Hand Gesture Recognition using Overhead Cameras to Build Virtual Cart

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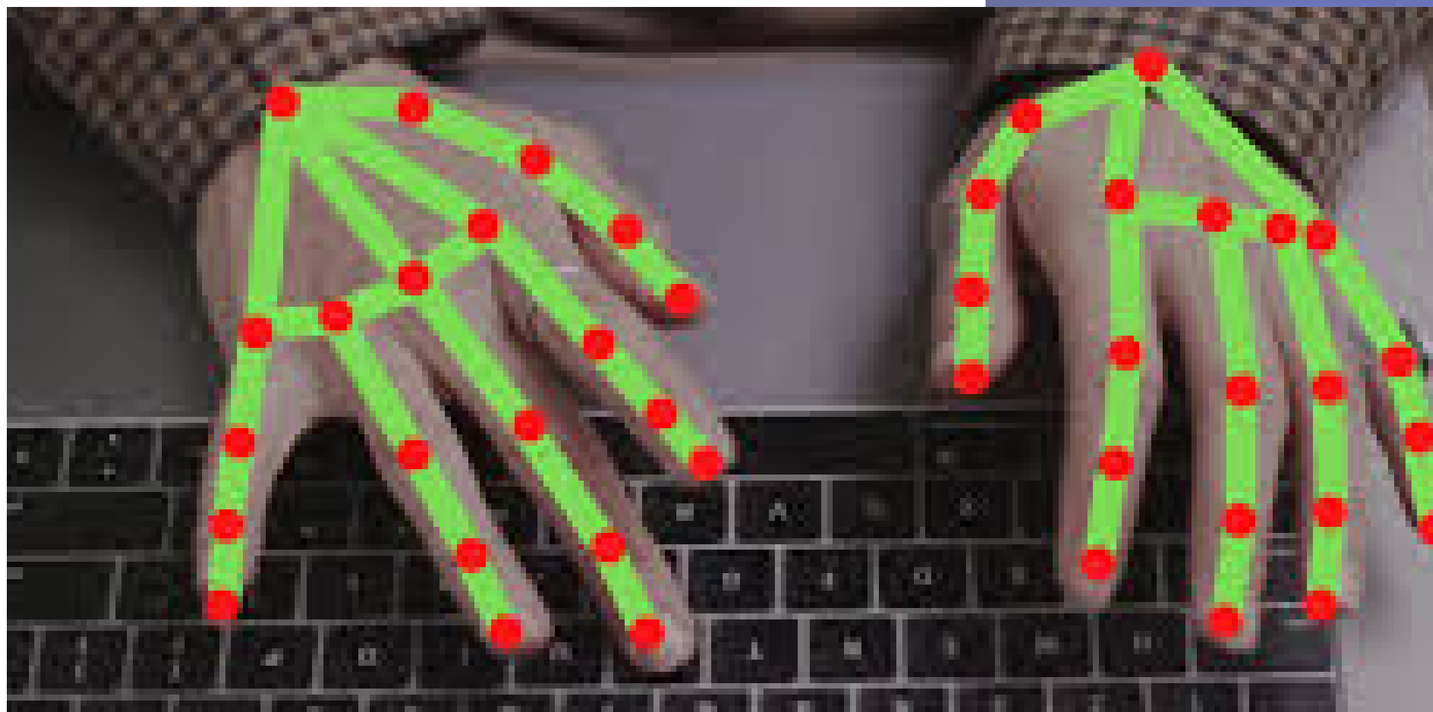


Problem Statement

- **Use Case Description:** This use case involves the development of a hand gesture recognition system that leverages overhead cameras in a retail store to identify when a customer takes a product from the shelf or returns it, with the goal of creating a virtual shopping cart. The system aims to provide a seamless and convenient shopping experience, offering customers a way to add and manage products in their cart digitally.

Real Problem , Relatable ???

- Familiar images are from Dmart , weekend rush
- Time consuming
- Difficult to manage both for customers and the store managers.
- Variability in billing according to the amount purchased

Solution no.1

Hand gestures recognition on each shelf

- Placing a camera , dedicated for each shelf to detect the picking of different products.
- this would minimize the data processing and no. of hands which we need to track on real time.
- Classification of customers can be done based on the number of items in the cart.
- Save time for billing.

Solution no.2

Self help billing system counter using computer vision

- Inspired from the DIGIYATRA used at Airports.
- A self help counter can help to reduce the rush at the counters.
- Reduce the extra human resource required at the billing counter.
- Virtual AI assistant can be created to enhance the customer satisfaction.
- Very easy to bill.

Solution no.3

Tracing the basket based on particular facial ID to detect the objects inside the basket

- Specified Object detection based on the facial Id of the person.
- This will be computationally expensive.
- More number of cameras required to monitor the basket more precisely.

