Deep Learning in Computer Vision

Face Mask Detection Using Serialized Model on Real and Semi-Artificial Datasets

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Dataset

- Four datasets each with
  - 300 images of people wearing mask (class: "with_mask")
  - 300 images of people "not" wearing mask (class: "without_mask")

- But different in two ways:
  - Whether that images for with_mask class are real or artificially obtained;
 - Whether masks are plain white or patterned

Dataset Samples

Real Without Mask	Artificial White Mask	Artificial Pattern Mask	Real White Mask	Real Pattern Mask
300 images	150 images	150 images	200 images	100 images

Dataset

▶ Resulting datasets:
- Dataset with white artificial white masks (A–W)
- Dataset with patterned artificial masks (A–P)
- Dataset with white real masks (R–W)
- Dataset with patterned real masks (R–P)

Creating Artificial Dataset by Prajna [1]

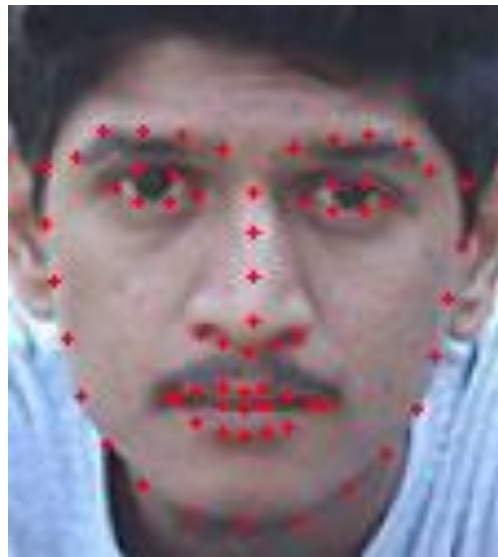- Normal images of faces + Transparent Mask => Face with Artificial Mask
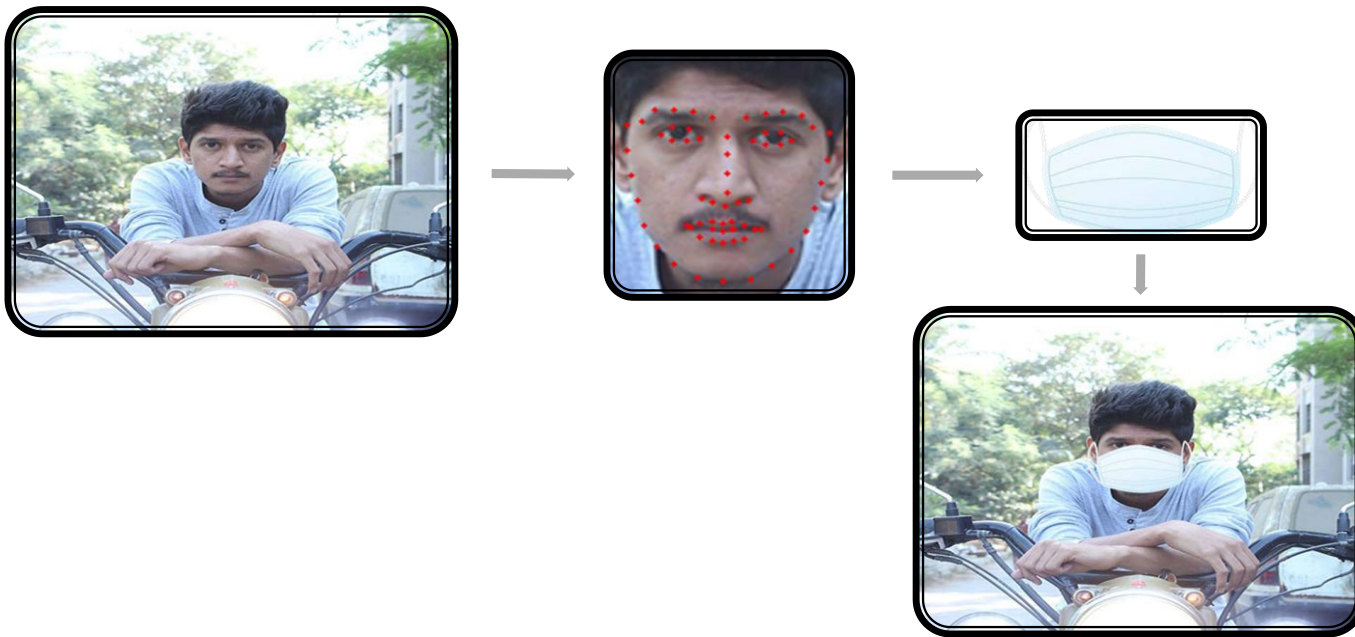
Creating Artificial Dataset by Prajna

