A Graph Based Approach for Naming Faces in News Photos

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Overview

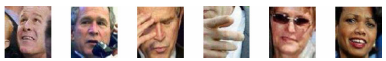
Goals:

• Face recognition on the large scale using multi modal information

• Association of names and faces for querying people in large news photo collections.

Problems:

• The usual way: search for the name of the queried person in the caption.



Sample faces associated with name ' George W. Bush'

• For larger and more realistic data sets, face recognition is difficult and error-prone due to large variations in pose, illumination and facial expression.

Assumptions:

• A person's face frequently appears around his/her name.

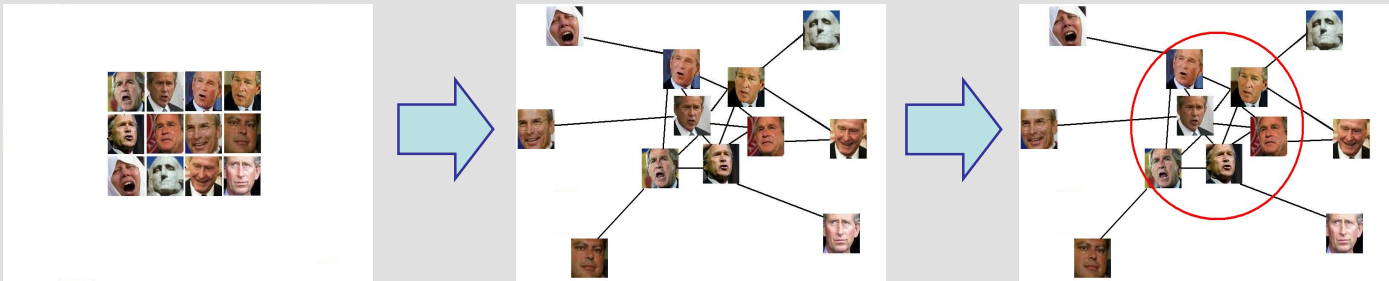
• The conditions or the poses can vary, but the different representations of the face of the same person tend to be more similar to each other than to the faces of others.

Approach

Step I: *Select all the faces associated with the query name (i.e. George W Bush).*

Step II: *Find dissimilarities among those faces and represent them in a graph structure. Nodes are faces, edge weights are dissimilarities.*

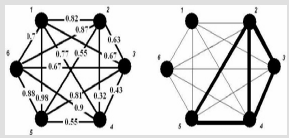
Step III: *Find the densest component in this graph, which corresponds to the faces of the queried person.*



Finding Densest Component

First, convert weighted dissimilarity graph to a binary one by using a threshold: 1 = edge, 0 = no edge

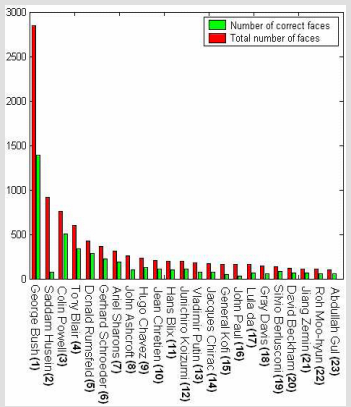
$$f(S) = \frac{|E(S)|}{|S|}$$

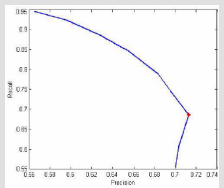


Then find subset S in G with max $f(S)$ value, where $E(S)=\{i, j \in E : i \in S, j \in S\}$ and E is the set of all edges in G. *(Charikar-APPROX'2000)*

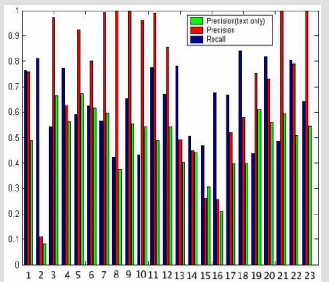
Experiments

• 30,281 detected faces from captioned news images collected from Yahoo! News. *(Berg-NISP'2004)*
• Each image is associated with a set of names. 13,292 names are used for association.
• More than half (9,609) of the names are used only once or twice.
• A particular person may be called by different names.
• In experiments, top 23 people whose name appear more than 200 times are used.





Recall-precision curve of 23 people for different thresholds used for converting the weighted dissimilarity graph to a binary one. Threshold used is marked with red.



Recall and precision values for threshold 0.575.
avg recall: 68%
avg precision: 71%
text only: 48%

Similarity Measure Between Two Faces

• Faces are represented by the interest points extracted from the images using the SIFT operator.

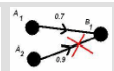
• Points on the first face are compared with the points on the second face. Initially, points having the least Euclidean distance are assumed to be the correct matches.

• Then, two constraints are applied on those matches:

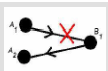
I) Geometrical Constraints presumes that the matching pair of points will be in close proximity when the normalized coordinates (the relative position of the points on the faces) are considered.

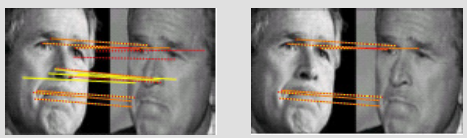
II) Unique Match Constraints eliminate *one way assignments* and *multiple assignments* to a point.

multiple assignment



one-way assignment

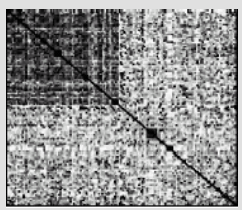




• Finally, the distance between the two faces *is defined as* the average distance of all remaining matches.

• After this elimination process, 72.6% of all possible true matches are kept (we lose only 27.3% of true matches).

• Among these assignments, a correct matching rate of 71.7% is achieved.



Dissimilarity matrix for 201 images in search space for '*Hans Blix*'. 98 of the images are true *Hans Blix* images, and are put on the top left of the matrix for visualization. Dark colors correspond to larger similarity values.

Name (Precision/Recall)

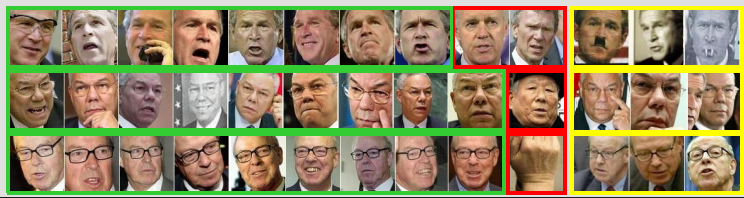
Sample faces retrieved

Not retrieved

George Bush (0.78/ 0.79)

Colin Powell (0.98/ 0.55)

Hans Blix (0.99/ 0.78)



Discussion and Future Work

•Compared to solely text-based methods, over 20% increase in precision is achieved.
•Other representations or similarity measures can also be used to construct the dissimilarity graph.
•A method, which does not violate the weighted graph property, may yield better results.