Case Study : Amazon Go

How to enjoy Just Walk Out shopping

1. Enter at gate

Use the Amazon app, a credit card, or Amazon One at select locations to open an entry gate and start shopping.

2. Shop

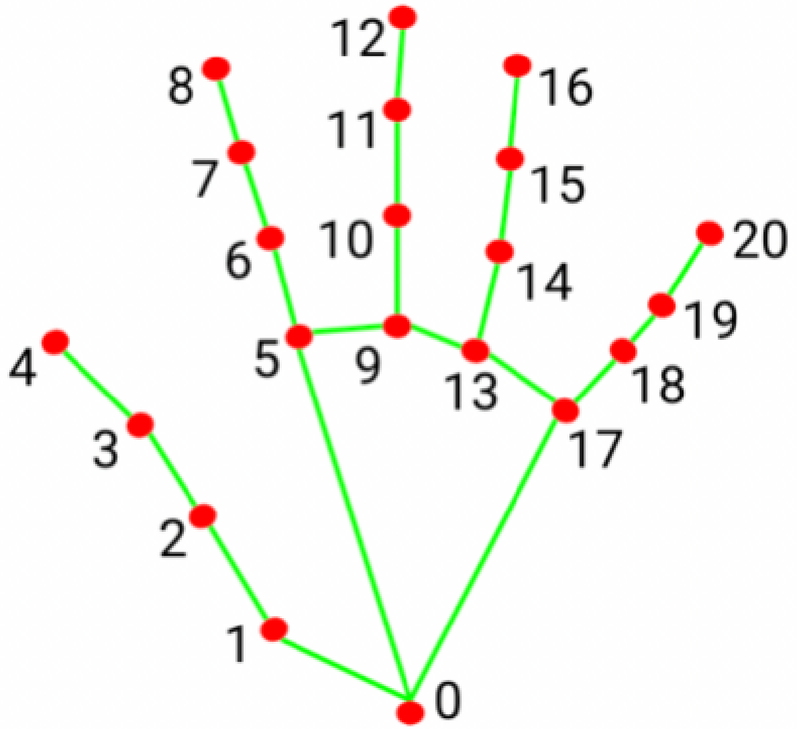
Pick up and put back items as you please. You can use your own bag, or one of ours, as you shop.

3. Walk out

When you're finished, walk through an exit gate. You'll only be charged for what you take.

For more information about entry or payment options see FAQs or a store employee.