- Normal images of faces

Creating Artificial Dataset by Prajna

- Extract the face ROI with OpenCV and NumPy and face-detection
- Apply facial landmarks to localize the eyes, nose, mouth, etc.:

Creating Artificial Dataset by Prajna

- Adjusting transparent mask (size, rotation, width/height ratio)
- Overlarding transparent mask on the original face
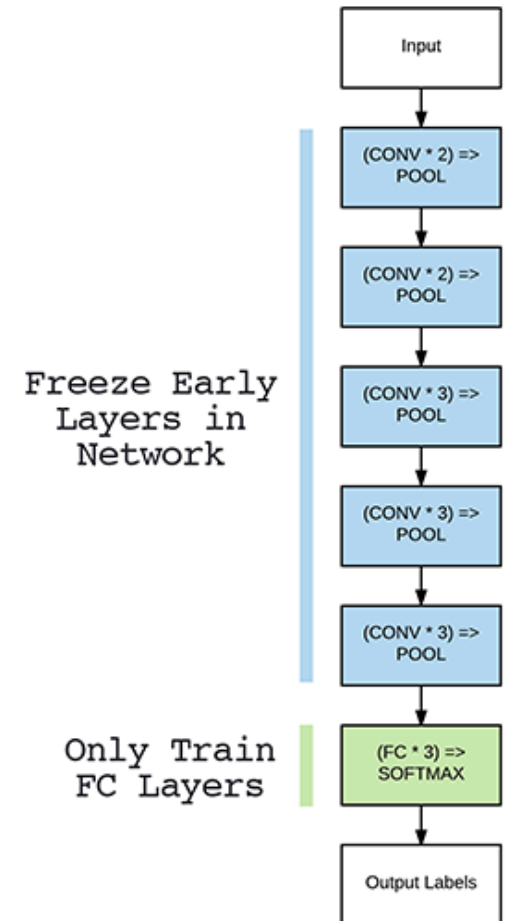
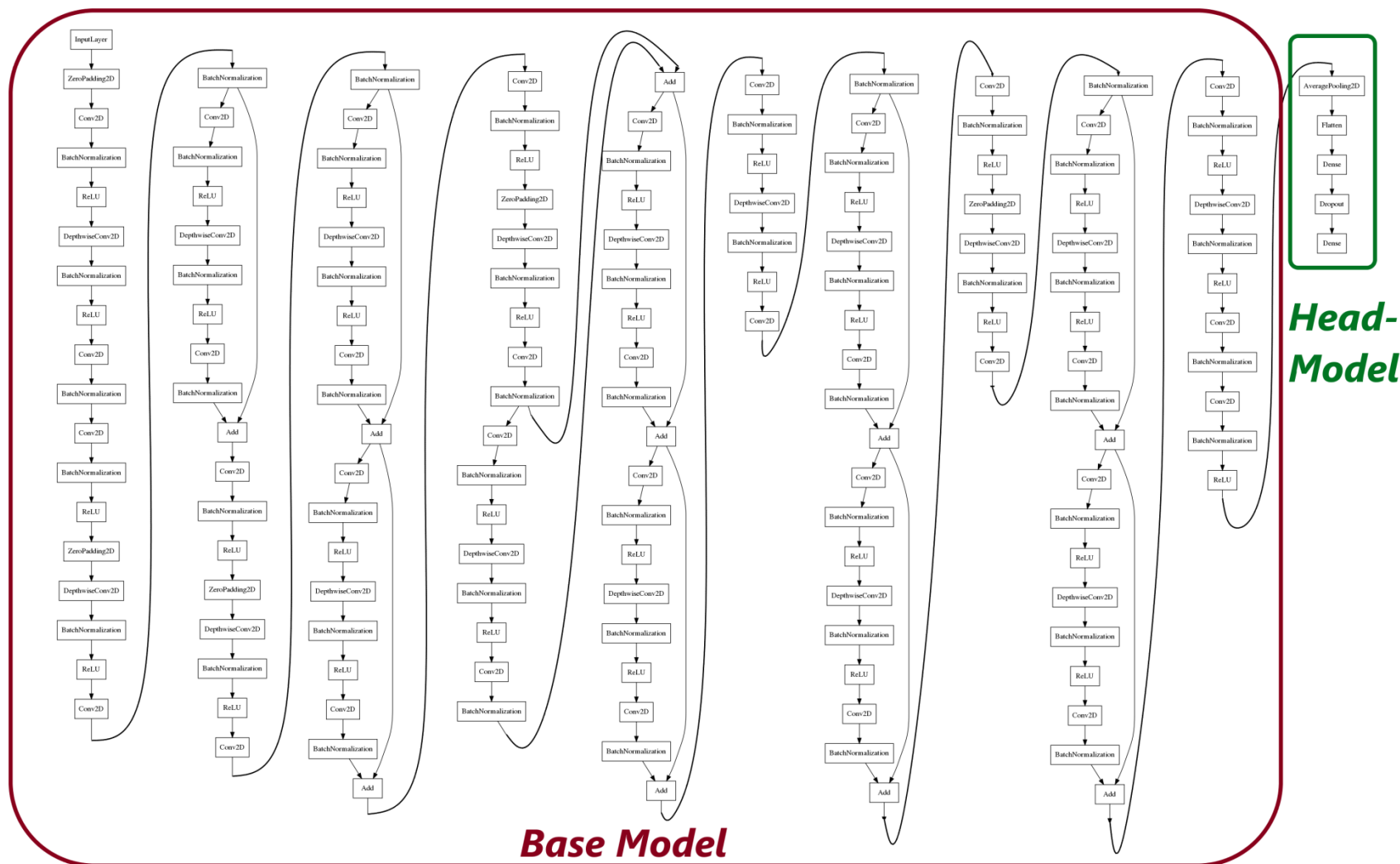# Creating Artificial Patterned Masks

