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Automated Shopping Using AI

Mohitha Thomas[1], Athira Sreela Reviprasad[1], Shaw Alam Saifudheen[1], Theerdha Thulasi [1], Yedhu Babu[1]
[1]*Mar Athanasius College of Engineering , Kothamangalam ,Kerala, India*
CorrespondingAuthor:athirasreelareviprasad@gmail.com

Abstract
In the current pandemonium of the covid pandemic, contact free methodology of living is an essential part of survival. Shopping from retail shops is one of the major concerns of contact and also the conventional mode of shopping has too many third-party middlemen. In this work, it is aimed to resolve all these issues by fully automating the whole shopping experience. Technologies such as Machine Learning, Computer Vision and Facial recognition are utilized here in order to achieve said experience. Machine learning is used in the facial recognition part to identify and to create a database of the customer. Then computer vision is utilized to track the customer throughout his/her/their shopping period. The products in the retail shop are tracked using object identification algorithm. These data in conjunction with each other will enable the system to add the list of items taken by the customer to the created database. The prices will be added to the list creating the bill for the customer. Thus, completely nullifying the need for a cashier to scan each product. Hence the efficiency of a retail store can be improved by removing the time wasted at the cash counter.

Keywords:*AI, OpenCV, NumPy, ML.*

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I. INTRODUCTION

The automation of products has obtained huge acceptance in the recent years. The retail market thrives to become more user friendly. The time consuming self-service systems may lead to customers choosing another grocery store. It is necessary to develop systems which decrease the processing time exists because of consumer's expectations of their constant endeavour to save time. In the retail business, the identification is mostly done manually by a cashier in a store. A cashier facilitates the checkout process at a grocery store. They operate the register, accept payments, deliver receipts, bag groceries and also assist customers as well. Self-checkout machines provide a mechanism for customers to process their own purchases from a retailer. They are an alternative to the traditional cashier-staffed checkout.

Facial recognition is a way of identifying or confirming an individual's identity using their facial features. Facial recognition systems can be used to identify people in photos, videos, or in real-time. Facial recognition is a category of biometric security. Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The technology is mostly used for security and law enforcement there is increasing interest in other areas of use too. A company which has made a tremendous progress in its technical evolution when it comes to artificial intelligence, image recognition and automating physical work is Amazon. Amazon has developed a product, called Amazon Go, which provides a shopping experience without cashiers or self-service checkouts. A large number of cameras and sensors are used to set up the store. With the help of computer vision and deep learning algorithms, Amazon managed to create a store. When customers walk out from the store with the chosen products, its price and total bill will be automatically debited from the Amazon Pay account of the costumer.

OpenCV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library which is built to provide a common infrastructure for machine learning algorithms and computer vision. It has thousands of optimized algorithms which can be used for different purposes like detecting and recognizing faces, identifying objects and many more. We need it to take pictures using our webcam and some manipulation is needed to be done in the image. NumPy is the fundamental package for scientific computing in Python which provides a multidimensional array object other mathematical operations can be performed using this but simply speaking we just need it to convert our images into some form of an array so that we can store the model that has been trained.

It is required to invest in next-generation retail technology, either by creating third-party alternatives or developing in-house solutions. Our retail markets need to digitise and automate their billing system. What we

propose is a semi-automated system that makes use of computer vision to automatize the identification process of customers and objects by self-service systems in the retail market.

Khalajzadeh H., Mansouri M., Teshnehlab M. et.al [1] is based on a hybrid system in which a convolutional neural network (CNN) and a Logistic regression classifier (LRC) are combined. A CNN is trained to detect and recognize face images, and a LRC is used to classify the features learned by the convolutional network. LRC which is a discriminative classifier is used to classify the extracted features of face images. The comprehensive experiments completed on Yale face database shows improved classification rates in smaller amount of time.

F. Femling, A. Olsson and F. Alonso-Fernandez et.al [2] describe an approach of creating a system identifying fruit and vegetables in the retail market using images captured with a video camera attached to the system. The purpose of the system is to minimize the number of human computer interactions, speed up the identification process and improve the usability of the graphical user interface compared to existing systems. Instead of assigning the responsibility to the user, who usually identifies the products manually, the responsibility is given to a computer.

II. FACIAL RECOGNITION

The facial recognition system captures the image of the customer as soon as the customers walks into the shop. This image is then resized and colour transformation is done. Then the image is encoded. When the customer takes an object, the camera present there captures another image of the customer which is then resized and colour transformation is also done. This image, known as the tracking image is also encoded. The face recognition module is loaded and both the encoded images are compared. If both the images are of the same person, the system recognizes it and using the unique customer ID, a customer database is created.

The flowchart of the proposed model is shown in the figure below.

