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ML BASED STOCK AND SUPPLY REGULATION SYSTEM

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ABSTRACT

This project can be used by shopkeepers who prefer to get benefited from new technology that will assist them in maximizing their profit via forecasting systems, stock monitoring, and demand forecasting with an add on of recommendation system. The purpose of this document is to describe the features, and interfaces to use the ML-Based Stock and Supply Regulation System and the requirements needed to develop it. It describes how the shopkeeper can take advantage of this product to empower the middleman, increase his/her profits, understand the pattern of supply and demand and increase customer relations using the ML-Based Stock and Supply Regulation System.

Index terms **-** Supply Chain, Demand Forecasting, Machine Learning, Optimization, homographic transform, cluster parameter tuning, speeded up robust feature.

I. INTRODUCTION

The COVID– 19 pandemics has affected the world economy – mainly small retail shopkeepers. This project is a technology which will assist the shop keepers while taking care of their shop. It is based on Video Capturing and object detection system [1-3]. It also uses Data Science for Prediction and Analysis of Market for supply & demand[4,5] Also, Re- shelving & Stock Monitoring[1] will be a value addition in improving Customer Relations which help find products in a shop at a faster rate.

This technology is the solution to the world's problems. We have observed the situation around us and came up with an idea to give a tech-aid to the small retail shops and their owners. We believe that using ML to detect and keep track of objects in their shops and data science prediction techniques to forecast the supply and demand, we can boost their sales and reduce their work burdens.

II. METHODOLOGY

ML-Based Stock and Supply Regulation System is basically an inventory management system in which 4 features are introduced to user of system. The features provided are-

a) Video Capturing & Object Detection
b) Stock Monitoring in shops.
c) Demand forecasting for shopkeepers.
d) Recommendation System for customers of small retail shops.

A. Video Capturing and Object Detection –

a) Video capture:

Video capture is the process of converting an analogy video signal which is captured by a video camera, DVD player, or television tuner to digital video and sending it to local storage or to external circuitry. The resulting digital data are referred to as a digital video stream, or simply a video stream.

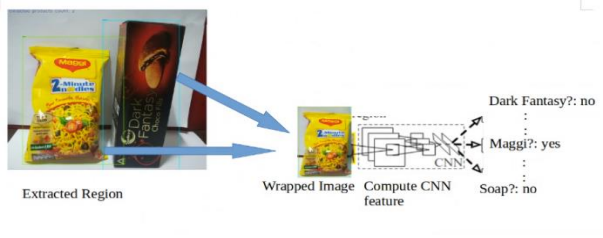
b) Object Detection

Object Detection is a computer technology related to computer vision, image processing, and deep learning that deals with detecting instances of objects in images and videos.

Common methods used most often are as follows: Hough transforms method, frame-difference method, background subtraction method, optical flow method, sliding window model method and deformable part model method.

c) CNN

A convolutional neural network (CNN) is a type of deep learning neural network[8] used in image recognition and processing that is specifically designed to process pixel data. In this input image is given as an input to the feature layer of the convolution neural network and conducts the pooling which helps to get feature vectors of fixed sizes.



d) YOLO

'You Only Look Once' is a convolution neural network for the recognition and detection of objects on a real-time basis[6]. The front end of YOLO connects a convolution neural network for feature extraction and the rear end connects two full connected layers for classification and regression in the grid regions.

B. Stock Monitoring –

Stock Monitoring is the most potential area for technologies like object detection, monitoring and regulation. For this a grid like structure is used to create a box to understand the presence or absence of the object in that box. Multiple methods can be introduced for this model and vehicle parking systems inspired us[7]. The process includes creation of a selected image into

1) Black-white image
2) Blur image

In each of these there is a comparison between two time-lapse images in comparison of light & pixels. The increase and decrease in the change of intensity helps to understand the presence and absence of the object in that particular part of that grid.

For the avoiding of over and under stocking of materials, the management decides about the maximum level, minimum level, re-order level, danger level and average level of materials to be kept in the store.

Levels:

(A) Reordering
(B) Maximum
(C) Minimum
(D) Average Stock Level:
(E) Danger

The front end of YOLO connects with a convolution neural network or a CNN for the extraction of feature and then the rear end connects with the two full connected layers for classification as well as regression in all the grid regions. YOLO then divides the input image scale into a 7*7 grid - usually, each of which will then produce two bounding boxes. The bounding box will give an output of a 4-dimnesional vector of coordinate information.