▸ White mask + Seven patterned masks

Fine Tuning
Training Serialized Model

▸ **Serialized Model** =
Base Model (Already trained & Frozen)
+
Head Model (Trainable)

▸ Base Model:
  ◦ MobileNet with pre-
    trained **ImageNet** weights, leaving off
    head of network

▸ Head Model
  ◦ a new FC head, and append it to the
    base in place of the old head

Input

(CONV * 2) =>
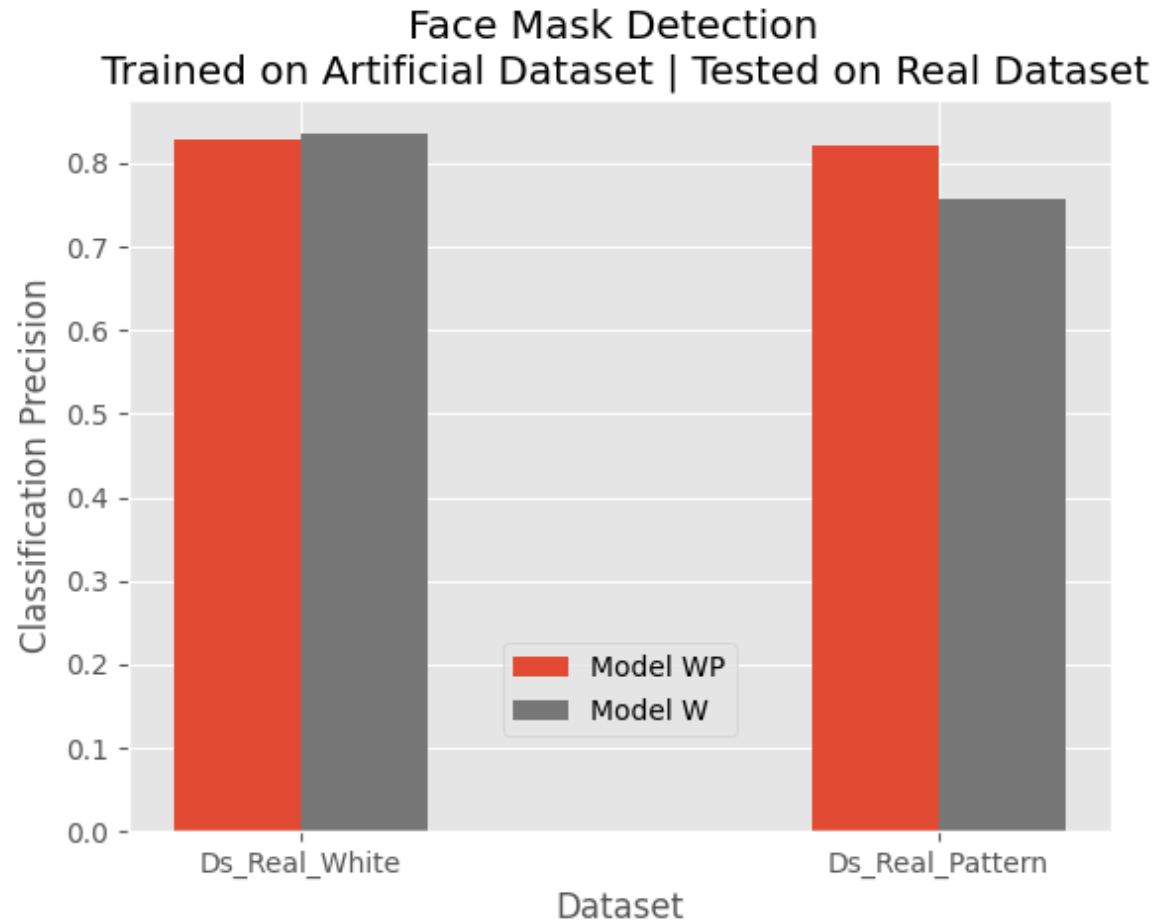POOL

(CONV * 2) =>
POOL

Freeze Early
Layers in
Network

(CONV * 3) =>
POOL

(CONV * 3) =>
POOL

(CONV * 3) =>
POOL

Only Train
FC Layers

(FC * 3) =>
SOFTMAX

Output Labels

Fine Tuning
Training Serialized Model

Base Model

Head-Model

Face Mask Detection
Trained on Art. Dataset | Tested on Real Dataset

Face Mask Detection
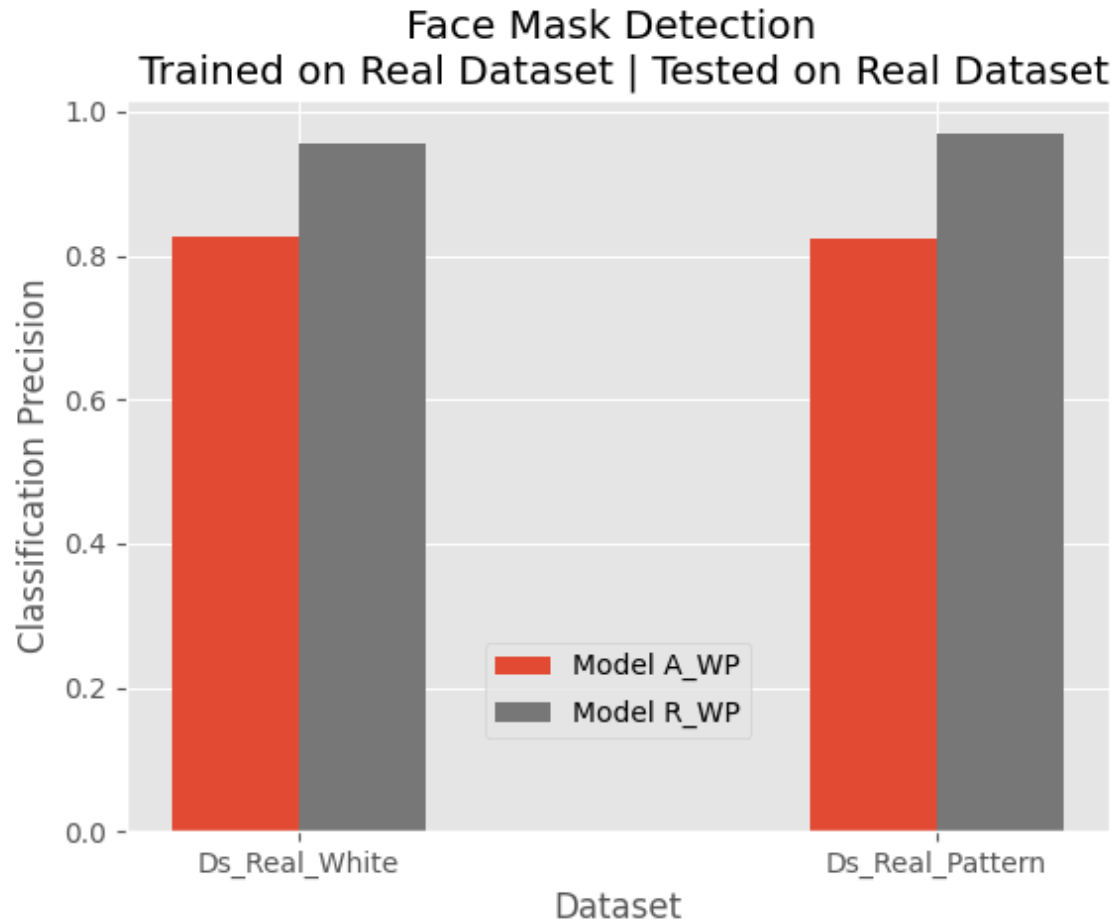Trained on Artificial Dataset | Tested on Real Dataset

Face Mask Detection
Trained on Art. Dataset | Tested on Real Dataset

▶ Even using artificial masks results in more than 80% detection of real masks

▶ Adding patterned masks to training dataset
  ◦ Negligible effect on detection rate for white masks
  ◦ Increases the detection rate of patterned masks

Face Mask Detection
Trained on Art. & Real Dataset | Tested on Real Dataset

Face Mask Detection
Trained on Real Dataset | Tested on Real Dataset

Face Mask Detection

Trained on Art. and Real Dataset | Tested on Real Dataset

- Training with real dataset increases detection rate from 83% to 96% both for white and patterned masks

References

▸ Adrian Rosebrock, COVID-19: Face Mask Detector with OpenCV, Keras/TensorFlow, and Deep Learning, PyImageSearch, https://pyimagesearch.com/2020/05/04/covid-19-face-mask-detector-with-opencv-keras-tensorflow-and-deep-learning, accessed on 16 May 2020

▸ https://github.com/prajnasb/observations/tree/master/mask_classifier/Data_Generator

▸ https://pypi.org/project/face-recognition/

▸ https://www.pyimagesearch.com/2017/04/03/facial-landmarks-dlib-opencv-python/

▸ https://www.pyimagesearch.com/2020/05/04/covid-19-face-mask-detector-with-opencv-keras-tensorflow-and-deep-learning/

Thanks for your attention

>> Questions are welcome