20th January

Ghaith:

- Created Baseline for face detection (PCA+SVM)
- Preliminary literature review:
  - An Optimal Hybrid Solution to Local and Global Facial Recognition Through Machine Learning
  - A face recognition software framework based on principal component analysis
  - SIFT Features for Face Recognition
  - Classical and modern face recognition approaches: a complete review
- Could Wavelet Scattering Transform be used for feature extraction (Wavelet Scattering Transform based Doppler signal classification)
- Implement (SIFT Features for Face Recognition) Paper

Aamir:

- TODO's: Implement Face Detection (First paper approach)

Ben:

- Proposed the use of EigenFaces
- Proposed projects should rely on arm-length phone photos to reduce input image complexity
- Compare and check EigenFaces implementation/results against other techniques
  - Appearance Based Stat Models
  - Comparison of Appearance Based Approaches

Justin:

- Literature review for some of the DL methods

Next Meeting: 11:45 AM Next Monday

Reqs for 24th Feb:

A comprehensive literature review that includes necessary background and the technical content of the topic assigned to you. You MUST include traditional computer vision methods (you can also add deep learning methods, but it is not mandatory). The technical content must be different from what we discussed in class (overlap is okay).

- Discuss state-of-the-art techniques in this topic
- Technical approach
- Results
- Pros and cons
- At the end of the literature review, you need to precisely define the problem statement and motivation of the proposed demo system that you will develop in PART-2 of the project, your proposed solution, and how you will implement it
- Each group will submit a report by the due date and meet with the TA to discuss their proposed demo system. The report must include:
  - A problem statement.
  - A description of the proposed vision system (the purpose or function your system serves).
  - The list of papers you will base your work on.
  - A template of the proposal will be posted on the course website.

27th January:

Ghaith:

- KPSIFT & PDSIFT (SIFT Features for Face Recognition) provide no advantage over vanilla SIFT when the image is padded with black pixel to enable detection of features near the end of the image for facial recognition
- Implement (Human face recognition using random forest based fusion of à-trous wavelet transform coefficients from thermal and visible images)
- Implement SIFT-CNN architecture that was proposed by Justin + compare simply SIFT-SVM, and SIFT.

Aamir:

- Haar Cascades is not viable; not accurate enough with the webcam.
- Implementing of HOG + SVM for facial detection
- Could try creating own cascade file to improve Haar Cascades?

Ben:

- Eigenfaces Report
- Create a sample program that uses eigenfaces and fisherfaces to demonstrate performance

Justin:

- Deep Learning Lit Review
- Proposed the usage of SIFT-CNN architecture
- TODO: Help Aamir for face detection

Next Meeting: 11:45 AM Next Monday

3rd February:

Ghaith:

- Fixed Face Normalization method implementation to work with OpenCV LBF Face Landmark detection and Python-3
- Tested it with BoVW and SIFT (KPSIFT and PDSIFT)
- Implement (Human face recognition using random forest based fusion of à-trous wavelet transform coefficients from thermal and visible images): Method requires an infra-red camera so it is infeasible for us

Justin:

- Researched additional approaches: https://docs.google.com/document/d/1VpItYbyYmikPRE0HpTkKgJY72E2DwNco0Q9y1QOiJX4/edit?usp=sharing

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10th February:

Ghaith:

- Implemented Wavelet Scattering following:
  Stephane Mallat. "Group Invariant Scattering," in Communications on Pure and Applied Mathematics, vol. 65, 2012.
  E. Oyallon, S. Mallat, L. Sifre. "Generic deep networks with wavelet scattering," in arXiv preprint arXiv:1312.5940, 2013.
- Performed tests using separate single models for face recognition (EigenFace, FisherFace, BoVW, KPSIFT, SIFT, Wavelet Scattering)

Justin:

- Implemented deepface detection model for comparison with our non deep learning approach

Aamir:

- Implemented HOG+SVM pipeline using scikit-image, achieved 98% accuracy on the face dataset. However, determined that the webcam performance was even worse than naive PCA approach, so this approach will need some hyperparameter tuning or adding webcam images to the test set.
- Proposed combining the Haar cascades with the HOG+SVM after finetuning the Open CV cascade classifier (using HOG+SVM for classifying whether there is a face, and then Haar cascades to put a bounding box around it)

Ben:

- Unavailable; travelling

Next Meeting: 11:45 AM Next Monday

17th & 24 February:

- Split up the work for writing the project proposal
- Section 1, conclusion - Ben
- Section 2 - Justin
- Section 3: related works - everyone adds something about the papers they've read
- Section 4.3, 4.4 - Ghaith
- Section 4.1, 4.2, conclusion - Aamir

Next Meeting: 11:45 AM Next Monday

12th March

Ghaith:

- Implemented the ensemble method over the models that achieved the highest performance in the single-method pipeline

Ben:

- Research available pre-trained models
- Look for more models suitable for facial detection training
- Begin looking into HOG optimisation

Justin:

- Attempted to help with HOG+SVM pipeline

Next Meeting: 11:45 AM Next Monday

17th March

Ghaith:

- Researched other traditional machine learning methods for face detection
- Organized all the code in the repository

Ben:

- Evaluating HOG performance on object - facial matching, performs well in testing, still performs poorly on webcam
    - Attempted aspect ratio preserving pass to ensure features maintain scale
- Found more datasets
    - MIT Scenes
    - YT Faces Dataset
    - Natural Scenes
- Wrote parser and formatter for identified datasets for efficient use
    - YT Processor

Aamir:

- Evaluated Haar cascades classification performance on dataset used to train HOG and PCA - saw 95% accuracy, 98% precision, 92% recall.
- Found another dataset for background images at https://www.kaggle.com/datasets/mikhailma/house-rooms-streets-image-dataset/data.
    - Reasoning: this dataset is more likely to capture backgrounds of images with faces and also, this dataset is 224x224.
- Wrote code to train CV2's CascadeClassifier
    - Parsed the YT faces numpy arrays to collect positive training examples (images with bounding boxes around faces)
    - Created negative examples out of the rooms-streets dataset
    - Tried different versions of OpenCV's training tools, including traincascade.exe, along with different hyperparameters. None of them seemed to help, and there were always errors with loading the negative examples.
        - Links for debugging:
        - https://docs.opencv.org/3.4/dc/d88/tutorial_traincascade.html
        - https://answers.opencv.org/question/10872/cascade-training-error-opencv-244-train-dataset-for-temp-stage-can-not-filled-branch-training-terminated-cascade-classifier-cant-be-trained-check-the/
        - https://github.com/opencv/opencv/tree/3.4/apps/traincascade

Justin:

- Searched for face detection and recognition datasets
- More research to improve understanding

Next Meeting: 11:45 AM Next Monday

24th March

Ghaith:

- Evaluated skin color segmentation: results indicate high recall but low precision
- Evaluated the ensemble method in a similar fashion to the single-method pipeline

Ben:

- Dataset parsing optimizations
- Final evaluation of HOG, consistent poor performance when evaluated on webcams and non-training/testing split despite training sets and parameters changed

All:

- Began delegation of work for slides and presentations

Next Meeting: 11:45 AM Next Monday

31st March

All:

- Discussed project report / slides status, delegated last sections for completion