COVID-19 Risk Assessment

SDSU AI Club

Outline

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- Social distancing detector
- Face mask detector
- Unique person identifier
- Risk assessment model
- Live demo
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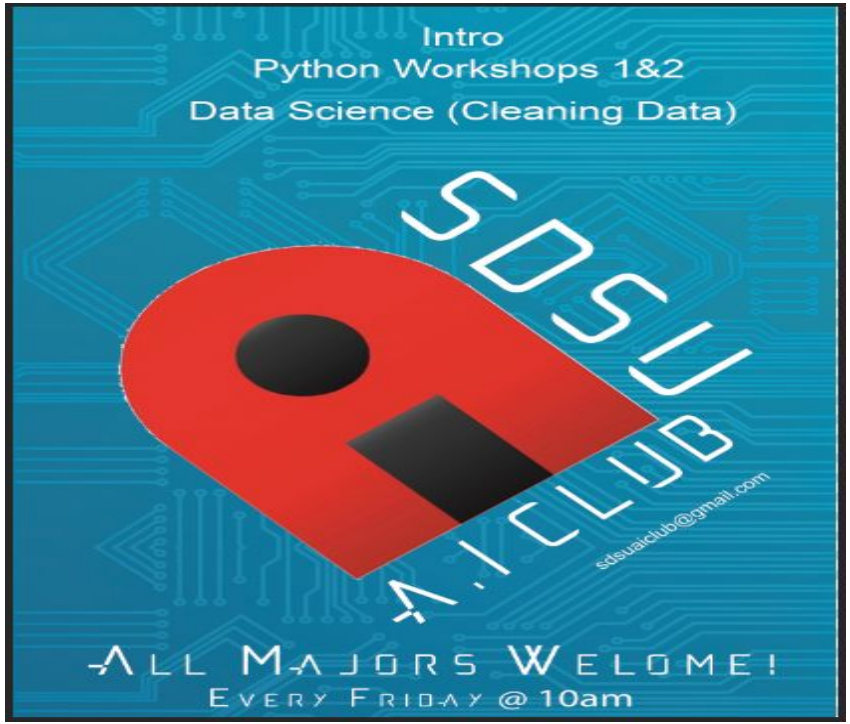
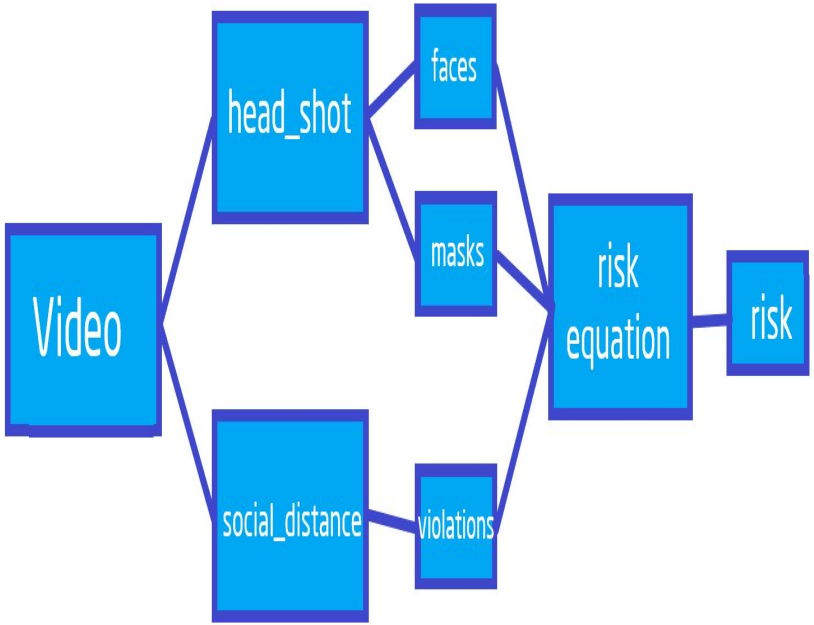
- Conclusion

