

FACIAL DETECTION WITH MASKS

SCOTT BING

DECEMBER 3, 2020

TODAY'S AGENDA

- A little History
- What is Facial Detection?
- Facial Detection vs. Facial Recognition
- How does Facial Detection Work?
- Face Detection Data
- Demonstration of the Facial Detection with Masks Application
- Facial Detection Challenges
- Results
- Concluding Remarks
- Questions

A LITTLE HISTORY

- Facial Recognition for cheap cameras - 2001
- Paul Viola – MIT
- Michael Jones

Viola, Paul; Jones, Michael (2001). "Rapid object detection using a boosted cascade of simple features". Accepted Conference on Computer Vision and Pattern Recognition 2001. [CiteSeerX 10.1.1.10.6807](https://www.citeSeerX.info/doi/10.1.1.10.6807).

Viola, Paul; Jones, Michael J. (1 May 2004). "Robust Real-Time Face Detection". International Journal of Computer Vision. 57 (2): 137–154. [doi:10.1023/B:VISI.0000013087.49260.fb](https://doi.org/10.1023/B:VISI.0000013087.49260.fb). [ISSN 0920-5691](https://doi.org/10.1023/B:VISI.0000013087.49260.fb).

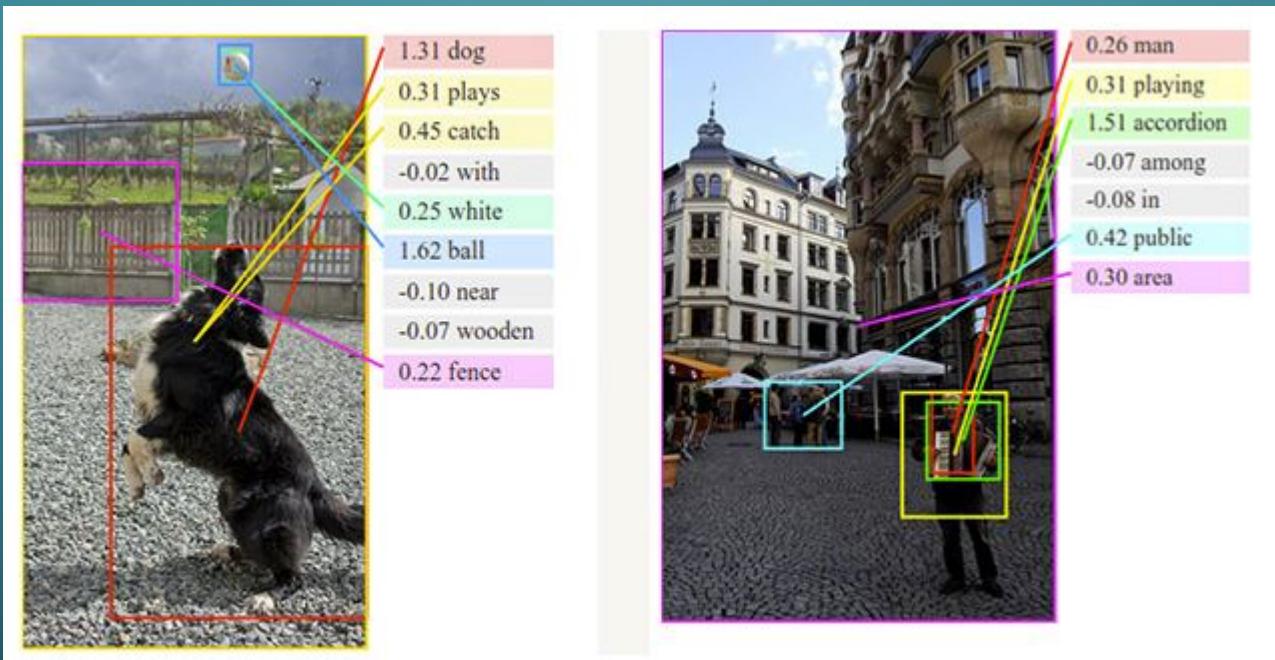
FACE DETECTION GOALS

- Faces must be detected with all manner of orientations
 - Camera Angles
 - Camera distance
 - Light levels illumination
 - Hairstyles
 - Glasses
 - Facial hair
 - Makeup
 - Age

“A Gentle Introduction to Deep Learning for Face Recognition.” *Machine Learning Mastery*, 30 May 2019,
machinelearningmastery.com/introduction-to-deep-learning-for-face-recognition”

Hjelmas, Erik, and Boon Kee Low. “Face Detection: A Survey.” *Computer Vision and Image Understanding*, vol. 83, no. 3, Sept. 2001,
pp. 236–274, www.sciencedirect.com/science/article/pii/S107731420190921X, 10.1006/cviu.2001.0921.

