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Smart Retail Checkout

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ABSTRACT: An integral part of Computer vision is Object detection. Object detection aids in pose estimation, vehicle detection, surveillance etc. Nowadays, we are using barcode to identify an object in retail stores. It consumes a lot of time as individual scanning of each item is required and results in long queues at the billing counter. The proposed system named Smart Retail Checkout, resolves this issue as it uses a camera to capture the image of multiple products at once. The input image is then given to a model which identifies the name and size of the products which are then used to generate a bill. The architecture of the proposed system is Faster R-CNN, which consists of two networks: Region Proposal Network(RPN) for region proposals and a network that uses these proposals to detect objects.

Keywords – Faster R-CNN, RPN

I. INTRODUCTION

Artificial Intelligence is transforming several sectors of the economy such as automotive, marketing and healthcare. Retail could be next. The essential retail experience of shopping in stores has remained unchanged for decades. AI could radically transform this experience by making it cost-effective to deliver a completely personalized, immersive and optimized experience for every individual consumer at a massive scale.

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

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A retail store is looking for a more digitised way of expanding their business. They want to use a more systematic way of the checkout system and reduce their human workforce at billing counters. A system is needed that allows automatic detection of products using a camera. The detection of the product must be with respect to the size of the product, type of product and automatically take the cost of the product to make a bill of materials at checkout.

The objective of this project is to develop Smart Retail Checkout system which can take images of various products of different shapes and sizes as input and recognise and classify them into ten product classes such as: Colgate, Sprite, Thums Up, Nivea Moisturizer, Surf Excel, Hide & Seek, Vim, Dairy Milk, Nescafe, Lays.

II. PROPOSED ALGORITHM

The data used to build the final model usually comes from multiple datasets. In particular, two data sets are commonly used in different stages of the creation of the model. The model is trained on the training dataset using a supervised learning method. Successively, the test dataset is a dataset used to provide an unbiased evaluation of a final model fit on the training dataset.

The architecture of the proposed system is divided into three phases which are shown in Fig 2.1. The first phase is Retail Local Server which is a web server which takes a picture of the products and stores the image and then it sends the image process request to the ML Model. Followed by Detection phase, it takes the image process request from the web application and pre-processes the image by converting it to a numpy array of pixels. Simultaneously model and labels are loaded. And the image array is sent to the model then a TensorFlow session is initialized, the image is processed and returns the names with sizes of the products as a response to the web server. The final phase is the Response phase which takes the Response from the model, then based on these it will classify the product names and quantities, calculate the cost and return the bill.

