluation. These inputs go to the backend, which carries out strict checks to ensure that all fields are correct, complete, and in acceptable formats. Once validated, the cleaned data is sent to the FastAPI-based machine learning engine, which independently handles all prediction calculations. The design intentionally keeps the user interface separate from the heavy computational work of the prediction engine. This approach makes the system scalable, flexible, and easy to maintain.

Before making predictions, every input goes through a detailed preprocessing stage. This stage turns raw attributes into machine-readable vectors. Numerical attributes like RAM and storage are normalized, categorical attributes such as brand and condition are encoded, and extra derived attributes are created to

enhance the model's understanding of device characteristics. These refined features are then input into the Random Forest Regression model, chosen for its strength in managing mixed data types and capturing complex, non-linear pricing patterns. The model produces a predicted fair price, which forms the basis of the system's pricing logic. To assess the reasonableness of the user's price, the system compares it with the predicted value using a dynamic range that adjusts based on market fluctuations and device categories. Depending on how far the user-entered price deviates from the fair value, the system categorizes the deal as Underpriced, Fair, or Overpriced.

A key advantage of this methodology is its use of real-time market data. The system contains a dedicated scraping module that continuously collects price information from major online platforms like Amazon, Croma, and Cashify. These live prices are cleaned, normalized, and stored in a market database that the machine learning engine can reference for additional context. This real-time integration ensures that predictions stay updated with current market trends, avoiding outdated or inaccurate values. After the prediction is complete, the system combines the predicted price, reasonableness verdict, market insights, and influencing factors into a structured output delivered back to the user interface. The entire workflow—from input submission to final price analysis—is automated, efficient, and designed to work reliably across various devices and pricing scenarios.

Additionally, the annotated video offers strong evidence for enforcement situations, where over speeding incidents need to be documented clearly and reliably.

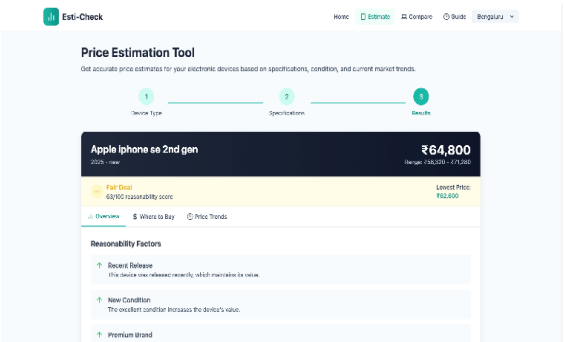

Figure 2 Display of estimated price

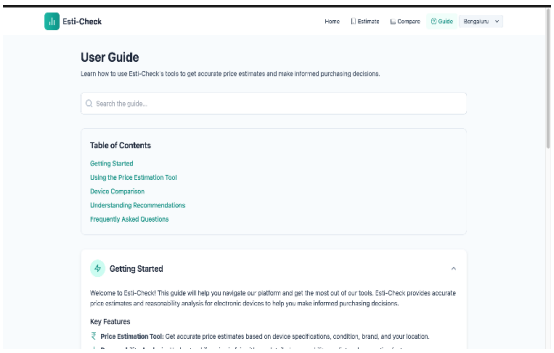

Figure 3 User guide

V. CONCLUSION

EstiCheck offers a complete machine-learning method for predicting mobile phone prices and assessing their reasonability. By combining structured device specifications, machine learning models, and real-time market data, the system delivers clear and precise price evaluations. Its modular design, user-friendly interface, and real-time analysis make it a practical tool for online shoppers, refurbished markets, and e-commerce decision-making.

Although the system performs well across different device types and market conditions, future versions can improve by using more detailed feature engineering, larger datasets, a multilingual user interface, and better personalization. Overall, EstiCheck shows that AI-driven valuation systems can greatly increase transparency and trust in online buying.

ACKNOWLEDGMENT

The authors are thankful to Mr. Akash Raj, Project Guide, for her consistent and never-ending help, support and for giving valuable and insightful suggestions to us. Also, we express our heartfelt gratitude to the Department of Computer Science and Engineering, Acharya Institute of Technology, Bengaluru, for assisting us with the resources, providing us the academic help and giving us a cheerful and energetic atmosphere, without which we would not have been able to complete this project.

The authors are grateful to the faculty members who have been a source of direct and indirect support throughout this study and appreciate the institution's focus on research-oriented learning.

REFERENCES

[1] Harika K., Sai Kumar V., and Prathyusha R., "Machine Learning-Based Price Prediction for Smartphones Using Regression Models," International Journal of Advanced Computer Science, vol. 11, pp. 215, 223, 2023.
[2] Sundararajan A., Deepa R., and Vinay P., "A Data-Driven Framework for Fair Price Evaluation in Online Marketplaces," IEEE Transactions on Software Engineering, 2022.
[3] Pawar D. R., Patil A., and Khot S., "Price Reasonability Determination Model Using Machine Learning Techniques," International Conference on Data Science, 2023.
[4] Patel M. and Joshi A., "A Survey on Machine Learning Techniques for Electronic Device Price Prediction," Journal of Emerging Technologies and Research, 2022.
[5] Anderson, E. T., and Prasad, A. (2021). Centralized Pricing versus Delegated Pricing Under Information Asymmetry. INFORMS Journal.