**Robust Face Recognition via Sparse Representation [1]**

[**https://blogs.nvidia.com/blog/sparsity-ai-inference/**](https://blogs.nvidia.com/blog/sparsity-ai-inference/) **[2]**

* Automatically recognizing human faces from frontal views with varying expression/illumination
* Classifying among multiple linear regression models
* Propose general classification algorithm for image-based object recognition.
* Feature extraction and robustness of occlusion
* Meant to imitate human visual perception
  + Studies show that human “classification” occurs when many neurons fire according to different stimuli, such as color, texture, orientation, scale.
* Since there are so many potential vectors that can define something like a human face, many machine learning models, sparse linear representations have seen a surge in interest.
  + A dataset is considered sparse if many of the parameters for each sample are 0. In this case, reducing the sparsity of a dataset can improve the model’s runtime performance. For an application that requires as much nuance as facial recognition, reducing unneeded parameters can provide critical time-saving measures
  + In facial recognition, researchers are considering if an optimal representation of a model can be considered sufficiently sparse, allowing for the aforementioned speed increase.
  + These researchers attempt to perform classification (using nearest neighbor and nearest subspace) on these sufficiently sparse datasets

**Facial recognition with PCA and machine learning methods [3]**

[**https://www.geeksforgeeks.org/principal-component-analysis-pca/**](https://www.geeksforgeeks.org/principal-component-analysis-pca/) **[4]**

[**https://www.sciencedirect.com/topics/computer-science/linear-discriminant-analysis**](https://www.sciencedirect.com/topics/computer-science/linear-discriminant-analysis) **[5]**

[**https://scikit-learn.org/stable/modules/svm.html**](https://scikit-learn.org/stable/modules/svm.html) **[6]**

[**https://www.geeksforgeeks.org/k-nearest-neighbours/**](https://www.geeksforgeeks.org/k-nearest-neighbours/) **[7]**

* Principal component analysis (PCA) is used to identify faces directly rather than identifying individual facial features.
  + As the number of dimensions of a dataset increases, the number of combinations of dimensions increases exponentially, negatively impacting runtime and increasing the model’s vulnerability to overfitting.
  + PCA is a form of dimensionality reduction that aims to preserve the most statistically important dimensions and relationships between dimensions while trimming unnecessary patterns. This is achieved by finding a subset of the original components that maximizes the variance in the training data.
* After computing an “eigenface,” the authors tested three machine-learning models:
  + Linear discriminant analysis
    - A classification approach that seeks to reduce the dimensionality of input data, similar to PCA.
  + Support vector machine (SVM)
    - Supervised learning technique that is effective in high-dimensional spaces.
  + K nearest neighbor (KNN)
    - A supervised learning method, new samples are compared to labeled training samples. Distance to nearest labeled samples is computed for each dimension and a class is determined.
* Authors concluded that SVM had the highest recognition accuracy, while KNN had a better balance between runtime and recognition accuracy.