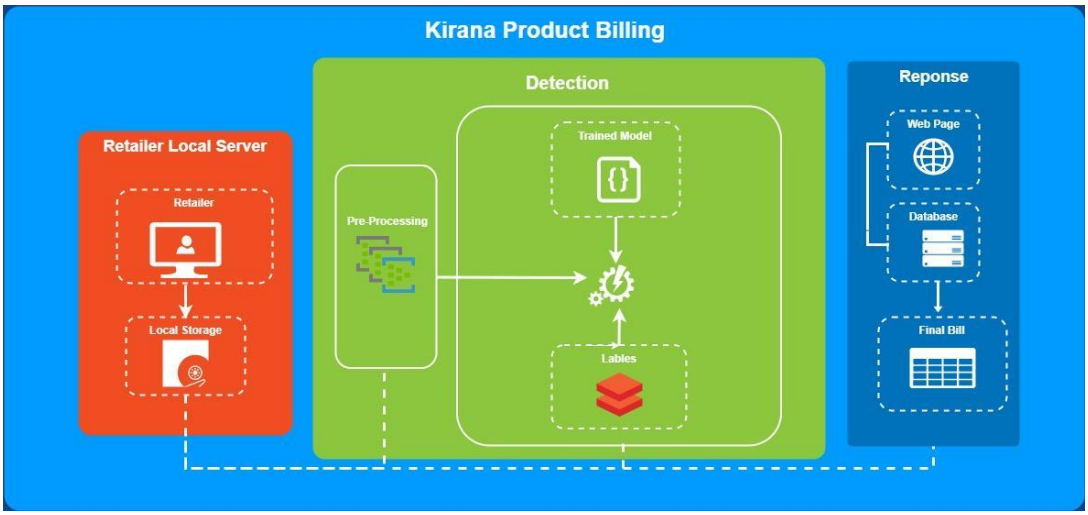

Fig 2.1 Architecture of the Proposed System

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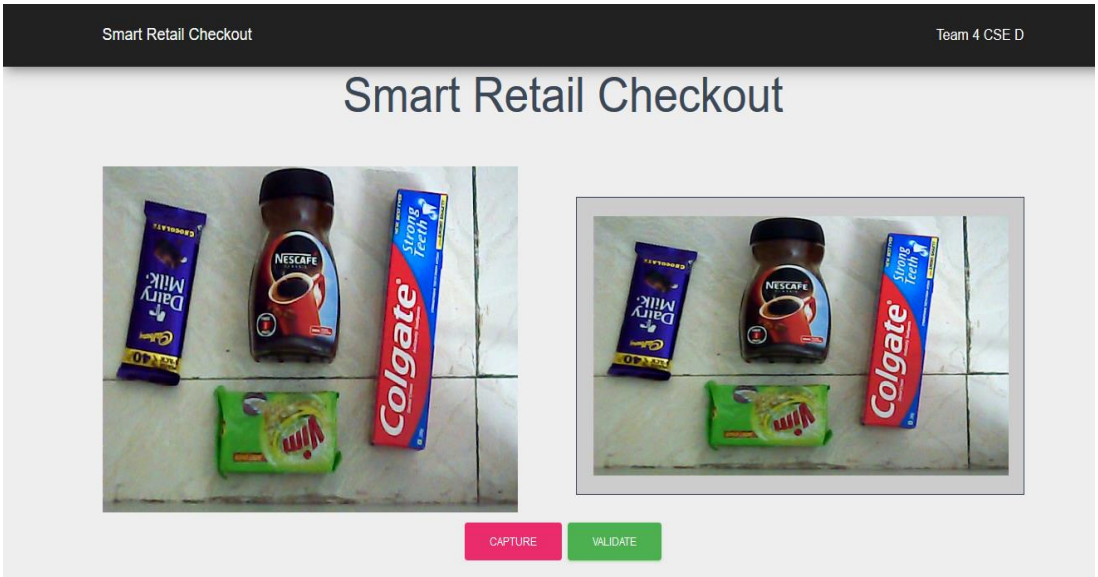
III. EXPERIMENT AND RESULT

The dataset we used is a CSV file and it contains 8 columns. The columns are the file name of the image, height and width of the bounding box, the class under which the product falls and xmin,ymin,xmax,ymax are the coordinates of the bounding box of the object detected in the image, also known as region of interest. The task is to categorize each product based on the features shown into one of ten categories.

To train the model we used Faster R-CNN model which is an object detection architecture presented by Ross Girshick, Shaoqing Ren, Kaiming He and Jian Sun in 2015, and is one of the famous object detection architectures that use convolution neural networks like YOLO (You Look Only Once) and SSD (Single Shot Detector). Faster R-CNN as shown in Fig 5.3 has two networks: region proposal network (RPN) for generating region proposals and a network using these proposals to detect objects. The main difference here with Fast R-CNN is that the latter uses selective search to generate region proposals. The time cost of generating region proposals is much smaller in RPN than selective search, when RPN shares the most computation with the object detection network. Briefly, RPN ranks region boxes (called anchors) and proposes the ones most likely containing objects.

The training set consists of 800 examples. The test set, which was used to determine the product, consists of another 200 examples.



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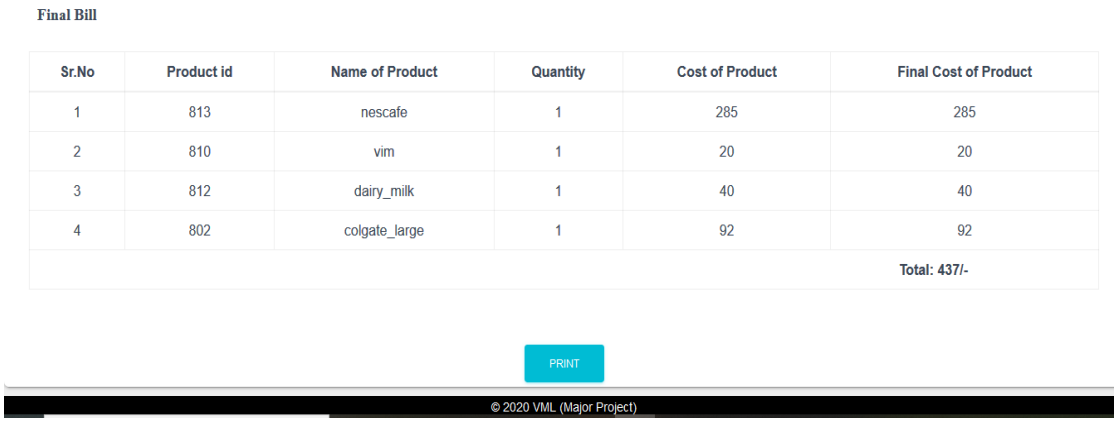