OBJECT DETECTION



<https://www.futuretimeline.net/blog/2014/11/21.htm>

WHAT IS FACE DETECTION?

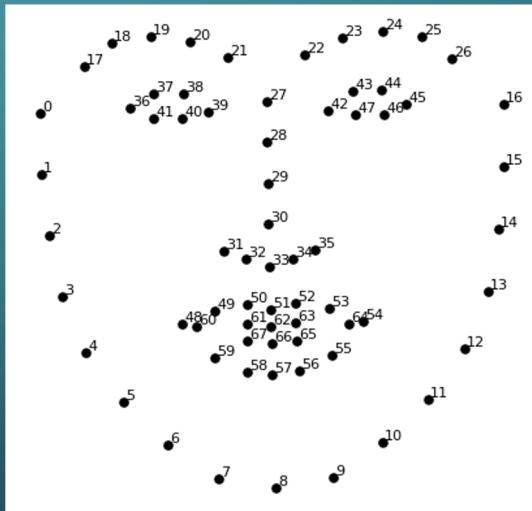
- Ability to distinguish a human faces in an image
- Uses facial characteristics
 - Eyes
 - Nose
 - Mouth
 - Hair
 - Eyebrows
 - Glasses
 - Ears

FACIAL DETECTION VS. FACIAL RECOGNITION

- Identify faces only
- Not interested in the identity
- Requires less training



- Identify faces
- Determine identity
- Requires more training

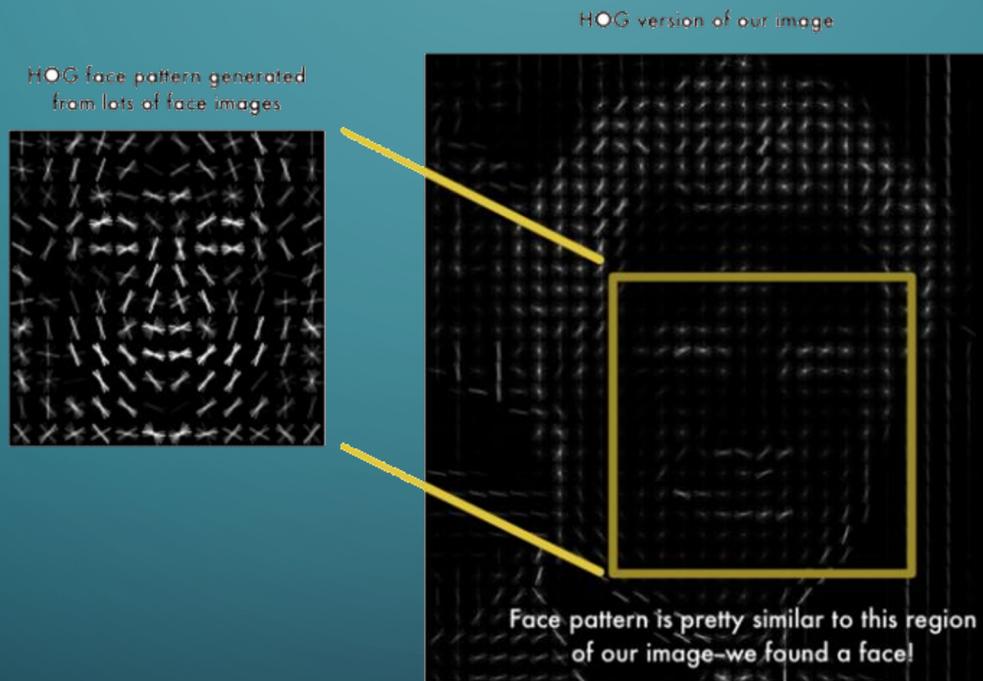


Geitgey, Adam. "Machine Learning Is Fun! Part 4: Modern Face Recognition with Deep Learning."

HOW DOES FACIAL DETECTION WORK?

- Detects facial characteristics
- ROI – Region of Interest
- Training Phase
- Prediction Phase
- Uses Machine Learning and Neural Networks

HOW DOES FACIAL DETECTION WORK?



