Deep Learning and its Applications
Project Presentation on
Visual Kinship Identification
Group-22

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Problem Statement

To design a pipeline that takes input a folder of pictures and establishes family and kinship relationship among the persons present in those images.

Motivation

Kinship Recognition has a variety of practical uses in the real world such as

1. issues of human trafficking and in missing children,
2. problems from todays refugee crises
3. anti-terrorism activities
4. In the academic world it can be used for machine vision (e.g., reducing the search space in large-scale face retrieval)
5. social media platforms
6. photo storage apps

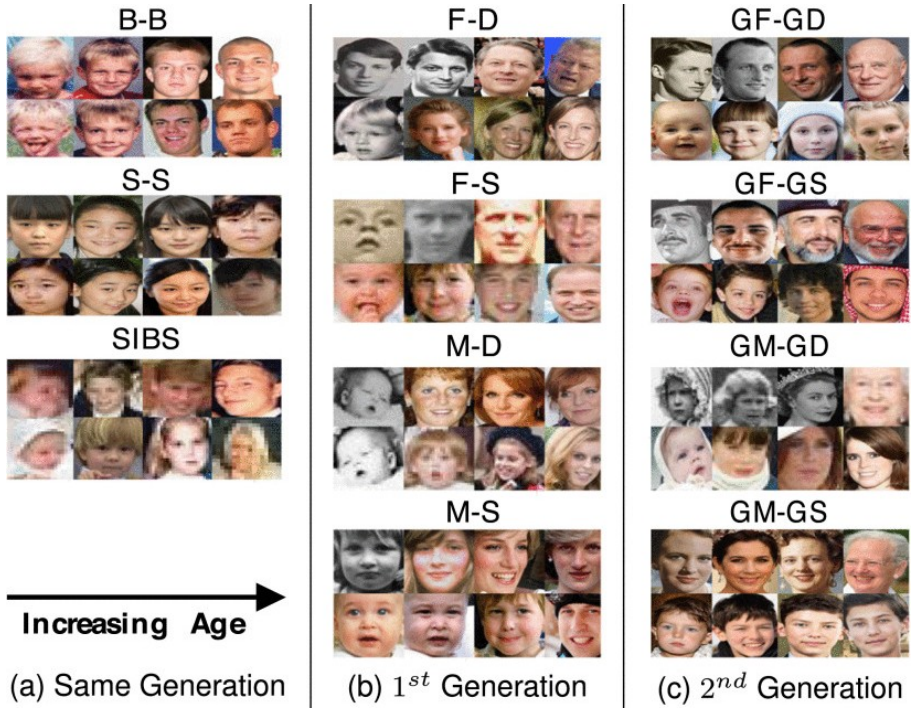
Challenges

1. Hidden factors of visual similarities/differences between blood relatives are complex and less discriminant and a factor of age and time.
2. Similarities between different generations are sparse as the previous generation gets older due to aging and difference in food habits.
3. There are some exterior attributes to faces like facial hair, spectacles, ornaments etc which can result in false positives when determining kinship between two persons with similar materialistic attributes.
4. Computation Issues: There can be numerous kinship combination possible in a graph of people in the test leading to requirement of huge computations in kinship queries.

Datasets

Families In the Wild (FIW) Dataset from NorthEastern University with over 13,000 family photos of 1,000 family trees with 4-to-38 members with labelled kinship among family members.

1. FIW has 10,676 distinct people of various ages with 30,725 faces.
2. 11 kinships in the dataset -



This dataset will be used during training and family photos of group members will be used during testing to verify the results produced.

Proposed Methodology

The entire pipeline is divided into 4 modules -

1. Face extraction and labelling of images in test folder using FaceNet or MTCNN.
2. Forming a graph with distinct persons as node and every node connected with a 11 vector weight of the edges representing the score of kinships.
3. A deep-learning **matching** model that gives a score for each kinship between two persons which is used as the edge weights in the graph. Edges with kinship score below a threshold are discarded from the graph, to reduce computations.
4. Answer kinship queries from the generated graph like family clustering, relationship with members of photoset, relationship score of two persons etc.