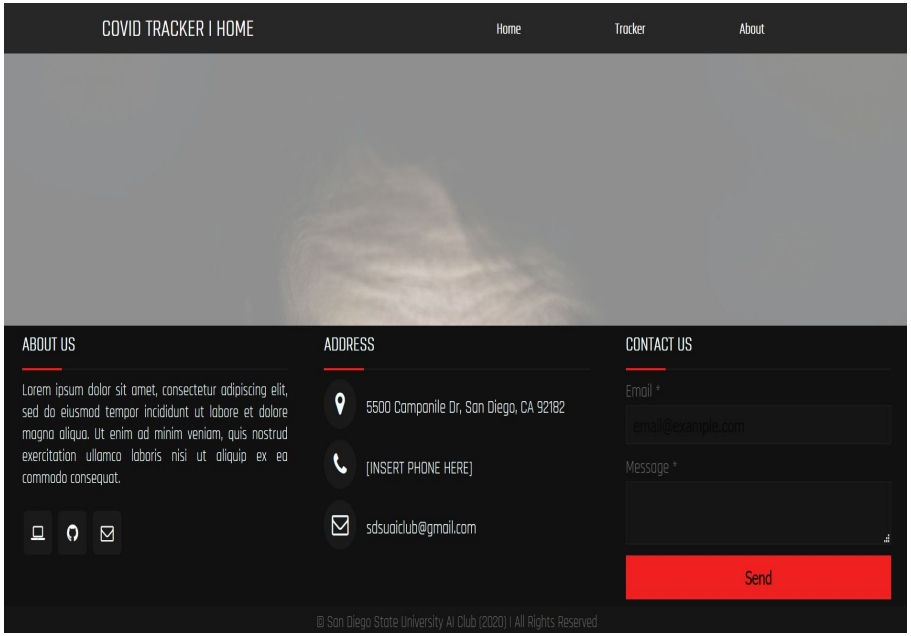


Introduction and motivation

- With the global pandemic striking down the world for over 9 months, we decided to tackle issues brought upon it.
- We were interested in creating a risk assessment algorithm.
- This algorithm would take in as an input various violations of CDC policy with COVID-19.
- The output would be a score that would assess how risky an area is with COVID-19 violations.



Website


COVID TRACKER | HOME
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5500 Campanile Dr, San Diego, CA 92182
[INSERT PHONE HERE]
sdsuaiclub@gmail.com
CONTACT US
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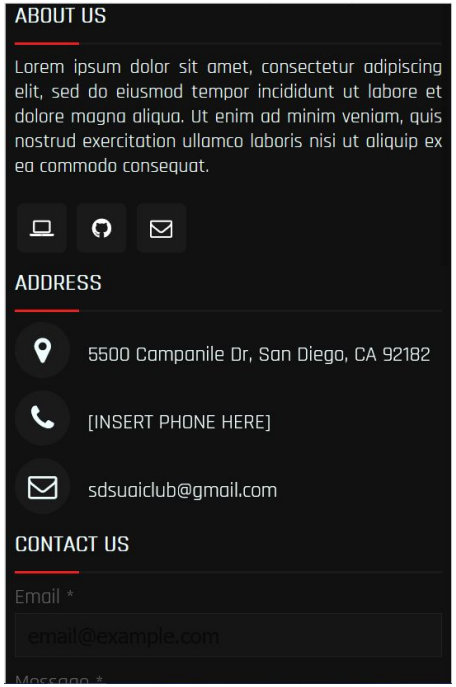
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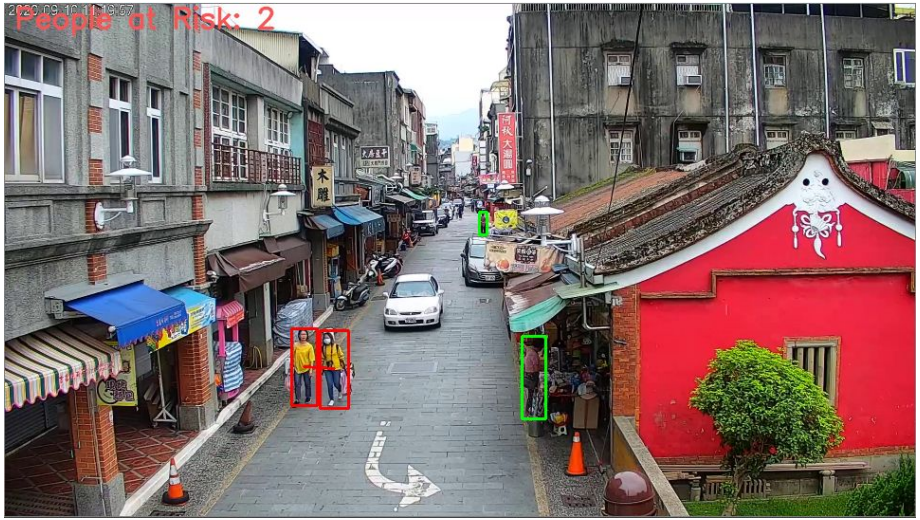
Social distancing detection

- The social distancing detector was implemented within the yolo v4 framework using its pre-trained models. Yolo was selected due to its consistent, high accuracy detection regardless of external factors.