<https://medium.com/@ageitgey/machine-learning-is-fun-part-4-modern-face-recognition-with-deep-learning-c3cffc121d78>

HOW DOES FACIAL DETECTION WORK?



<https://medium.com/@ageitgey/machine-learning-is-fun-part-4-modern-face-recognition-with-deep-learning-c3cffc121d78>

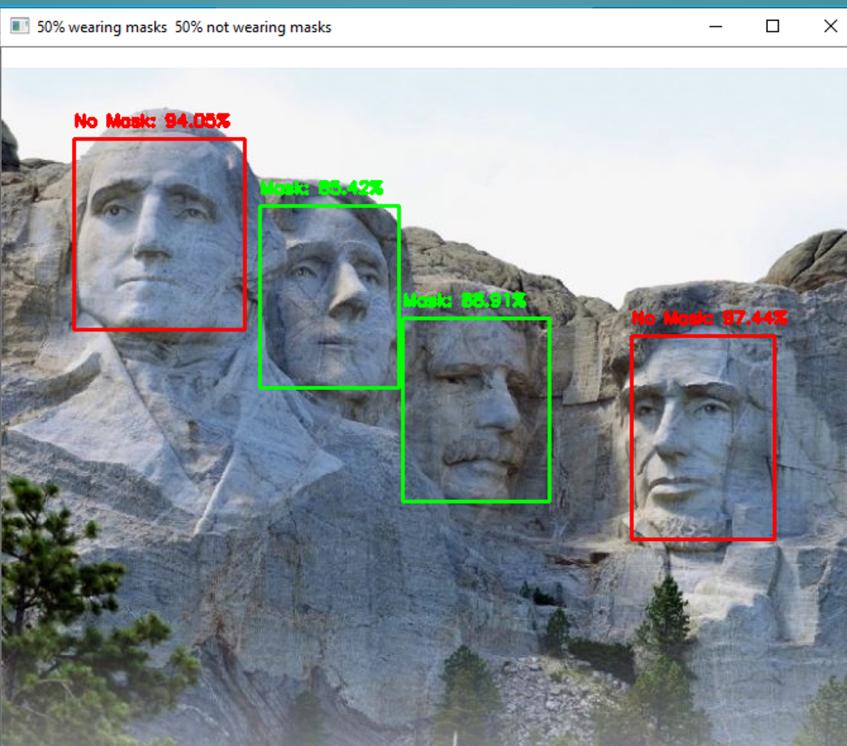
TRAINING TESTING PREDICTING

- Show negative and positive images
- Test the trained models
- Reinforce when the correct answer is given
- Making final predictions

