Assignment 2

Training a computer vision model for gender classification

Assignment Instructions

Try to attempt the assignment on your own at first. You may collaborate on the assignment.

You should attempt to answer all questions for this assignment. Most of them can be answered partially even if you were unable to finish earlier questions. If you were unable to run the experiments, please discuss what outcomes you might hypothetically expect from the experiments. If you think your computational results are incorrect, please say so; this may help you get partial credit.

Assignment link

Introduction

Problem Statement

Deep learning is used in face detection and gender detection. In this assignment we will create a simple binary classier that detects gender from images.

Data

We use a subset of the IJB-C[1] (30k images from 1.2k subjects). The dataset has been accurately annotated for gender and skin colour, age group, eyeglasses, head pose, image source and face size.

The data format is as follows:

- **TEMPLATE ID:** Unique ID of the image. The filename of the corresponding image – is TEMPLATE ID.jpg
- **SUBJECTID:** ID of the subject
- **AGE:** Age group: 0 is 0-34 years, 1 is 35-64 years, and 2 is 65+ years

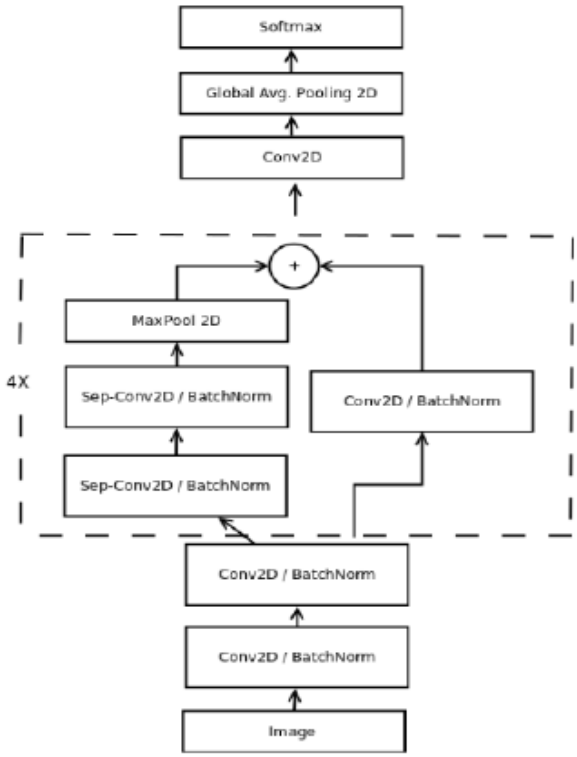

Figure1: The mini-Xception Model from [2]

- **SKIN COLOUR:** 0 bright (Fitzpatrick types I-III), 1 dark (types IV-VI)
- **GENDER:** 0 male, 1 female
- **HEAD POSE:** 0 frontal (easy), 1 other (difficult)
- **SOURCE:** 0 image, 1 video frame
- **GLASSES:** 0 no glasses, 1 or 2 glasses
- **BOUNDING BOXSIZE:** 0 if both dimensions of the face are > 224 px (big), 1 otherwise (small) For this exercise, we will only use the gender attribute.

Model

We follow the paper Real-time Convolutional Neural Networks for Emotion and Gender Classification[2] and use a modified Inception based neural network for this assignment. An implementation is given in the base code file and the model architecture can be seen in Fig:1

Part 1: Training and Evaluating the Model (50 Points)

We provide a starter code with a basic mini-Xception model set in tensor flow and keras. We also provide code for easy model evaluation and visualization.

- (10 points) Training and Evaluation: Try to run the code and get predictions. The submission should include the accuracy, AuCROC, two examples where the model does a correct prediction and two where the model is wrong. The accuracy and AuCROC should at least be greater than 60

- (10 points) Modifying hyperparameters: We have set a bunch of hyperparameters for the model by default try playing around with the to try and get a better accuracy. The submission should include only the final list of parameters you used and why (not more than 2 lines).

- (10 points) Data Augmentations: We do minimal data augmentations by default. Try different data augmentations and see if it improved performance. Give a list of techniques used (along with any new ones you implemented)

- (10 points) Model Improvements: The model used is pretty lean, should we add more layers to it? How would you improve the architecture. The code submission should include the updated code for full points.

- (10 points) Use a better model: You have an option to use a different model altogether.

However, (a) you may not change the data and (b) It should be trainable on Colab.

Part 2: Identifying Bias (50 points)

Once you have trained and tested the model, you should see that the train accuracy is much higher than the test accuracy. Here we will analyze why. We will look at two potential avenues for bias:

- (20 points) Is our model biased? [Hint: Are we looking at the right metrics?]

- (20 points) Is our data subset biased? [Hint: Analyze the labels in the training and validation set]

- (10 points) What problems will the model face if we include more non-binary genders? You may try using images of your own. Remember this is a CV assignment, the more images the better

Part 3: Eliminating Bias (Bonus 20 points)
Now that we know how our model is biased, how do we eliminate it? We will look at two possible avenues.

- (5 points) How would you reduce the bias, given you CAN add more data?
- (15 points) How would you reduce the bias, given you CANNOT add more data? Try to explain in your own words and cite relevant articles. No code is necessary for this section.

What To Submit

For reference, here is everything you need to hand in:

- A PDF file answering all questions from both Part 1 and Part 2 (bonus too if you attempt it), the file should be saved as lastname-assignment2.pdf
- Your implementation on the starter code lastname-assgnment2.zip. You should not include pre-trained models or dataset.

Your report must be typeset and saved files should be uploaded on D2L.

References

[1] Maze, Brianna, et al. ”Iarpa janus benchmark-c: Face dataset and protocol.” 2018 international conference on biometrics (ICB). IEEE, 2018.

[2] Arriaga, Octavio, Matias Valdenegro-Toro, and Paul PlÖger. ”Real-time convolutional neural networks for emotion and gender classification.” arXiv preprint arXiv:1710.07557 (2017).

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