- The detector works well both up close and at long range. It is able to correctly identify the individuals in frame who are violating social distancing guidelines regardless of their position.

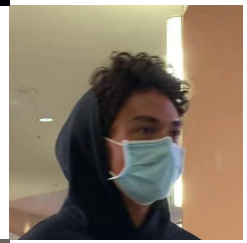


Building the face mask dataset

- Three Categories:
  - Faces
  - Masks
  - Reverse
- Locations
  - Pacific Beach, San Diego, CA
  - Fashion Valley Mall, San Diego, CA
- Headshots extracted using yolo

Face

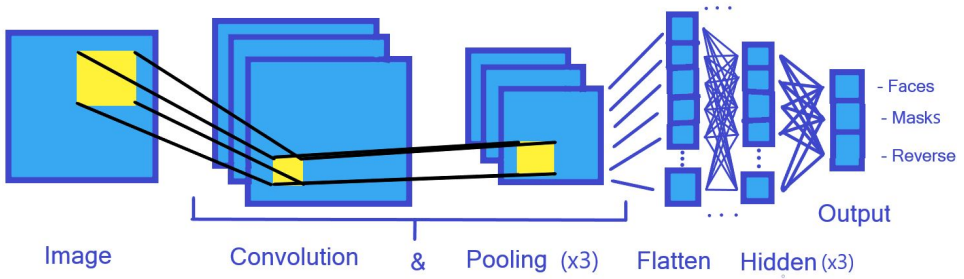
Mask

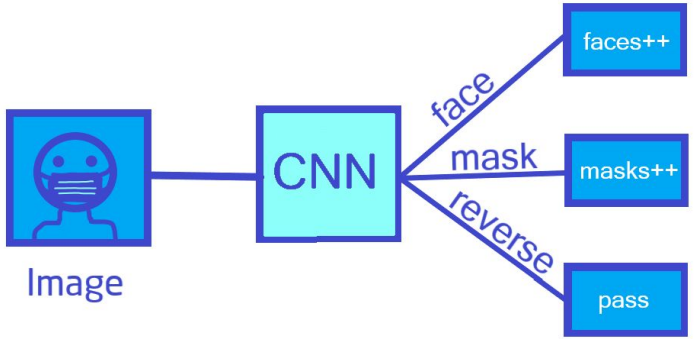


Reverse

Building the face mask classifier

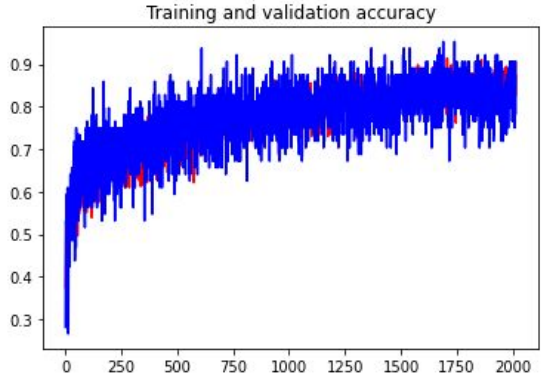
- Implements a CNNs with three outputs
  - 3 Convolution and Pooling layers
  - 3 Fully Connected Hidden Layers
  - 3 Neuron Output Layer with Softmax Activation

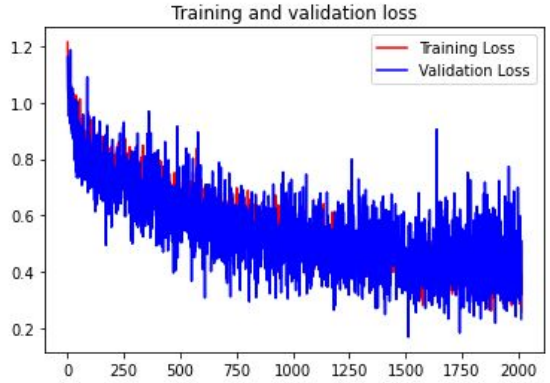




Training the face mask classifier

- Network Achieved:
  - Training Accuracy: 96.88%
  - Validation Accuracy: 96.88%
- Network Loss (Categorical Cross-Entropy)
  - Training Loss: 0.1057
  - Validation Loss: 0.1353

