

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)

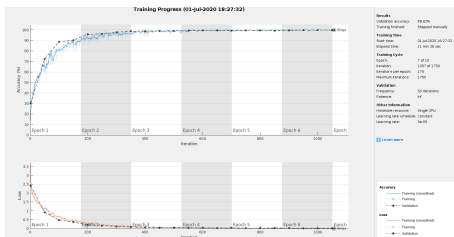
    softmaxLayer();

    classificationLayer()
];
```

Face Classification - CNN Training

Training parameters:

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



Confusion Matrix

Output Class \ Target Class	Adam Sandler	Alyssa Milano	Brace Willis	Danise Richards	George Clooney	Gwyneth Paltrow	Hugh Jackman	Jason Statham	Jennifer Love Hewitt	Lindsay Lohan	Mark Ruffalo	Robert Downey Jr	Will Smith
Adam Sandler	430 5.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Alyssa Milano	1 0.0%	430 5.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Brace Willis	0 0.0%	0 0.0%	388 3.2%	0 0.0%	0 0.0%	0 0.0%	1 0.0%	7 0.0%	3 0.0%	9 0.0%	0 0.0%	0 0.0%	0 0.0%
Danise Richards	0 0.0%	4 0.1%	0 0.0%	533 7.3%	0 0.0%	6 0.0%	0 0.0%	0 0.0%	7 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
George Clooney	1 0.0%	0 0.0%	0 0.0%	0 0.0%	767 10.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Gwyneth Paltrow	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	737 9.0%	3 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Hugh Jackman	7 0.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	524 7.0%	4 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Jason Statham	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 0.0%	0 0.0%	234 3.1%	0 0.0%	7 0.0%	0 0.0%	0 0.0%	0 0.0%
Jennifer Love Hewitt	0 0.0%	1 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	438 5.4%	0 0.0%	4 0.0%	0 0.0%	0 0.0%	0 0.0%
Lindsay Lohan	0 0.0%	13 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	2 0.0%	1388 28.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Mark Ruffalo	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	248 3.3%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Robert Downey Jr	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	171 2.3%	0 0.0%	100% 0.0%	0 0.0%
Will Smith	1 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 0.0%	0 0.0%	0 0.0%	380 5.1%	98.5% 0.0%	98.7% 1.3%

Figure: Confusion matrix of the CNN

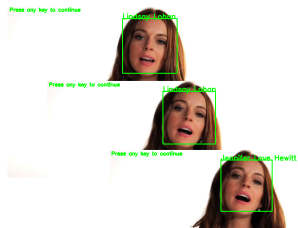
Video Processing

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



$N = 3$



Predicted label: Lindsay Lohan

Detection and Classification

Conclusions

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