Each grid also then outputs of recognition information and location information. While the detection occurs, YOLO then filters the object proposals with low confidence by setting the threshold and wipes off the redundant object proposals to gain the detection results. This help in understanding of the objects present

The background subtraction method has three processes

1) background modeling,
2) object detection
3) background updating.

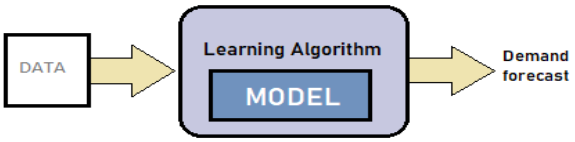
The process of background subtraction method is almost like the frame-difference method and the difference is the background subtraction defines a background frame and then updates in a timely manner. The background modeling technologies of defining the background frame are done by combining with the image features, which include light related , and text related information the Main

model is the global feature extraction and subbase model is the local feature extraction. The subbase model divides the object into several parts and carries out feature extraction for every part. There is a cost function of position offset between the main model and sub-based model to describe the confidence of the deformation. The object detection method is based on the sliding window model to extract feature and classify.

C. Demand Forecasting –

In ML-Based Stock and Supply Regulation System, one of the salient features is demand forecasting using machine learning for the shopkeepers to forecast future demand and manage products sale.

a) Demand Forecasting –Application of Machine Learning



Machine Learning Application

Demand forecasting is application of machine learning. Machine Learning is feeding data and providing system the ability to learn itself and improve from experience without use or intervention of code. Choosing the correct data to feed to your model is tremendously important. By providing relevant data to your ML model, it will be able to predict future demand more accurately.

The current forecasting methods can be divided into three key classes such as the following:

i) Time series models
ii) Econometric models
iii) AI-based models

b) ML-Based Stock and Supply Regulation System makes use of time series models –Regression and ARIMA for demand forecasting.

Regression is nothing but finding relation between variables one be the dependent and remaining variables are independent. Overview of demand forecasting in ML-Based Stock and Supply Regulation System is finding the number of products to be kept in shop (dependent variable) by knowing the previous months demand of that product (Independent variable).
Let's consider simple linear model, demand estimated be the dependent variable which will depend on the previous months purchase history so we will have the aye linear slope i.e. high sales of particular product will have high demand estimated.
Demand estimated=a + b* (previous sale)
ARIMA - Autoregressive Integrated Moving Average
ARIMA is time series forecasting model. Beginning with what is time series, it is sequence where metric is recorded over regular time interval and the forecasting is next step where we
find future values of time series. Now forecasting time series is mainly of 2 types-
a) Univariate time series forecasting – if only the previous values of time series has been used then it is known as univariate model.
b) Multivariate time series forecasting-other than the previous values if any other variables have been used then it is multivariate model.
ARIMA is forecasting algorithm based on information from past values of time series can alone be used for predicting future value.
ARIMA is class of 3 models or divided into 3 methods-
Autoregressive model – with p parameter indicating p terms in equation.
Integrated - with d parameter – d is difference between previous and current value which is used to make model stationary.
Moving Average - with q parameter indicating q terms in equation.
Before using autoregressive model and moving average we need to make model stationary as ARIMA model works in stationary model. So firstly we need to find out the values of d.

Integrated -d parameter is minimum difference of previous values in time series from current values in time series. d indicates order of difference. To find value of d we need to check if model is non stationary, if model is already stationary and we perform difference the model may get over difference. Check the series if stationary by ad fuller () - Augmented Dickey Fuller test.
If series stationary d=0.
If not perform differencing .To decide the order of difference we need to check auto correlation. If the autocorrelations are positive for many number of lags (10 or more), then the series needs further differencing. On the other hand, if the lag 1 autocorrelation itself is too negative, then the series is probably over-differenced.

Autoregressive model- Auto regression is time series model that uses observations from previous time steps as input to regression equation to predict future value of time series.
We look at PACF (Partial Auto correlation) plot to decide the value of P. PACF is correlation between series and its lag. Lag is where the result from one time period affects following period.
In Autoregressive model is one where Yt depends only on its own lags. That is, Yt is a function of the 'lags of Yt'. Yt is dependent variable in regression. So we can define function Yt as

Yt =constant + coef1.lag1 of y + coef2.lag2 of y+……+ coefp.lagp of y + error term.

