Real-time Face Detection and Classification from YouTube videos using Matlab, Python & OpenCV

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Face Detection - Viola and Jones algorithm

Object detection method using Haar features, consists of 3 concepts:

- Integral images
- Adaboost
- Cascade classifiers

Main characteristics:

- Fast, Real-time
- Already trained by OpenCV
- Returns bounding boxes

[1]P. Viola, M. Jones, *Rapid Object Detection using a Boosted Cascade of Simple Features*, International Conference on Computer Vision, 2001

Figure: Example of face detected

Face Classification - CNN design

Designed in Matlab by extending the code of lab 3:

- Added convolutional layers
- Added dropout
- Npeople = 13

Will be imported in Python after the training:

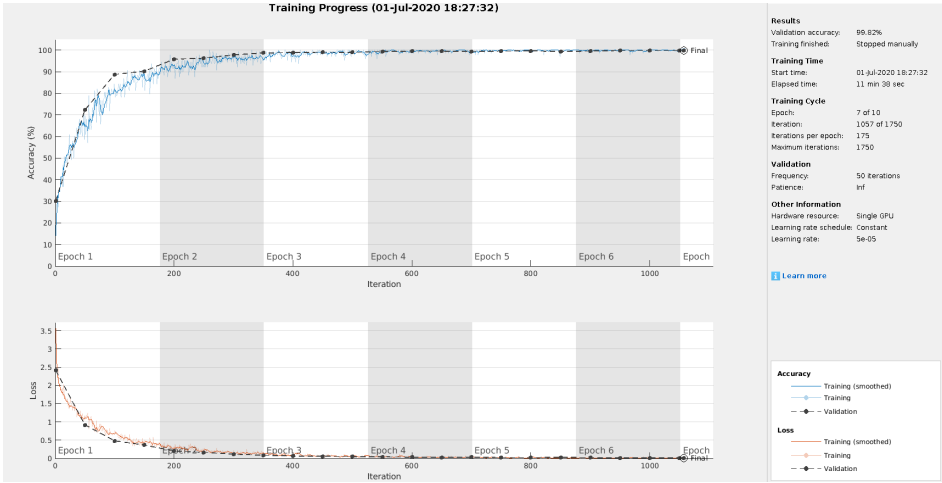
- ONNX format
- OpenCV - DNN module

```
layer_vet=[
    imageInputLayer([64 64 3])

    convolution2dLayer([3 3],64)
    batchNormalizationLayer
    reluLayer();
    maxPooling2dLayer(2,'Stride',2)

    convolution2dLayer([5 5],128);
    batchNormalizationLayer
    reluLayer();
    maxPooling2dLayer(2,'Stride',2)

    convolution2dLayer([8 8],128);
    batchNormalizationLayer
    reluLayer();
    maxPooling2dLayer(2,'Stride',2)

    convolution2dLayer(9, 128, 'Padding','same');
    batchNormalizationLayer
    reluLayer();
    maxPooling2dLayer(2,'Stride',2)
    dropoutLayer(0.25)

    fullyConnectedLayer(Npeople)

    softmaxLayer();

    classificationLayer()
];
```

Face Classification - CNN Training

Training parameters:

- Epochs = 6
- Batch size = 128
- Learning rate = 0.00005
- Accuracy = 98.7%



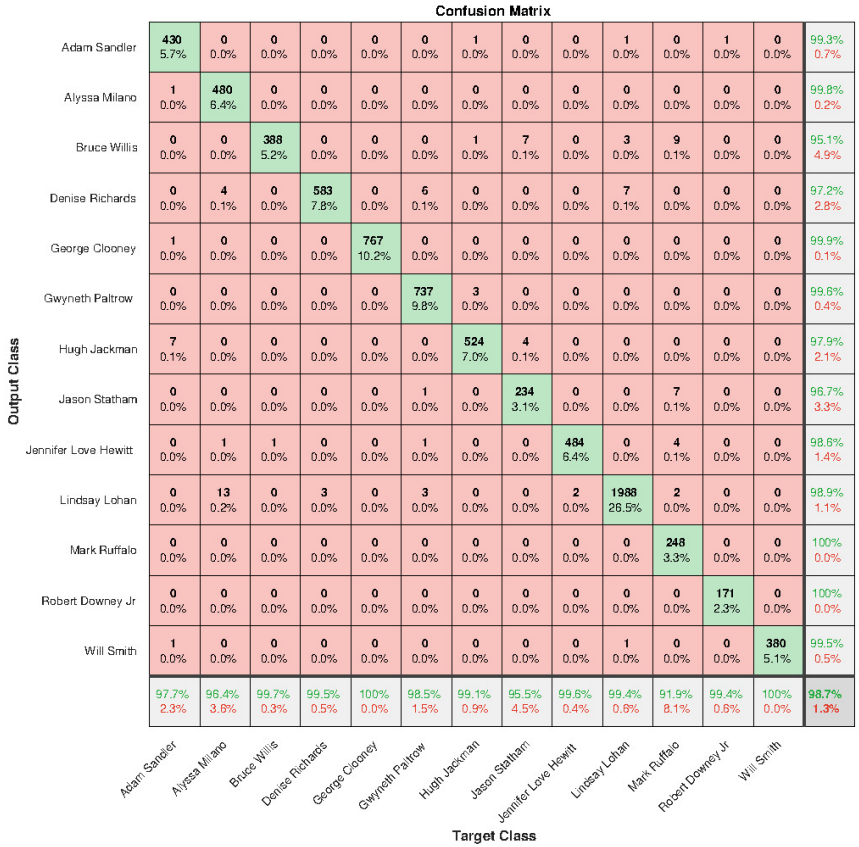


Figure: Confusion matrix of the CNN

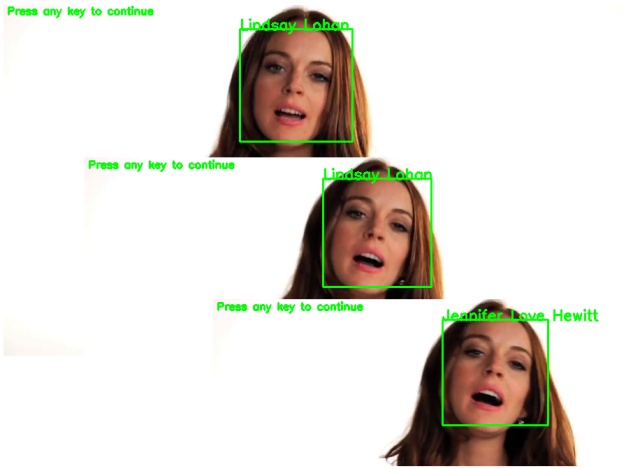
Video Processing

Implemented in python using:

- OpenCV: face detection and classification
- VidGear: YouTube video frames from url

Main features:

- Resized video frames
- N consecutive frames classification
- Removed false positive faces
- No video tracking



$N = 3$

$\Downarrow$

Predicted label: Lindsay Lohan

Detection and Classification

Conclusions

- Limits:
  - Not too accurate
  - Multiface detector
- Improvements:
  - Morphing operations
  - Efficient tracking algorithm
  - Faster face detection