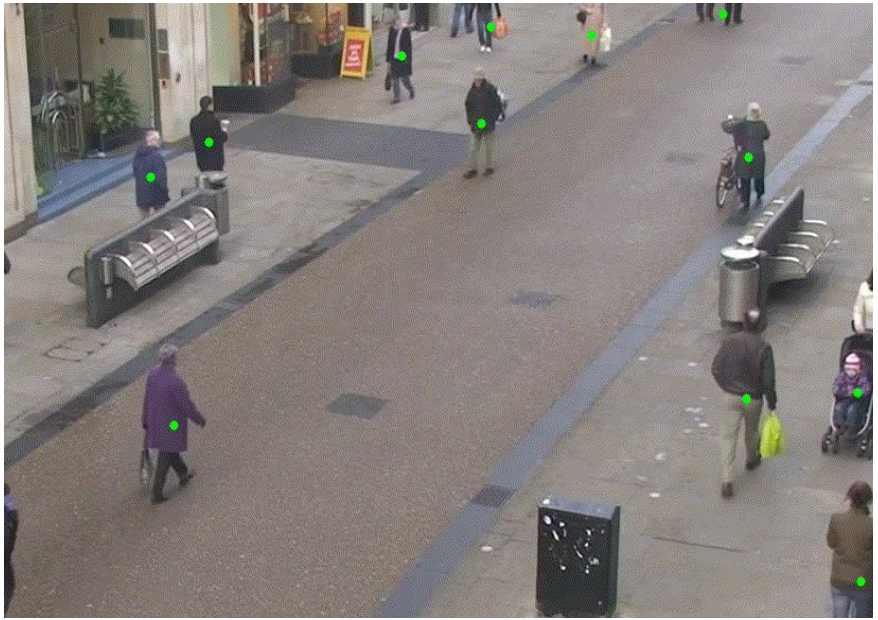




Person Tracker

- We need a way to associate the data we're gathering with each unique person in frame
  - Face mask detection
  - Social Distancing detection
- The solution we proposed it is to give each person in frame a unique ID number
  - We can associate information with a person for visual demonstration
  - Speed up software
  - Establish error threshold