Moving Average – Just like how we looked at the PACF plot for the number of AR terms, you can look at the ACF plot for the number of MA terms. An MA term is technically, the error of the lagged forecast. The ACF tells how many MA terms are required to remove any autocorrelation in the stationary series.

Moving Average (MA only) model is one where Yt depends only on the lagged forecast errors. Where the error terms are the errors of the autoregressive models of the respective lags.

After finding all the parameters of ARIMA build a ARIMA model.

D. Product Recommendation –

Product recommendations are part of an e-commerce personalization strategy wherein products are dynamically populated to a user on a webpage, app, or email based on data such as customer attributes, browsing behavior, or situational context providing a personalized shopping experience. Recommendation systems that recommend items through consumer collaborations and are the most widely used and proven method of providing recommendations. There are three types:

1) user-to-user collaborative filtering based on user-to-user similarity: User-User collaborative filtering (UUCF) approach heavily relies on active user

neighborhood information to make predictions and recommendations. Neighborhood selection can either make or break the recommendation for an active user and can have a direct bearing on the rating prediction and item recommendation.

2)item-to-item collaborative filtering based on item-to-item similarity: Item-item collaborative filtering is a type of recommendation system that is based on the similarity between items calculated using the rating users have given to items. It helps solve issues that user-based collaborative filters suffer from such as when the system has many items with fewer items rated.

3)latent factor-based collaborative filtering based on user-item matrix factorization: Collaborative filtering is a family of algorithms where there are multiple ways to find similar users or items and multiple ways to calculate rating based on ratings of similar users. Depending on the choices you make, you end up with a type of collaborative filtering approach. Collaborative filtering is a technique that can filter out items that a user might like on the basis of reactions by similar users. Collaborative Filtering Methods:

A) Slope One Algorithm: Slope One Algorithms are easy to implement, efficient to query, reasonably accurate, and they support both online queries and dynamic updates, which makes them good candidates for real-world systems. The Slope One Algorithm performs calculations based on a linear relationship of preference or weight values for each item compared.

B) Ontology: Ontology is a formal representation of the knowledge by a set of concepts within a domain and the relationships between those concepts. It is used to reason about the properties of that domain and may be used to describe the domain. An ontology represents concepts and relationships in a particular domain of interest. Ontology is widely used for various fields of research.

III. RESULT

The objective of our model is to maintain stock at an appropriate level to avoid excess or shortage of inventory. Our system reduce the cost of carrying stocks & ensure that the supply of raw material & finished goods remains continuous throughout the business operations. Our model is also meeting demands of the customer.

IV. CONCLUSION

This project is the base of a high potential project which can help shopkeepers and supply managers in taking the assistance of technology to help boost their economical sales. It will help in keeping a record of the stocks in their shop and guide in the prediction of the future demand in the market.

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REFERENCES

[1]Serdar Birogul , Günay Temür , And Utku Kose, YOLO Object Recognition Algorithm and ''Buy-Sell Decision'' Model Over 2D Candlestick Charts,IEEE access, 8(2020) 91894-915

[2] S.Manjulaa and Dr.K.Lakshmib "A Study On Object Detection", International Journal of Pharmacy & Technology 8(2016)pp- 22875-22885

[3] Massimiliano Iacono; Stefan Weber; Arren Glover; Chiara Bartolozzi in "Towards Event-Driven Object Detection with Off-the-Shelf Deep Learning", 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) DOI: 10.1109/IROS.2018.8594119

[4]Zhong-Qiu Zhao, Peng Zheng,Shou-tao Xu, and Xindong Wu, in Object Detection with Deep Learning: A Review , IEEE Transactions on Neural Networks and Learning Systems 30(11)(2019)pp- 3212 – 3232 DOI**:** 10.1109/TNNLS.2018.2876865

[5] Cong Tang; Yunsong Feng; Xing Yang; Chao Zheng; Yuanpu Zhou in "The Object Detection Based on Deep Learning" ,2017 4th International Conference on Information Science and Control Engineering (ICISCE) DOI: 10.1109/ICISCE.2017.156

[6] https://www.section.io/engineering-education/introduction-to-yolo-algorithm-for-object-detection/

[7] Jae Kyu Suhr; Ho Gi Jung in "Sensor Fusion-Based Vacant Parking Slot Detection and Tracking", IEEE Transactions on Intelligent Transportation Systems 15(1)(2014)21-36, DOI: 10.1109/TITS.2013.2272100