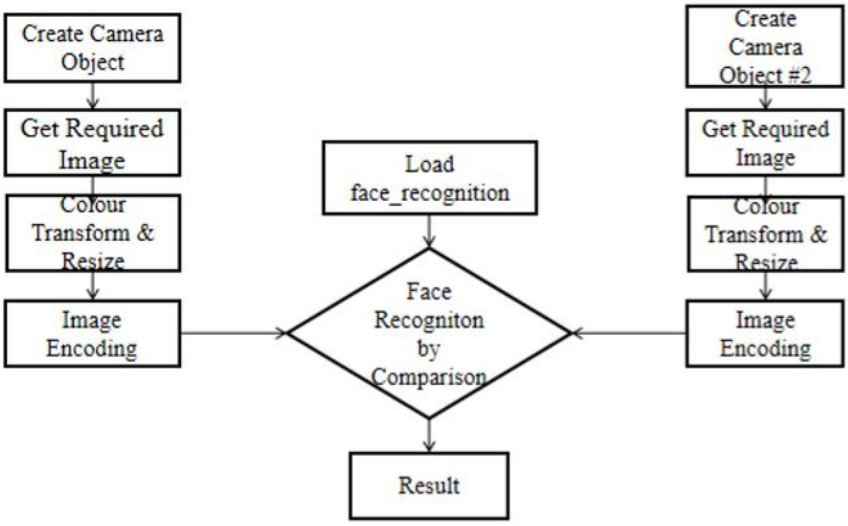

Figure 1: Flow chart for Facial Recognition

The system is able to identify the human face. It takes face images and finds the important points such as the corner of the mouth, eyebrow, eyes, nose, lips, etc. Coordinates of these points are called facial-feature points, there are 66 such points. In this way, a different technique for finding feature points give different results. This system first captures an image of the customer and generates a unique customer ID. At a later stage, the system uses this image to track the customer. The system successfully identifies human face and generates a unique customer ID.

III. OBJECT IDENTIFICATION

Object recognition describes a collection of related computer vision tasks that involve identifying objects in digital photographs. Image classification refers to predicting the class of one object in an image. Object localization is identifying the location of one or more objects in an image and drawing a box around their extent. Object detection integrates the above two tasks and localizes and classifies one or more objects in an image.

Dataset

We employ three different classes in our study. The chosen classes are Slice, Maa, and Green Lays. These classes are chosen because they are frequently bought in retail markets. Limitations have been done to the dataset in order to not to make the project extensive. A new dataset was created manually using the Raspberry Pi camera module. It consists of 100 training and validation images per class. For simplicity, images of items have been taken without being placed in plastic bags. To make things less complex, images of items sitting alone in a white background is also captured.

Training Methodology

All the training processes were performed on an online platform called Google Collaboratory, which is a product from Google Research. Colab allows anybody to write and execute python code through the browser, and is especially applicable to machine learning, data analysis and education purposes. It also helps all the members of the team to access the code from a common web-link. Our first step is to import all necessary software packages into our Google Collaboratory. We can simply access Google machines which are already equipped with these packages. Step two is to customize our base model Tensorflow Lite. We need to remove the last layers and customize its structure accordingly which is done by adding dense layers and output layer. Third step is to mount Google drive to the Collaboratory since we have stored the training and validation folder, where each folder consists of folders for each class containing the corresponding images. The names of the folders must be the names of their respective classes. Step four is to load the data and pre-process it so that the images are in the prescribed format. Next step is to train the customized pre-trained architecture with the images provided by us.

Result

A dataset consisting of 100 training and validation images was created using Raspberry Pi camera module and the training processes were completed on Google Collaboratory. The deployed model successfully identifies two distinct objects present in the same frame. The items purchased by the customer is identified in this manner. The model is trained using images of all the items available in the shop. The model then identifies the items purchased by the customer and sends the result to the billing system for bill generation.

Figure 2: Object Identification Result

IV. BILLING SYSTEM

Bill Generation

The scope of AI automated shopping is not complete without an automatic bill generation system. We developed a method of generating the bill for the customer based of the data from the face-recognition and object identification. The cross-referenced data in tandem generates a bill unique to each customer. When a customer enters into a shop, an image of the customer is captured and an ID is generated. As the customer starts shopping, this image is used as the reference image to track the customer. The items that the customer takes is identified by the object detection model which is pre-trained. If the customer and the object are present in the same frame, the item is added to the bill and the stock is updated. When the customer reaches the cash counter, the total bill is displayed.

The flowchart of the proposed model is shown in the figure below.