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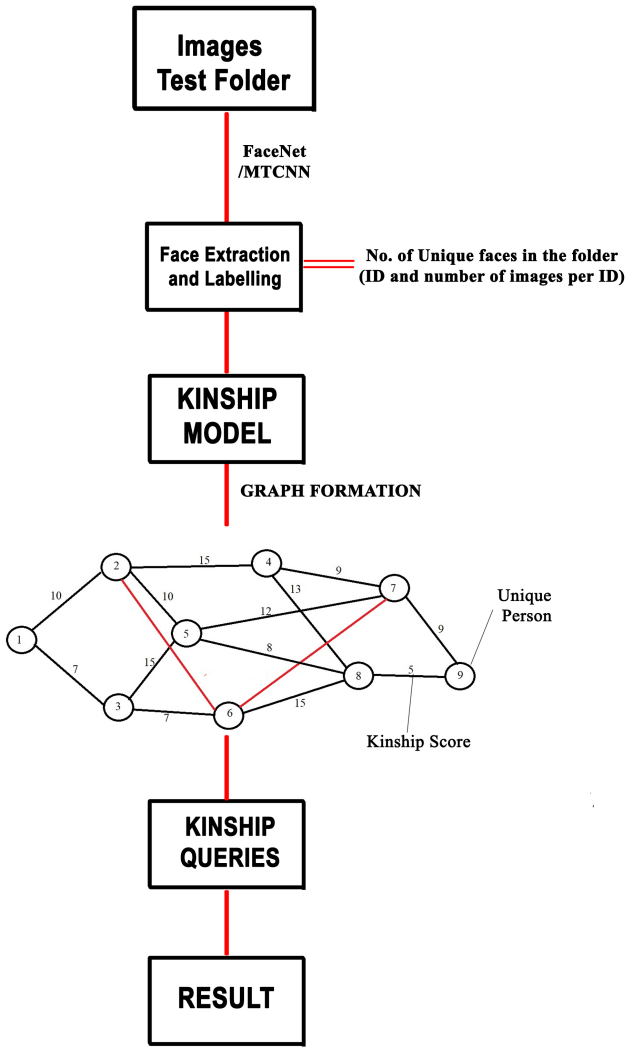
Proposed Model Flow Chart



Methodology explored

1. **Use of MTCNN to segment and crop faces of images with single and multiple persons.**
2. **Building a FaceNet model to get unique faces (Assigning each an ID and finding number of faces of each) on the ouput received from MTCNN.**
3. **Data Processing (Face Normalization to reduce intra class variation and to avoid error by scaling of image)**
4. **Training the Family classification Model and using its output for Kinship verification**

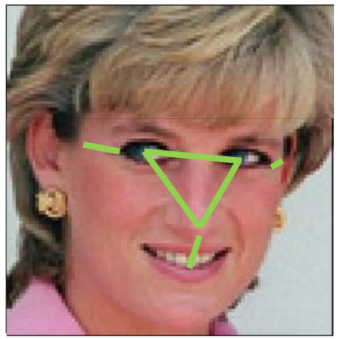
Results and their discussion

1. A lot of intra class variation was found out when the given dataset was explored. the following 2 images of the same person, one seems to be streched a lot. To deal with this problem we are passing each image(Face) before passing it to the Kinship network through Face Normalization which reduces corresponding intra class variations.

Face Normalization was done on the following metrics:-

1. Eye distance
2. Nostril to mouthLeft
3. temple to eye cornerLeft
4. eye comer to noseRight
5. temple to eye cornerRight
6. eye comer to nose

Results and their discussions contd.

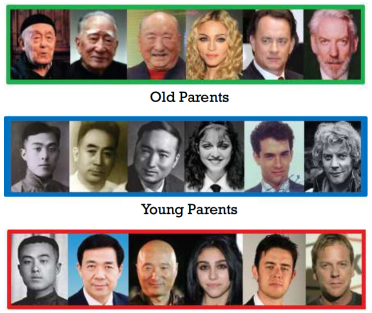


Using a FaceNet model A pre-trained model of FaceNet is used for face recognition, which will cluster all the photos in which a person is present together. But the accuracy of the model is low, which is evident by the:

1. Inter class similarities: 
2. Intra class variations: 

Conclusion and future work

1. The next step of work is to start building upon the convolutional network that would be used to give score for kinship between two person among the output provided by the Facenet.
2. Following that, the next work will be to setup an infrastructure to run the graph based queries on the graph developed based on the output of the convolutional model.
3. Final work would be to engulf three parts of the project into a single infrastructure or pipeline.
4. Improving visual kinship recognition performance by using the fact that most of children look like their parents at young ages



We wish to include that in our model to improve their relationship identification in older ages.