Face Mask Detection Project

CS 5500

Team Members

Python Development Team

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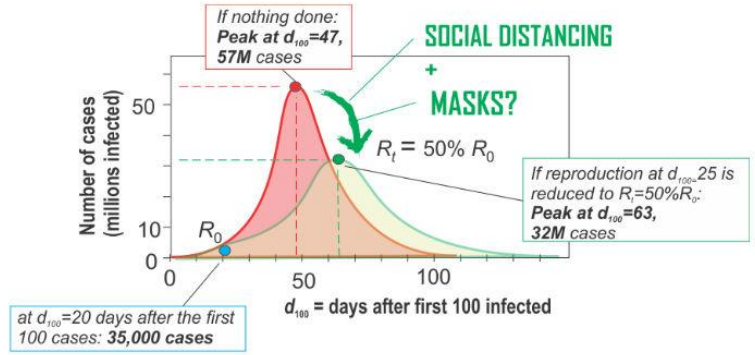
Purpose of the Application

- COVID-19 has a high infection rate which needs to be controlled
- To flatten the curve, masks are recommended
- Enforcing the use of masks in communities is a challenge

- **Solution:** Automate the monitoring
  - Inspired by current automatic temperature measurement applications
- Tool follows mask-wearing CDC protocols
- Tackles the problem in the time feasible time frame
- Increasing the effectiveness of enforcing mask use in public places



[Image Source](#)
[CDC mask source 1](#)
[CDC mask source 2](#)

Major Feature

Python

- Real-time facemask detection
- Deployed on web, or any machine that can run Python

Web

- Test model with image/live stream on device camera
- Easy to connect with team
- Application hosted on Heroku server as part of immediate future work

Data Metrics

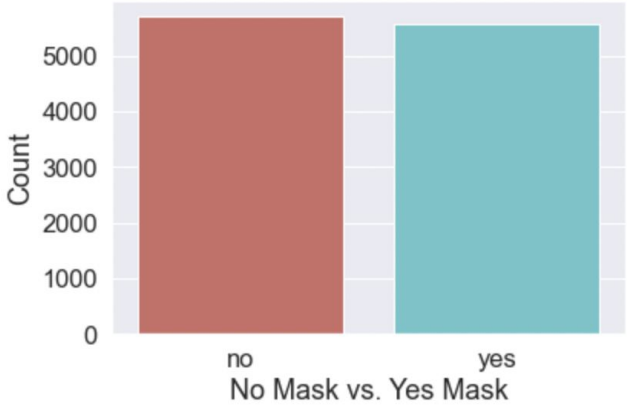
The dataset contains 11,264 images, where:

