

E-Commerce Product Price Tracking and Prediction

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Abstract:

A price tracking and prediction system has various applications in the field of e-commerce industry. This project promises a reliable prediction of the change in prices and price drop expectancy of the products using historical data and formulating them using various machine learning algorithms to determine the price of products in the future which can be extremely helpful for customers/buyers online. This takes the e-commerce business to a whole other dimension helping not just the customers but also the companies to find best sales prices for their products according to the prevailing market.

I. INTRODUCTION

This paper is a technical paper on the development of E-Commerce Products Price Tracking and Prediction application. The goal is to achieve a system using which we will collect prices for E-Commerce products, accurately forecast the price for these products in the recent future and display it in our application. In this paper we will be going through the thorough process of research, literature review and implementation required in the development of an E-Commerce Product Price Prediction application.

II. LITERATURE SURVEY

A. Algorithms

1) Long Short-term memory:

Long short-term memory is a deep learning artificial recurrent neural network architecture. Unlike traditional feedforward neural networks, LSTM includes feedback connections. It is capable of processing not only single data points, but also entire data sequences. To forecast the next time step, the weight values in the network must be updated, which necessitates the

preservation of the initial time step data. An RNN can only learn a limited number of short-term affiliations; however, long-term time series, such as 1000-time steps, cannot be learned by RNNs; however, LSTMs can learn these long-term affiliations properly. If the length of the input vector is d and the number of neurons in the hidden layer is h , then the memory space required for an LSTM cell is $O(d \cdot h)$. The amount of memory required in LSTM is $O(d \cdot h)$ because the result of the next cell ($t+1$) is replaced in the same memory for the old values. Because computational models have an infinitely large memory, space complexity is not normally considered a primary issue; therefore, time complexity is of the utmost importance.

2) Facebook's Prophet:

Prophet, an open-source software released by Facebook's Core Data Science team, is a procedure developed for forecasting time series data based on an additive model where nonlinear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects. It works best with time series that have strong seasonal effects

and several seasons of historical data. Prophet is robust to missing data and shifts in the trend, and typically handles outliers well. Fb-prophet prediction process consists of four parts: model building, evaluation of predictions, problem solving, and manual checking, which work in a sequential loop until a suitable predictive model is obtained. Fb-prophet algorithm decomposes the time series y into three parts, as shown in the following equation:

$$y(t) = g(t) + s(t) + h(t) + \epsilon(t),$$

where $g(t)$ is the trend term, which represents the trend of the time series on a nonperiodic basis; $s(t)$ is the seasonal term (period term); $h(t)$ is the

holiday term; and $\epsilon(t)$ is the error. By fitting these three items through the sub-model, it can be reasonably applied to a variety of time-series predictions with regularity and can identify and adjust the anomalies in the data, effectively dealing with the jump points and periodicity of the time series, while the Fb-prophet algorithm also takes into account the seasonal and holiday effects that are of concern to the prediction model and is a convenient and efficient time-series prediction tool.

B. Literature Review

TABLE I
Literature Review

Ref No.	Title of Paper	Algorithm	Dataset	Accuracy	Improvement
1	Stock Price Prediction Using Machine Learning and LSTM-Based Deep Learning Models	LSTM-Based Deep Learning Models.	The historical index values of NIFTY 50	LSTM((1 Week): 0.0311(RMSE)	Other deep learning models could be mentioned to show how LSTM performs the best.
2	E-Commerce Price Forecasting Using LSTM Neural Networks	Long-Short Term Memory Support Vector Regression	Amazon.fr	LSTM: 23.640(RMSE)	Dataset could be expanded for more products to study what type of products are predicted accurately.
3	Importance of Web Scraping in E-Commerce and E-Marketing	Web Scraping	-----	-----	-----

4	Short-Term Electricity Consumption Forecasting Based on the EMD-Fbprophet-LSTM Method.	LSTM, ARIMA, FB-Prophet	Smart meters at an enterprise in Province Z between Jan 2019, and Sept 2019.	FbProphet: 0.20(RMSE) LSTM: 0.05(RMSE)	This paper is used for Electrical consumption, will give us a more comprehensible result with our dataset
5	Application of facebook's prophet algorithm for successful sales forecasting based on real world data.	FB-Prophet	Sales records of Retail companies in Bosnia and Herzegovia.	Forecasting Mape < 30% (Monthly)	There could have been more retail store data taken into consideration .

C. Proposed Methodology

In the System we propose to build an application for this topic we initially plan on making it for Android OS. We will initially be scraping the data from the webpages of Amazon.in for the dataset we plan on taking. This data will then be used for visualization of inside the app that will present the historical data of that product hence providing the tracking of the price through time. Then after that we plan on using the time series data to run through our Prediction algorithm (FB-Prophet) which will process the data from our database and produce the prediction for the next day. This will be displayed on our app interface.