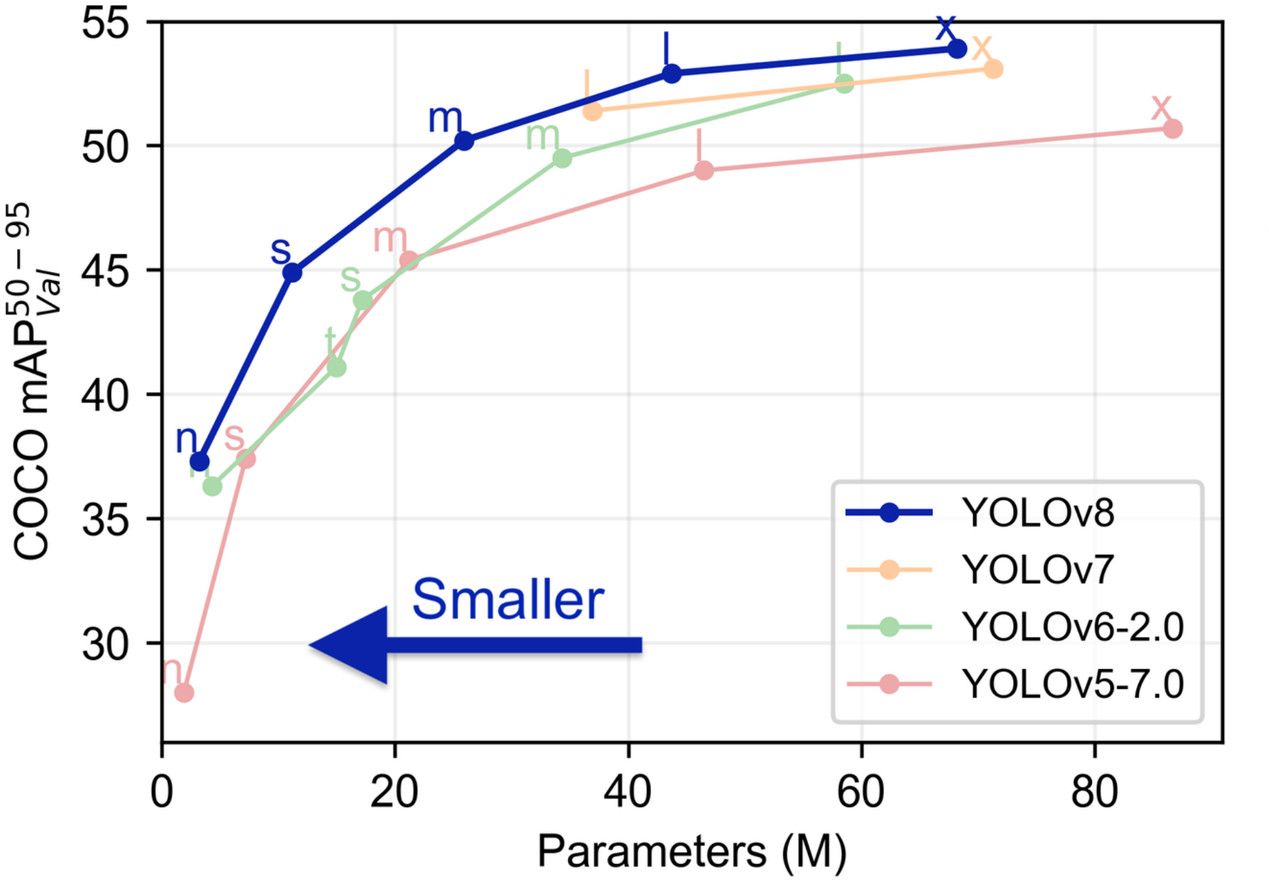
Google MediaPipe



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Key Features of YOLOv8 :UltraLytics

- Improved Accuracy
- Enhanced Speed
- Multiple Backbones
- Adaptive Training
- Advanced-Data Augmentation
- Customizable Architecture
- Pre-Trained Models



Proposed Solution

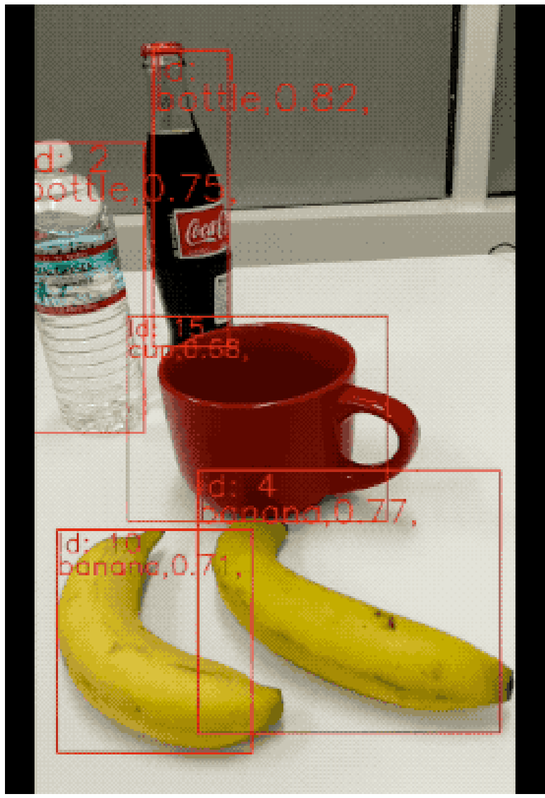
- Used mediapipe for hand gesture detection
- used CNN for classification for different types of classes
- Self created classes
- Self trained model
- Self created database using MySql
- Real time classification of pick and put of products
- The product is directly added into your cart through your unique product Id (Facial recognition can be used later for user Id).
- The final total amount is then messaged into your whatsapp through PyWhatKit.
- A payment link is generated on your whatsapp message for checkout.

Scope and Applications

- Can be used in retail stores with no ERP systems.
- Direct go and Shop using your unique Customer Id {Here , we are using it as mobile number}
- Better way to track the inventory , based on different Customer.
- customer segmentation to reduce the waiting time At billing counter.

Deep Sort and Object Tracking

- As a future scope, we need to track multiple objects with respect to theirs own ID.
- DeepSORT is a computer vision tracking algorithm for tracking objects while assigning an ID to each object.
- Simple Online Realtime Tracking (SORT)
  - **Detection**
  - **Estimation**
  - **Data association**
  - **Creation and Deletion of Track Identities**
- Through different ID , we can track the specific object through multiple cameras in the shop, so that the object does not count twice when it get encountered with different camera.



Using PicSellia for Custom Data Training

- PicSellia can be used to train the custom by our own.
- train your own dataset by classifying the dataset manually.
- For better precision and reducing the parameters of the images.

Research Papers

- Computer vision-based hand gesture recognition for human-robot interaction: a review 2023 , Springer Link
- Hand gesture recognition with focus on leap motion: An overview, real world challenges and future directions
- Nahla Majdoub Bhiri , Safa Ameur , Ihsen Alouani , Mohamed Ali Mahjoub , Anouar Ben Khalifa
- cspdarknet53: Papers with code
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