- Number of images with NO mask : 5701
- Number of images with mask : 5563

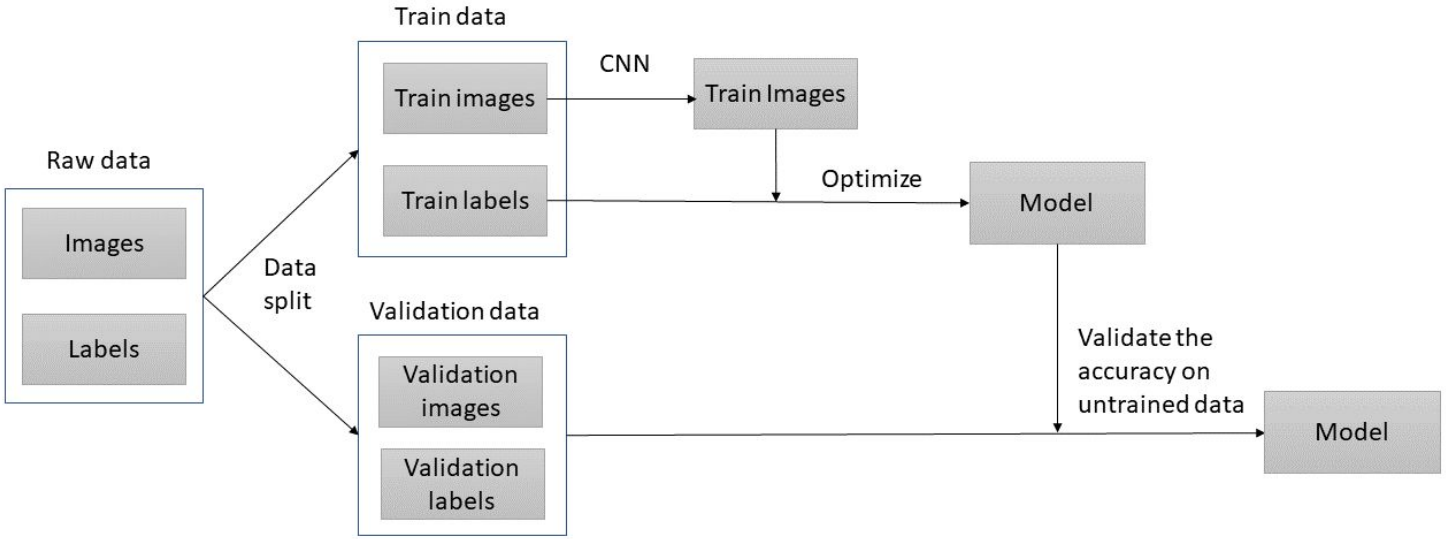
Statistics of the dataset

	label (0/1)
count	11264.000000
mean	0.493874
std	0.499985
min	0.000000
25%	0.000000
50%	0.000000
75%	1.000000
max	1.000000

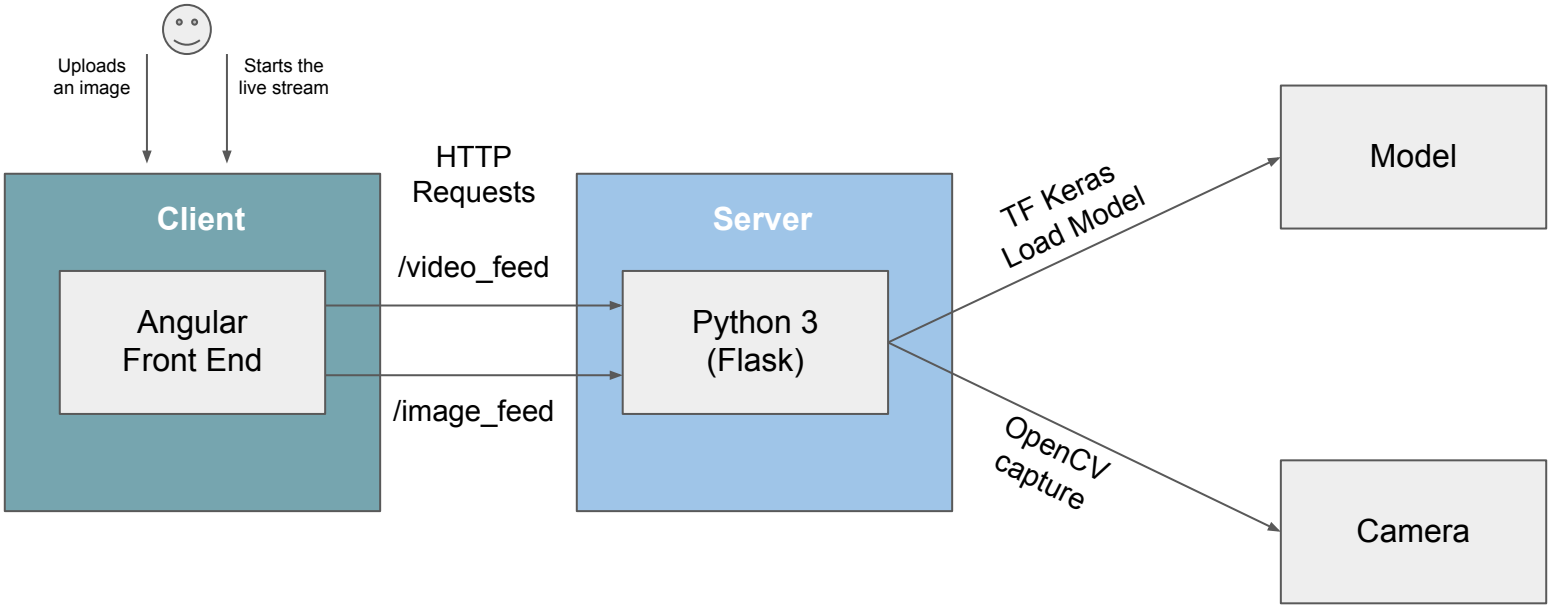
Data representation



Application architecture



Application architecture



UI Design

Design goal: Create a simple and informative interface for users to learn about and interact with our model