Final Bill

Sr.No	Product id	Name of Product	Quantity	Cost of Product	Final Cost of Product
1	813	nescafe	1	285	285
2	810	vim	1	20	20
3	812	dairy_milk	1	40	40
4	802	colgate_large	1	92	92
					Total: 437/-

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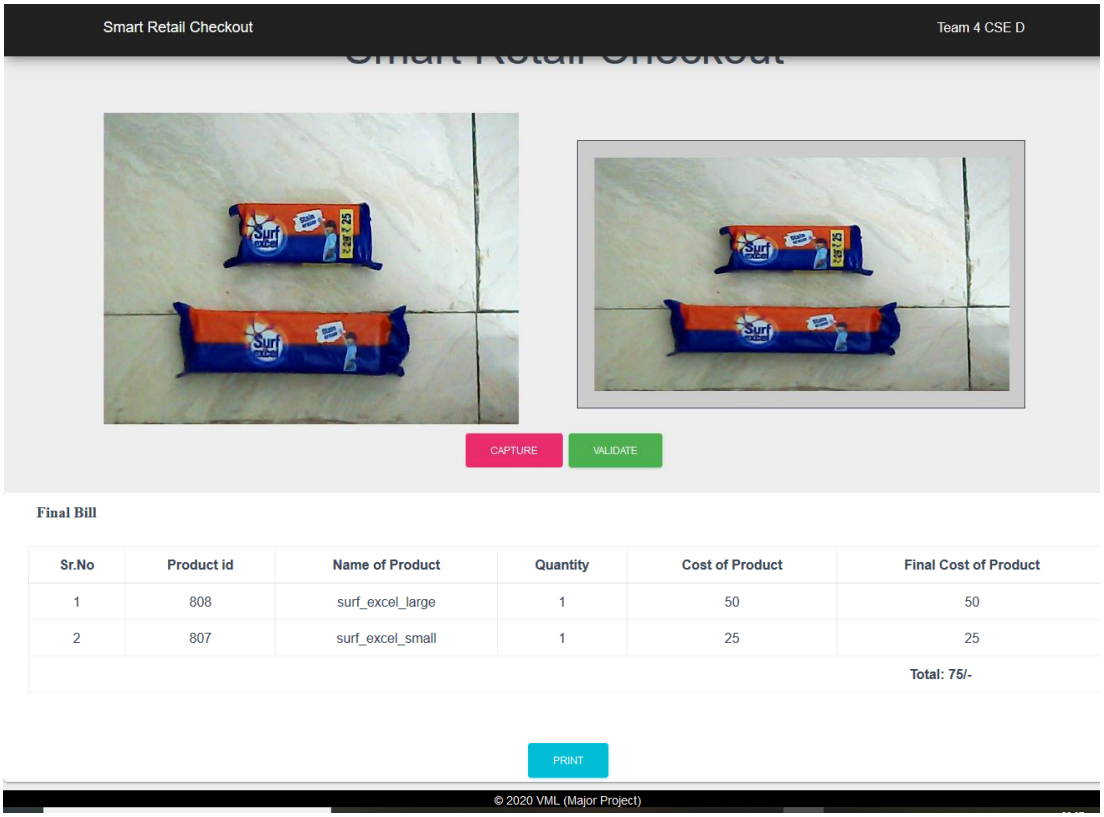
Fig 3.1 Different types of products are given, then the output is given as shown above.



Final Bill

Sr.No	Product id	Name of Product	Quantity	Cost of Product	Final Cost of Product
1	808	surf_excel_large	1	50	50
2	807	surf_excel_small	1	25	25
					Total: 75/-

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Fig 3.2 Same product of different sizes are given, then the output is given as shown above.