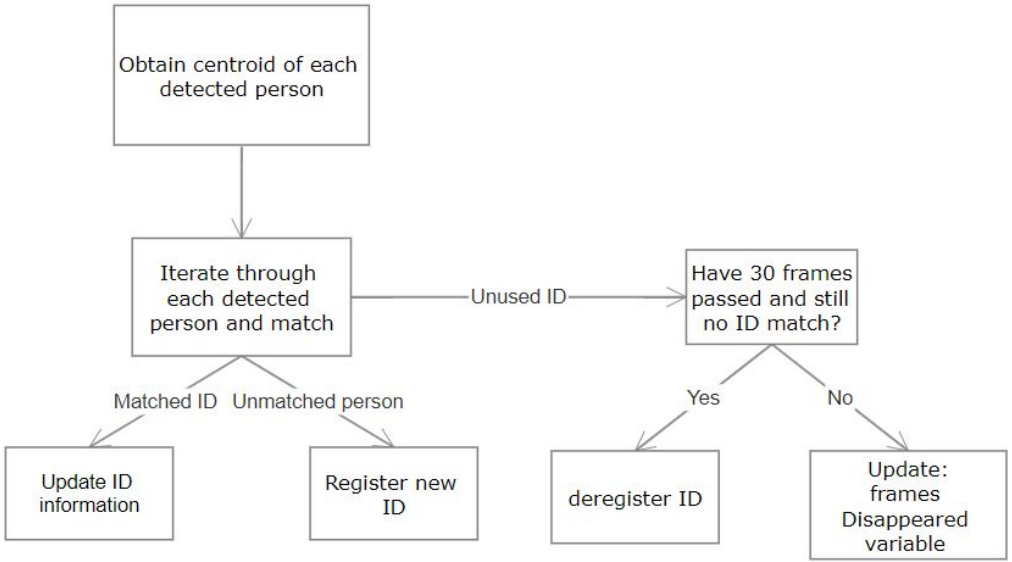
Demonstration of Person Tracker



Person Tracker System

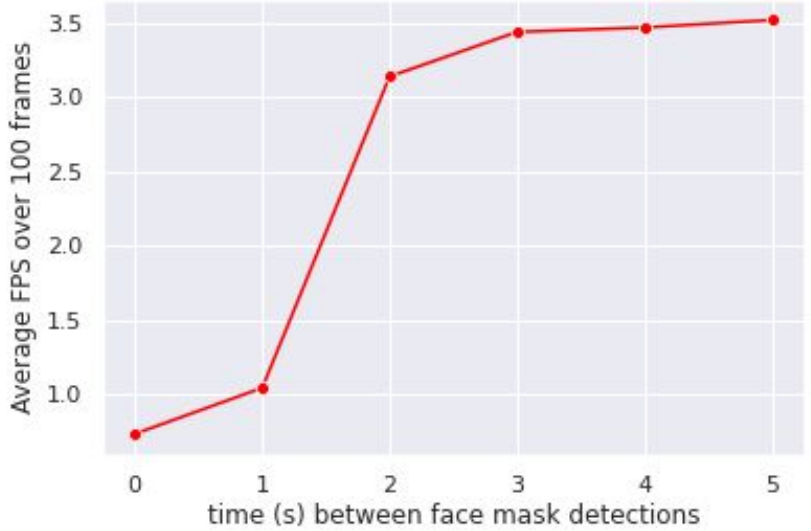
- The person tracker information is stored inside of a class
- Each frame the person tracker will evaluate the given centroids
  - The centroid are the center of a plane figure. In this case we are obtaining the centroids of rectangles
  - To create a match the shortest euclidean distance between registered centroid location and detected centroid is calculated

Person Tracker process every frame



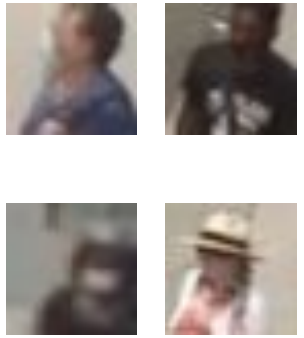
Person Tracker Benefits

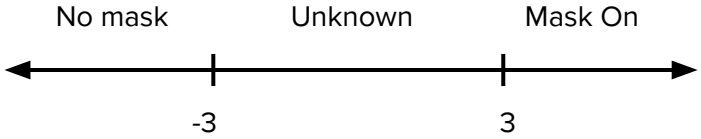
- We are able to speed up the software
  - We can delay the time between the face mask detection by storing each users previous information
  - This speeds up the software as a whole
- We can see the impact on the frame rate from the graph on the right
  - The testing was done using CPU
  - Intel Core I7-8750H



Person Tracker Benefits

- We can establish an error threshold for the face mask detection
  - Relying solely on face mask detection each frame can create inaccurate results
    - If person turns away
    - Incorrect detection
- We can establish a threshold to accurately detect based on persons history
  - +3 for confirming face mask is worn
  - -3 for no face mask being worn
  - Anything in between is unknown





Risk assessment

- Combining all the previous aspects of algorithms to render a risk level to the area.
- Using weighted influences, create a metric to accurately assess risk.
- Based off CDC advice and studies, we were able to create an equation and weighting system that is able to render a proper assessment.
- Be able to provide a score that displays the COVID risk of an area.
- Better track COVID spreads and risks across an area.

$X_{FMD}=[(FS)/(MS+FS+RS)]$

X_{SD}=[Based on how many at risk, score assigned based off cdc research]

$y_{Total}=[X_{SD}*.35]+[X_{FMD}*.65]$

How it works

- In the following slide we will show a demo of our software
- Social Distancing Detector
  - Each detected person will have a bounding box around them. The color of the box will change based on if they are social distancing or not
    - A green box indicates proper social distancing
    - A red box indicates a social distancing violation
- Face Mask Detection
  - Each detected person will have a bounding box around their face.
    - A green box indicates they are wearing a face mask
    - A white box indicates that it is unknown whether they are wearing a face mask or not
    - A red box indicates the person is not wearing a face mask
- Person Tracker
  - Each person will have a green dot located at their center position. This indicates a person is being tracked

Demo

Open Source

- Our main goal with this project was to create something that anyone could use for their own implementation. For that reason, our software is open source and can be found documented on github
  - GitHub

Conclusion

- There are a few ways to better improve our project, one of those being getting more data.
- We feel that this would be a good way to provide a way to plan tasks and activities concerning COVID.
- We appreciate the chance to come here and present our project.