Users will be allowed to copy a URL for the product or the ASIN for the product and enter them as input, once they confirm this action by clicking on a fetch button they will get the description of that product, the tracked price through time and the predicted price with a suggestion if they should purchase the product.

III. IMPLEMENTATION

A. Web Scraping

Web scraping is the automated retrieval (and processing) of data from websites. Web scraping is the process of creating a semi-structured document from the internet, typically in the form of web pages like HTML or XHTML and analyzing the document to extract specific data from the page to be used for other purposes. Web scraping has emerged as an important strategy for e-commerce businesses, particularly in terms of providing rich data-based insights.

Practices:

- Price-monitoring and Product Research
- Online price comparison
- Better Customer analysis
- Market Analysis

One of the difficulties we find while scraping information from various websites is that these websites have various structures. That means the templates of websites are different and unique and therefore tough to generalize.

Other difficulty could be longevity. Since the developers update their websites frequently, you cannot be reliant on a scraper for a long period of time. Although the webpages might not have major differences it can still hinder the process of acquiring data.

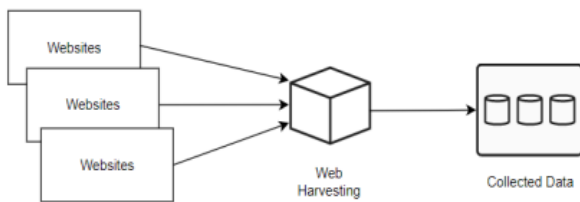


Fig .1 Flow of Web Scraping

B. Dataset

Dataset for which we want the prediction is a curated list of 550 products on Amazon.in that encompasses products from the categories such as sports, clothing, footwear, electronics, etc.