- Technologies used: modified HTML/CSS template & turned into an angular application
- Design and front-/back-end development were worked on in parallel and later integrated together to become the final website
    - This method of collaboration allowed different team members to take ownership of different aspects of the final product and gain experience in merging code written by various people to create a product greater than the sum of its parts

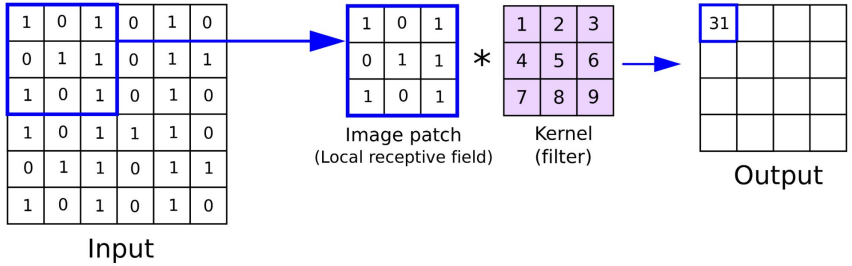
Technologies Used (Web-Development)

- Backend python server flask
  - Flask==1.1.2
  - Flask-Cors==3.0.10
  - Werkzeug==1.0.1
  - tensorflow==2.5.0rc1
  - opencv-python==4.5.1.48
  - numpy==1.19.4
- Frontend framework
  - Angular ^12.0.0-rc.0
  - Bootstrap ^4.6.0
  - Node 15.13.0
  - Express ^4.17.1

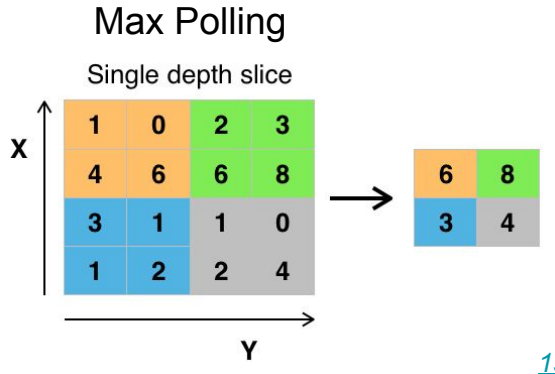
Technologies Used (Python)

Deep learning: convolutional neural network

- Decode images to numpy arrays
- Train the CNN model with numpy arrays and their labels
- Apply a filter over the image to extract the features



- Max Polling to scale down the image



[1st Image Source]
[2nd Image Source]

Development Methodology

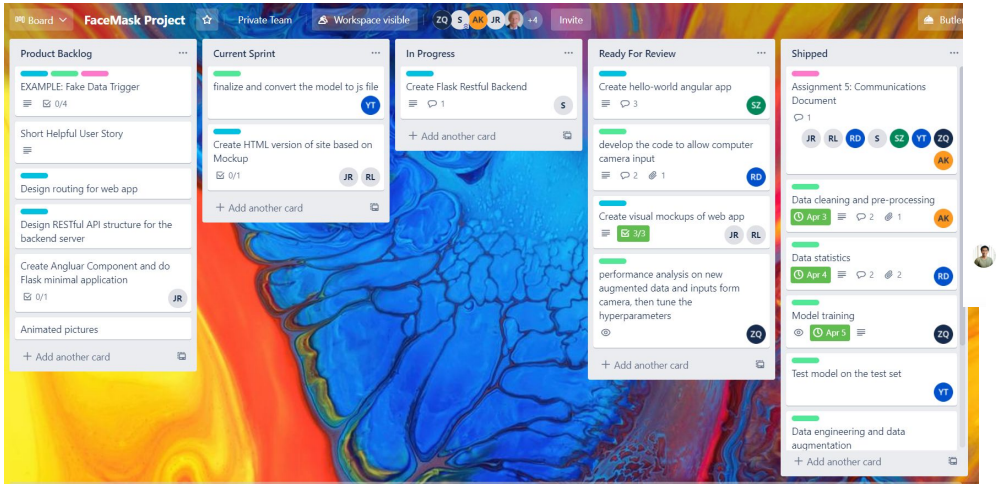
Date	Communication Type	Action Item			
23-Feb	Kick-off Meeting	Introduction between team members	Possible ideas discussion		
1-Mar	Project Team Meeting	Three new members joined since the last meeting	Introduction between team members	Possible ideas discussion	
3-Mar	Project Team Meeting	Finalize ideas brainstorming	Vote for project idea to pursue		
18-Mar	Project Team Meeting	Three new members joined since the last meeting	Explained the details of the project	Introduced similar project's reference	Sub-teams formed
25-Mar	Project Team Meeting	Setup repository	Scrum method adopted	Discussed how to code as a team	
31-Mar	Stakeholder Meeting	Meet the product owner			
1-Apr	Weekly Team Status Update	Setup a backlog with product owner	Sprint (start to code)		
8-Apr	Weekly Team Status Update	Weekly scrum meeting			
15-Apr	Weekly Team Status Update	First sprint ends	Deliver a demo to customers	Check backlog	Start second sprint
22-Apr	Weekly Team Status Update	Weekly scrum meeting	Final discussion	Presentation preparation	
29-Apr	Finalize Project	Final product delivery			

