Mask Detection

Deep Learning with PyTorch

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Background

- Public health concerns regarding airborne viruses
- Implementing Computer Vision and Machine Learning
- Existing Project – Referencing Resource & Extension Ideas

Problem Statement

- Inspired by Covid-19 Pandemic
- Today's problems should be met by today's technology.
- Our goal was to create a program that can detect whether a face in a picture is wearing a mask or not.

Data Selection

- Images sourced from Kaggle and pre-existing face mask detection project
- The images used as data are comprised into categories “masked” and “unmasked”

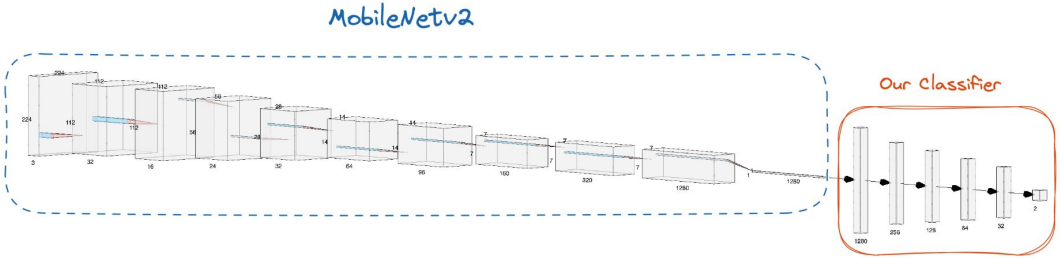
Deep Learning

Build a Neural Network and Learn from Labeled Data to Make Predictions!

Preprocessing & Loading Data

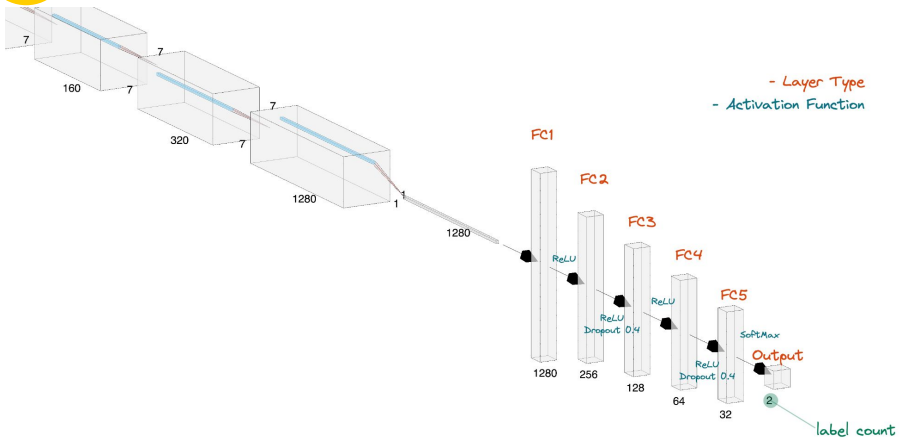
- Each image will be matched with its own label, cached as a (pixleInfo, label) tuple
- Images will be randomly flipped/rotated/resized, and will al get normalized
- Load into network as batches of size 60 img/batch (a.k.a. Mini-batch training).

Network Architecture - Overview



- Transfer learning (Parameters were freezed);
- Got a 1280-dimension vector as input for classifier;
- Classifier redefined.

Network Architecture - Classifier



- 5 fully connected layer, non-linear activation function featured;
- Use Cross Entropy Loss as loss function, and use Adam algorithm for optimization (a.k.a. backward/forward prop);
- Use SoftMax for multiple labels prediction.

1339 instances

of masked faces

1322 instances

of bare faces

94.07%*

accuracy after training **2** Epochs!

*Result from One Time Testing - 1349 successful predictions out of 1434 trials.

Usage In Practice

Presenter Not w/ Mask

Presenter w/ Mask

Limitations & Next Steps

- Performance under a low-light environment is suboptimal;
- The model cannot really distinguish between masks (any types) and other objects that can be used to cover face;
- Currently we only have access to (big enough) data set for training a binary classification model.

  -> Performance for multi-label classification is unknown.

  -> But doable given enough data!

Repo & Reference & Thank You

Clone Our Repo & Train Your Own Model

- **Deep Learning Specialization Offered By DeepLearning.AI on Coursera**: Structural knowledge for DL.
- **Extracting faces using OpenCV Face Detection Neural Network**: Inspiration for extracting faces from image
- **Face detection with OpenCV and deep learning**: Inspiration for runModel.py, mostly the OpenCV part.
- **PyTorch Official Github Profile**: Reference for PyTorch relevant issue.
- **PyTorch Tutorials**: Practical material of syntax and semantics of PyTorch; Help get familiar with functions.
- **PyTorch Vision**: Official documentation as a reference for transfer learning
  - **mobilenetv2**: The pre-trained model the projected used
- **Face-Mask-Detection**: A similar project as a reference, also as our data set source