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CSE 40535

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Semester Project Part 4: Classification

For my project, I chose to classify four different facial attributes on various celebrities from the CelebA dataset. The attributes being classified are whether the subject has bushy eyebrows, a slightly open mouth, a big nose, and/or a mustache. The CelebA dataset contains metadata for each subject, which includes whether the subject has any of these four attributes.

I trained a separate classifier for each of the four attributes, however nearly all of these classifiers are setup in the same manner. Each classifier is a Support Vector Machine (SVM) classifier and uses a linear kernel. From the Practical 04 assignment, I analyzed that using an SVM with a linear kernel was a great combination for detecting objects in a single frame. Although I am not analyzing any video footage for this project, I thought that the parallel between a single frame and an image of a celebrity would prove the SVM and linear kernel to be effective for detecting various facial attributes.

First, I trained a classifier for detecting whether a subject has a mustache. I trained the model to respond positively to any subject with a mustache or a goatee, since the goatee covered much of the same region of the face as a mustache. While training the model, I cropped the training dataset celebrities to just the region of their face where you would expect to find a mustache, so that the classifier was not trained

on extraneous features of the subject. When tested on 90 subjects, this classifier is 95.56% accurate, reporting 0% false positives and 4.44% false negatives.

The next classifier detects if a subject has a big nose, as detailed by the CelebA dataset. After being trained on cropped samples of 400 subjects, this classifier reported 72.22% accuracy with 18.89% false positives and 8.89% false negatives on the 90 test subjects.

Third is the classifier for predicting if a subject's mouth is slightly open. Again, cropping the samples, this classifier reported 85.56% accuracy, with 5.55% false positives and 8.89% false negatives on the 90 test subjects.

The final classifier predicts whether a subject has bushy eyebrows. This classifier was trained on 400 subjects, but cropped to only their right eyebrow. This was made on the assumption that subjects had symmetrical eyebrows. Although only trained one eyebrow, both of the subject's eyebrows would be highlighted if they were classified as bushy. On 90 test subjects, this classifier reported 80.00% accuracy, with 8.89% false positives and 11.11% false negatives.

Overall, I think these classifiers were effective and clearly some performed better than others. I think that increasing the size of my training dataset would allow for more accurate predictions. One observation I have is that the predictions were most often inaccurate when a subject was in lighting that was significantly different from most other subjects. Shadows seemed to play a major role in false predictions.

Of course, I saw much higher accuracy when running a classifier over the dataset it was trained on, because the classifier modeled its predictions based on those subjects. This means that the model was fitted to match those subjects' features and

metadata. Therefore, when the model is run over the test dataset, there may be subjects whose features do fit in their correct prediction. As mentioned previously, this can be improved by increasing the size of the training dataset so that more variation in subjects is accounted for in the model's predictions.