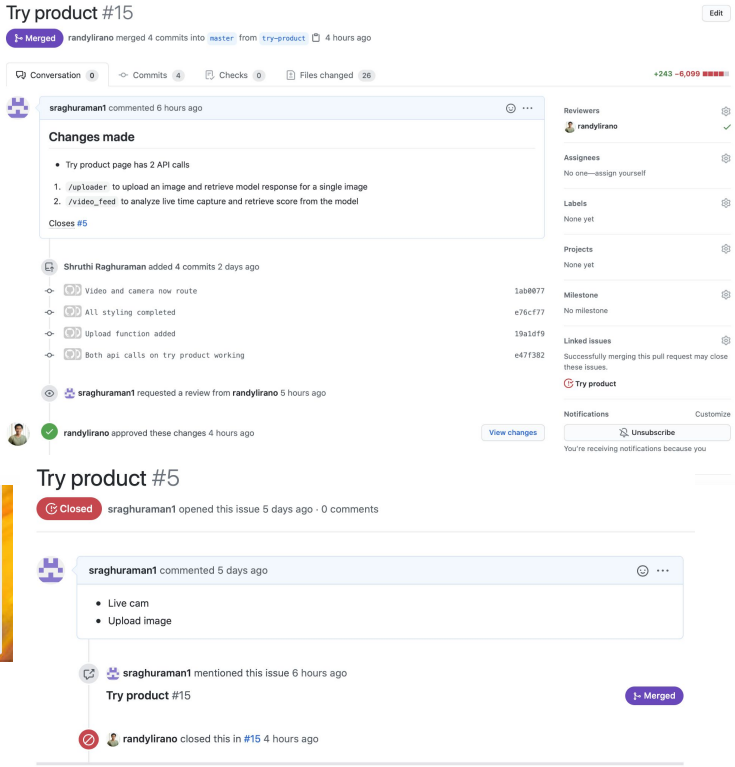
Scrum

- Web development and Python development team split
- Weekly scrum meeting and daily chatting
- Solid and continuous communication on Teams
- Requirements updated over time
- Motivated, self-organized individuals

Development Methodology Continued

- GitHub Code Sharing
  - Push, Pull, Merge, Issues
- Trello Task Management Board





Development Process

Python Team Early Process:

Data preprocessing

- Label preprocess

Data Augmentation

- Rotate the original data
- However, the augmented data is not used in this project
- In future, this data can be used for training and testing to reduce overfitting

Data statistic

Development Process

Python Team Later Process:

Model training

- CNN

Model testing

- Test on new dataset

Camera input

- Cv2 package

Demo delivered

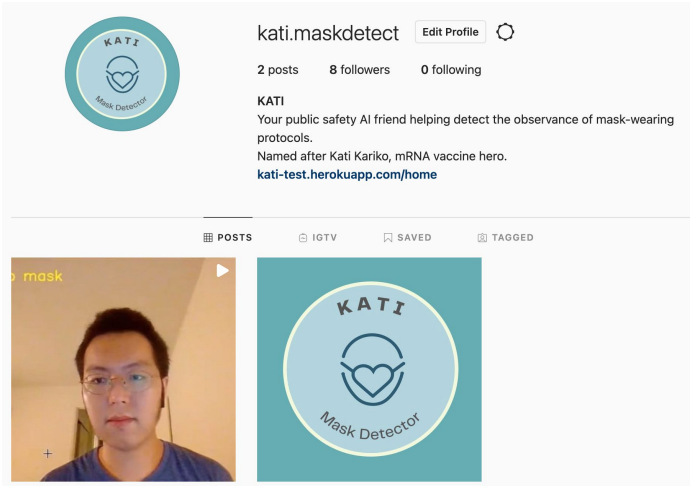
- Working Python standalone demo

Integrate with the Web team

Development Process

Web Team Development:

- Knowledge transfer
  - Tutorial
- Concept and web skeleton
  - Adobe XD
  - HTML
- Connect to Python
  - Backend Flask
- Implement frontend template & backend connection



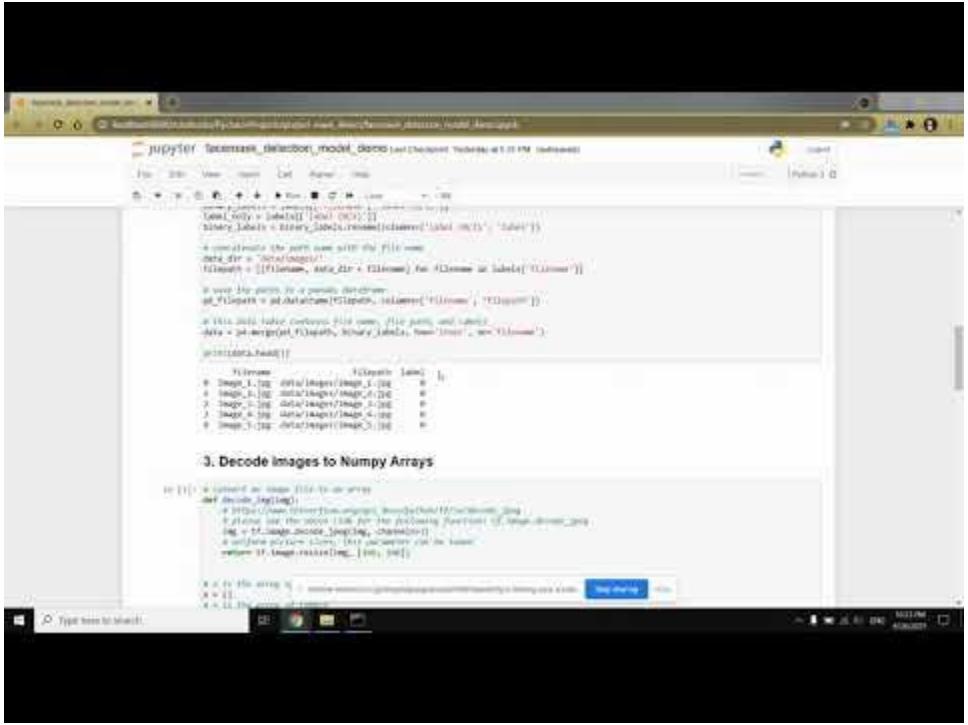
Social Media Development (@kati.maskfinder):

- To provide customers with updates on the tool
- KATI inspired by Dr. Kati Kariko, a scientist who laid the foundations for the vaccine

Organization of the Repository

- Our team uses GitHub for several reasons:
  - It allows different parts of the project being done in parallel through branching
  - It is easy to do version control
  - Github repository also enables Heroku deployment
  - README with team information and information on how to run/access project
- There are two main parts of our repository:
  - Main directory
    - Documents, Data set, Saved model, Data analysis notebook
    - Flask backend in api.py
  - Face-mask-ui folder
    - Angular front end
  - Kati-maskdetect-ui folder
    - Angular mock design

Project Demo - Python



Project Demo- Web Application

- How to run
  - Run requirements.txt
  - Start the Flask backend server in main repository
    - env FLASK_APP=api.py FLASK_ENV=development flask run
  - Cd into face-mask-ui
  - Start Angular front-end
    - Npm install
    - Ng serve --open

Thank you!

Acknowledgements:
Stakeholders Professor Gust and Luna Szymanski for their feedback and guidance