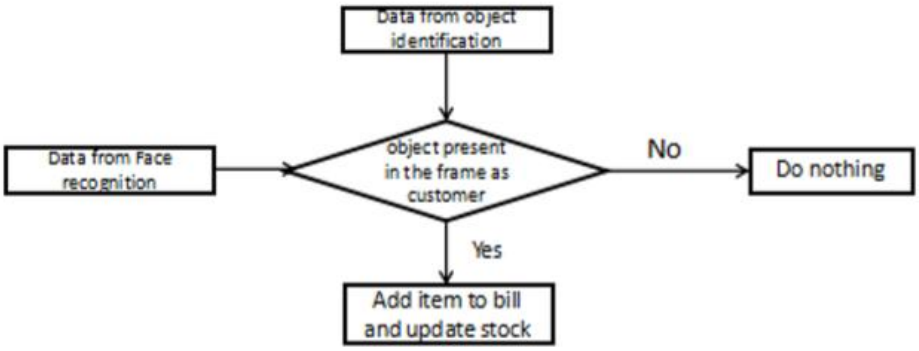

Figure 3: Flowchart for bill generation

Result

The data from face recognition and object identification are fed to the billing system. If the object is present in the same frame as the customer, the item is added to the bill and the stock is updated.

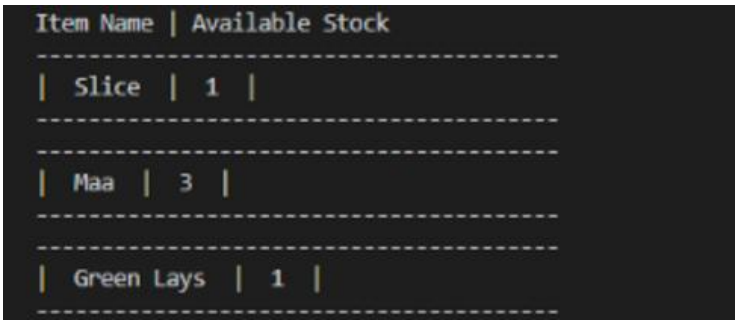

Figure 4: Available stock

The above image shows the details of the available items in the shop before the customer starts shopping.

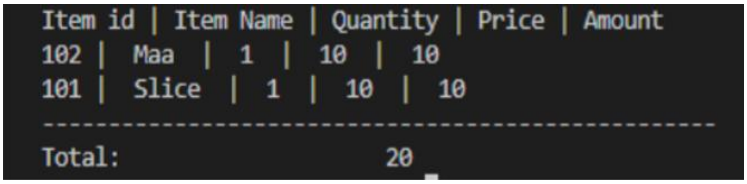

Figure 5: Total Bill

The above image shows the total bill containing the items and its quantity and price. This is displayed at the cash counter once the customer completes shopping.

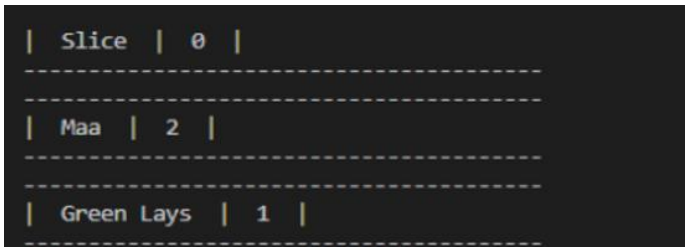

Figure 6: Remaining Stock

The above image shows the details of the remaining items in the shop after the customer leaves the shop.

V. CONCLUSION

In this implementation of AI technology we developed, a contactless method for retail shopping using Machine learning, Facial Recognition and Computer Vision has been recognised. This methodology holds scope for future in making shopping fully automated with a larger data set of unsupervised and supervised data. Machine learning is used in the facial recognition part to identify and to create a database of the customer. Then computer vision is utilized to track the customer throughout his/her/their shopping period. The products in the retail shop are identified using object identification algorithm. These data in conjunction with each other will enable the system to add the list of items taken by the customer to the created database. The prices will be added to the list creating the bill for the customer. The list of available stock before the customer enters the shop and the remaining stock after the customer leaves the shop is also made available. The customer can directly pay the bill by either inserting cash into the machine or by entering payment card information. This completely nullifies the need for a cashier to perform the aforementioned duties.

REFERENCES

[1]. M. Co¸skun, A. U¸car, ¨O. Yildirim and Y. Demir, "Face recognition based on convolutional neural network," **International Conference on Modern Electrical and Energy Systems (MEES).,** 2017, pp. 376-379.

[2]. M. S. Umar, J. A. Ansari and M. Q. Rafiq, "Automated Retail Store Based on RFID**". International Conference on Communication Systems and Network Technologies**, 2013, pp. 17-21.

[3]. J. Schmidhuber, "Deep learning in neural networks: An overview". **Neural Networks**, 2015 vol.61,pp.85-117.