CS 4641 Project Proposal

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Motivation:

Facial recognition, once thought of as a core animal ability, has blossomed in recent years through artificial intelligence. Facial recognition technology has been useful in biometrics and can be applied in the cases of both identification and authentication. This technology has been indispensable in finding lost children, detecting human emotion (especially pain), quickly confirming signatures and payments, and even in criminal investigations. The importance of these fields requires high fidelity facial recognition algorithms, and one anticipated problem with these processes is the emergence of wearable technology that may obscure or alter the profile of faces. Our project begins addressing this issue by accurately detecting the presence of the most common and oldest wearable – glasses.

Problem definition:

This project will perform glasses verification on full-frontal face images. Given a photo of a face, we deduce whether the person is wearing glasses. Our balanced dataset contains 5000 faces with glasses and 1000 faces without glasses. These will be full-color 5000 images of unreal people created by Generative Adversarial Neural Network, labelled with their corresponding classification (Dataset here: [https://www.kaggle.com/jeffheaton/glasses-or-no-glasses)](https://www.kaggle.com/jeffheaton/glasses-or-no-glasses). In this set, the images used for training feature glasses of many common types (sunglasses, rimmed, rimless) and sometimes pupils will not be visible. All algorithms will work with the pixel intensity array and make inferences based on given properties.

We will compare the effectiveness of linear regression, k-nearest neighbors, and the naïve Bayes model in detecting the presence of glasses on faces. The efficacy of each supervised learning model, along with possible advantages and disadvantages of each, will be discussed. Linear regression has been the go-to model for facial recognition, but we are also looking to experiment with other ideas. The naïve Bayes model was selected because it does well with binary classification problems like ours. Finally, k-nearest neighbors should be an easily customizable model that can support many iterations of training if necessary.

Our project will focus primarily on determining whether the pictured person is wearing glasses or not, but the next logical step would be to ID a person, matching a photo of a person without glasses to that same person wearing glasses. We could also train the AI to distinguish between faces and non-faces with increasingly complex obstructions, such as hats, headphones or helmets.

Evaluation process and results:

The base evaluation metric will be the percentage of correctly classified faces in a randomly generated test set. The test subjects are not real people and instead, the 512x512 photos are generated by a generative adversarial neural network from the same source as our test data. For more sophisticated evaluation of each algorithm, we can test with actual photos of human faces, with varying alignments and distracting backgrounds. We can also reduce the resolution of some images and observe the decrease in algorithm accuracy, if any.

Timeline:

10/24

- Justin: Evaluate training set and choose photo resolution/number of iterations
- Quyen: Finalize necessary parameters for algorithms

11/16 Midpoint Report: Finish shell for all algorithms and begin training

12/5

- Justin: Analyze algorithm effectiveness, list pros + cons, and select preferred model
- Quyen: Finish data visualization methods and explore further investigations

12/17 Project Due

Resources:
https://www.cambridge.org/core/journals/apsipa-transactions-on-signal-and-information-processing/article/future-of-biometrics-technology-from-face-recognition-to-related-applications/98B13157669DFC22D36F284228A0CE42
https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/biometrics/facial-recognition
https://machinelearningmastery.com/introduction-to-deep-learning-for-face-recognition/