The collection of this data started from January 22nd, 2022 and will collect real time data continuously, getting updated on 7.30 p.m. IST (Indian Standard Time) daily. This dataset will get more efficient with the passage of time. The longer the data is collected the better results that will be acquired by our Prediction algorithm.

```

success : true
product [10]
  rating_details [2]
    rating_count : 675
    rating_average : 3.9
    _id : 61ec7027e753a3c8f429782a
    amazon_id : B09718Y74W
    name : Zinq Full HD 1080P 2.1 Megapixel 30 FPS USB Webcam with Built-in Mic, Plug and Play for PC/Mac/Laptop Video Calling for Skype, Meet, FaceTime, WebEx, Zoom, Microsoft Teams, Web Camera
  prices [88]
    original_price : 1499
    image : https://m.media-amazon.com/images/I/61cTSuBRA+L._SL1500_.jpg
    in_stock : true
  features [4]
    0 : • PRO QUALITY: High-Quality webcam with 1920x1080 FHD resolution and 30 FPS, designed for professional-level video calling, recording and gaming.
    1 : • CMOS SETTINGS: CMOS Sensor with a world-class lens that enables enhanced sensitivity, reduces noise, adds high fidelity, adds more pixel depth and provides a higher dynamic range.
    2 : • SMART LIGHT BALANCE: Automatic Light and Colour correction and light adjustment to present excellent quality imagery during extremely low and bright lights.
    3 : • SUPERIOR EXPOSURE CONTROL: Up to 30% better Exposure control than other webcams.
    
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Fig .2 Data Segment

C. Method of Prediction

We have used FB-Prophet for creating the model for the prediction of price of the E-commerce product that we have scraped the data for. FB-Prophet as the literature survey suggests is one of the most efficient data prediction models that we can use for univariate time series models.

Below are figures that represent the graphs that we have derived from our FB-Prophet prediction model that we have used.

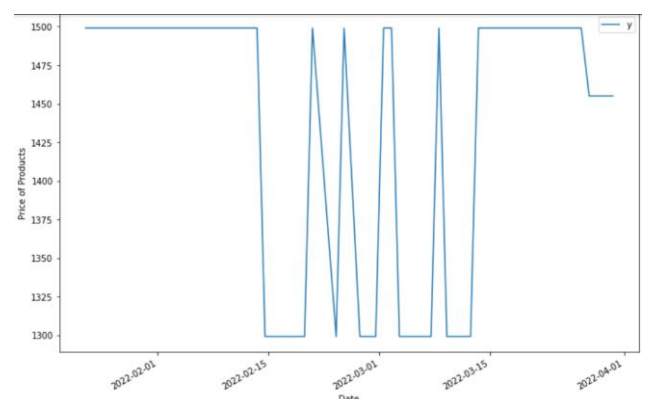


Fig .3 Price Data



Fig .4 Price Prediction Graph

For this product the accuracy of this prediction model is:

- RMSE : 38.73
- MAPE : 2.63%

D. App Development

Flow of the project:

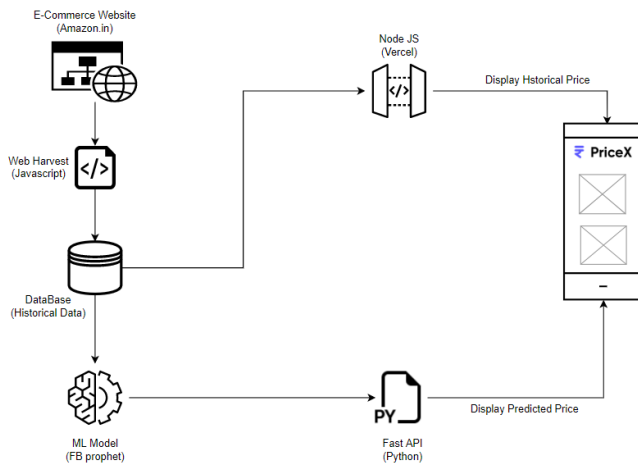


Fig .5 Flow of Project

Technologies Used:

- Node JS
- Flutter
- Python
- AWS Lambda
- Heroku

E. Result

1) Fetching Data

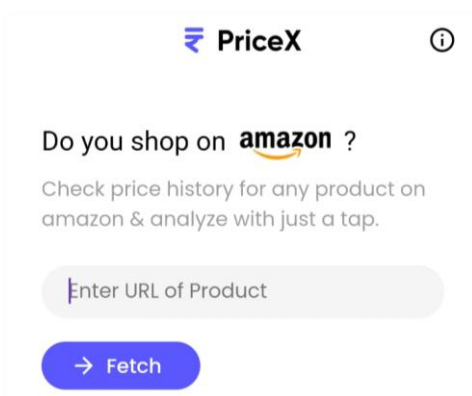


Fig .6 Fetching Module

Here the user of this application will enter the URL or ASIN of the product from Amazon.in. This product will call the API

developed for fetching different attributes of data from our database.

2) Data Description

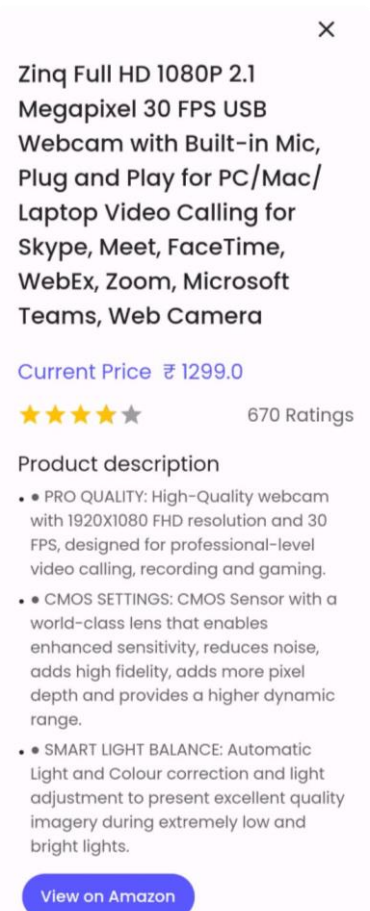


Fig .7 Product Description

This component of the application is responsible for displaying the various specifications of the product found on the E-Commerce Website.

3) Display Price Categorically

Current	₹ 1299.0
Average	₹ 1499.0
Lowest	₹ 1299.0
Highest	₹ 1499.0

Fig .8 Price Description

REFERENCES

These are different categories in which price of the product is segregated, Current price is the price of the product last recorded by the system, Average is the price at which the product has been for most of its history, Lowest price is the lowest cost of the product and Highest price is when the product costed the most.

4) Price Tracking



Fig .9 Price History

This component displays the graph for price of the product throughout the time we have recorded it since the beginning to the last record. This is visualization of the data used for our price prediction as well.

5) Price Prediction

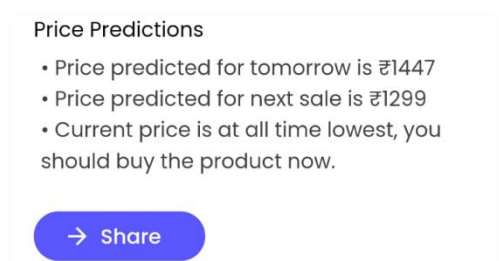


Fig .10 Price Prediction

This component is the part of our application that is responsible for displaying the price predicted for the next day, the price predicted for the next sale and also a suggestion if it is the right time to buy the product or should the user wait.

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