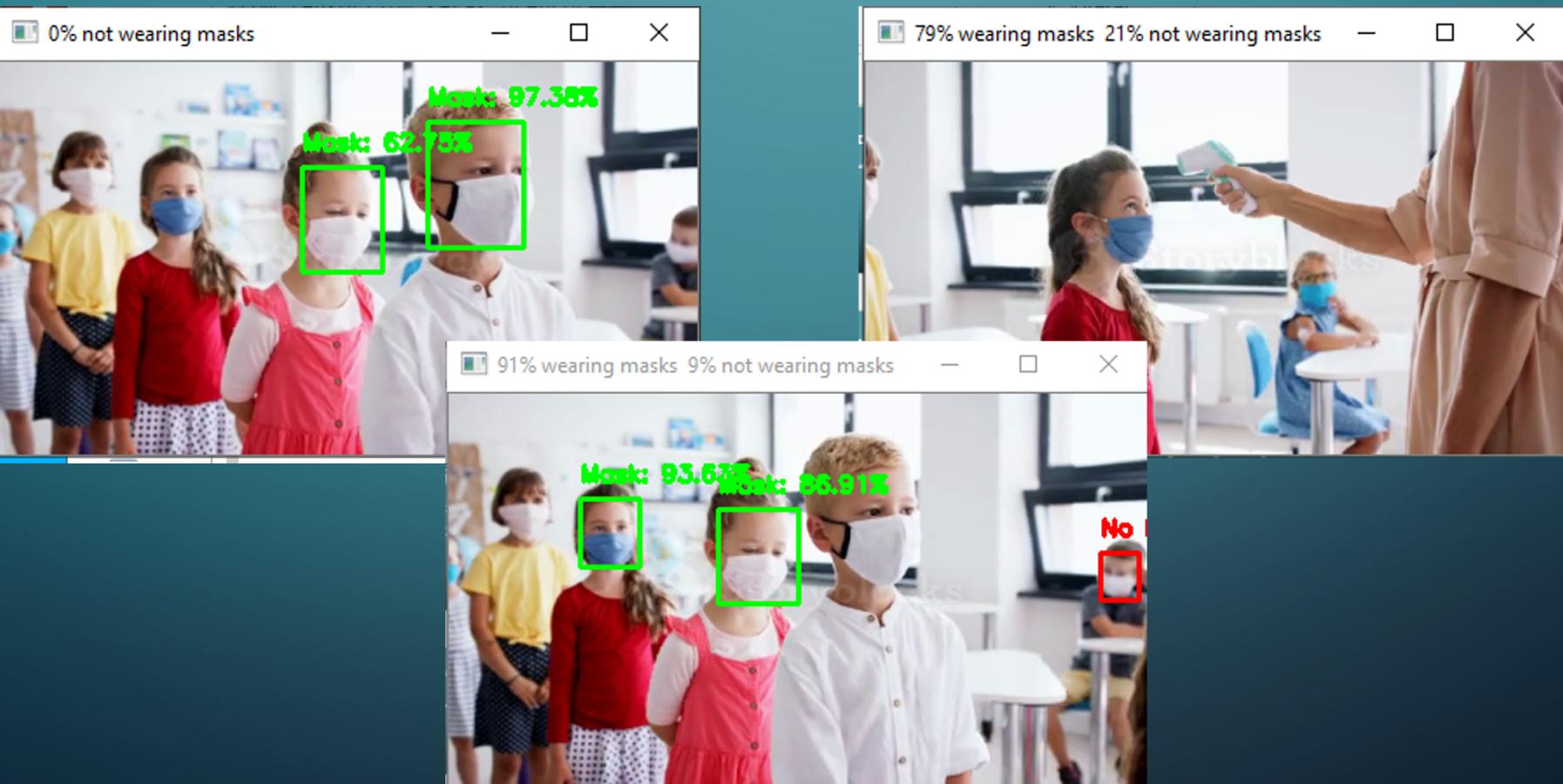
FACE DETECTION WITH MASKS DATA

- Two folders
 - Positive images – faces with masks
 - Negative images – faces without masks
- Prototxt.txt – face detection settings
- Caffe Model

FACE DETECTION APPLICATION IMAGE DEMONSTRATION



FACE DETECTION APPLICATION VIDEO DEMONSTRATION



FACIAL DETECTION RESULTS

- Relative measurement
- Capture simple statistics based upon a percentage
- Displayed on screen title
- Accurate for static image
- Results skewed for video based on false negatives
 - Camera distance
 - Video quality
 - Frame speed

FACIAL DETECTION CHALLENGES

- Continual head movement
- Camera Distance
- Image Quality
- Statistics difficult to gather with video
 - Multiple frames with same individual

REFERENCES

- Geitgey, Adam. “Machine Learning Is Fun! Part 4: Modern Face Recognition with Deep Learning.” *Medium*, Medium, 24 July 2016, medium.com/@ageitgey/machine-learning-is-fun-part-4-modern-face-recognition-with-deep-learning-c3cffc121d78.
- “PoseNet.” *Www.Edgee.co.uk*, www.edgee.co.uk/demo/_posenet/index.html. Accessed 22 Nov. 2020.
- “A Gentle Introduction to Deep Learning for Face Recognition.” *Machine Learning Mastery*, 30 May 2019, machinelearningmastery.com/introduction-to-deep-learning-for-face-recognition/.
- Hjelmas, Erik, and Boon Kee Low. “Face Detection: A Survey.” *Computer Vision and Image Understanding*, vol. 83, no. 3, Sept. 2001, pp. 236–274, www.sciencedirect.com/science/article/pii/S107731420190921X, 10.1006/cviu.2001.0921.
- Ren, Shaoqing, et al. “Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks.” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 39, no. 6, 1 June 2017, pp. 1137–1149, 10.1109/tpami.2016.2577031.
- Singh, Shilpi, and S.V.A.V. Prasad. “Techniques and Challenges of Face Recognition: A Critical Review.” *Procedia Computer Science*, vol. 143, 2018, pp. 536–543, 10.1016/j.procs.2018.10.427

QUESTIONS... COMMENTS...

