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.

Work Done

Visual Kinship Recognition of Families in the Wild
For Kinship Verification(a binary classification problem) a ResNet model with transfer learning using CenterFace Loss function which takes into account 3 losses:-

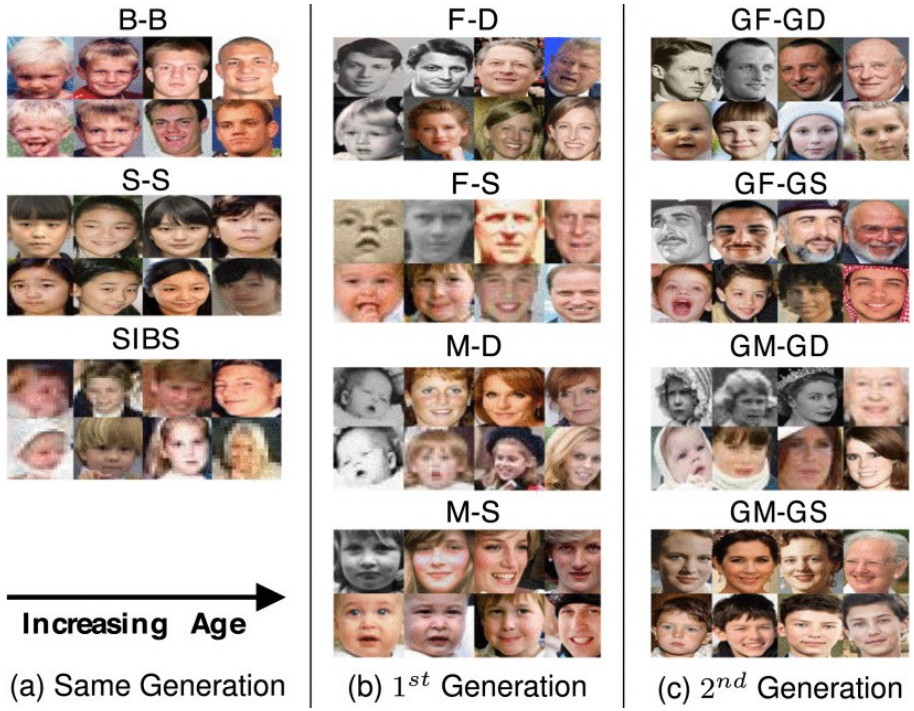
1. Softmax Loss
2. Center Loss
3. Center Invariant Loss

In order to predict, both images were run on the model and the cosine similarity was found between the output vectors which was then compared to a threshold to classify each pair as either kin or non-kin
Accuracy:- 67.87
The Paper also evaluated the dataset using SphereFace model and achieved an accuracy of **69.18**

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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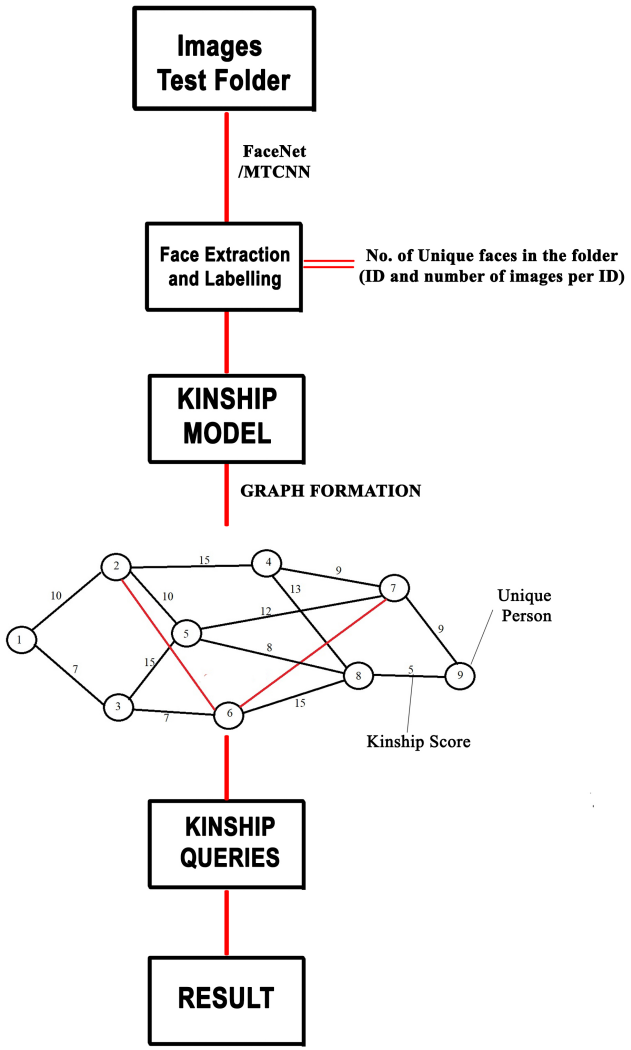
Proposed Model Flow Chart



Performance Measure

Performance of the pipeline would be measured by its performance on individual kinship queries. For different type of kinship queries a suitable accuracy measure would be used to gauge its performance.
For example for the query to determine kinship between two persons accuracy would be $\frac{correct\ kinship\ queries}{total\ kinship\ queries}$.

Performance of the kinship deep learning model would be the mean recall of the input data.