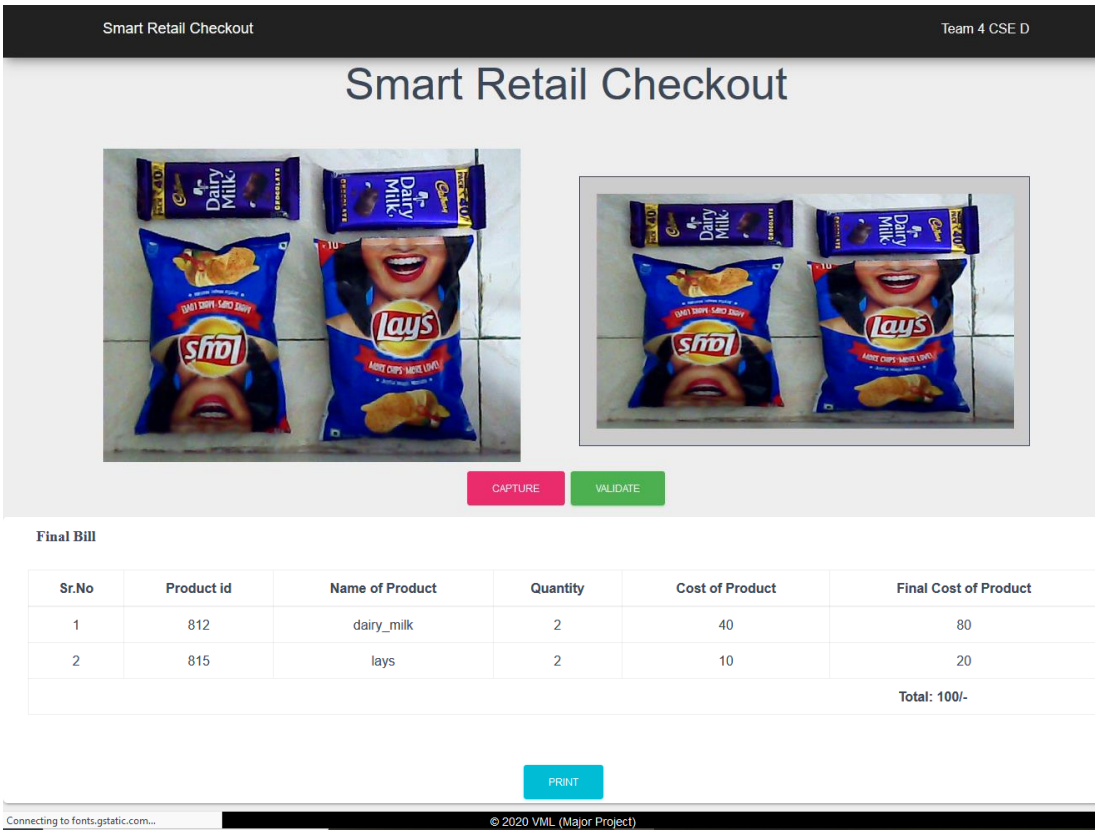

Fig 3.3 Different quantities of different products are given, then the output is given as shown above.

IV. CONCLUSION

According to Global Market Insights, investments in AI by the retail segment will exceed USD 8 billion by 2024. There are many applications of AI in Retail and Smart Checkout will be a transformative change. Retailers would love it as it would cut the cost and customers would enjoy the smooth checkout experience. The proposed system has produced encouraging results compared to the existing systems. So our method got an accuracy of 92%. But we need to improve in specific areas like- number and configuration of convolutional layers, number and configuration of dense layers, dropout percentage in dense layers.But due to lack of a highly configured system we could not go deeper into a dense neural network as the system gets very slow and we will try to improve in these areas in future. We would also like to train more databases into the system to make the model more and more accurate but again resources

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become a hindrance in the path and we also need to improve in several areas in future to resolve the errors and improve the accuracy.

REFERENCES

[1] Chenhui Yang, Xin Hong, Pubudu Ekanayake, Zhaoli Deng, "Naïve Approach for Bounding Box Annotation and Object Detection Towards Smart Retail Systems", Security, Privacy, and Anonymity in Computation, Communication, and Storage, Volume 11637, 11 July 2019. [https://www.researchgate.net/publication/334369472_Naive_Approach_for_Bounding_Box_Annotation_and_Object_Detection_Towards_Smart_Retail_Systems]

[2] Bing-Fei Wu, Wan-Ju Tseng, Yung-Shin Chen, Shih-Jhe Yao, Po-Ju Chang, "An intelligent self-checkout system for smart retail",2016 International Conference on System Science and Engineering, 25 August 2015 [https://ieeexplore.ieee.org/document/7551621]

[3] Shaoqing Ren, Kaiming He, Ross Girshick, Jian Sun, "Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks", Advances in Neural Information Processing Systems 28 , 2015 [http://papers.nips.cc/paper/5638-faster-r-cnn-towards-real-time-object-detection-with-region-proposal-networks]

[4] Priya Dwivedi, "Using Object detection for a Smarter Retail Checkout Experience", towards data science, 11 Dec 2017 [https://towardsdatascience.com/using-object-detection-for-a-smarter-retail-checkout-experience-3f39acef857b]

[5] Artificial Neural Network & Convoluted Neural Network, Wikipedia [https://en.wikipedia.org/wiki/Convolutional_neural_network] [https://en.wikipedia.org/wiki/Artificial_neural_network]

[6] Edje Electronics, "How To Train an Object Detection Classifier Using TensorFlow (GPU) on Windows 10", YouTube, 19 Feb 2018 [https://www.youtube.com/watch?v=Rgpfk6eYxJA]