A Journey to Origin

Kinship Verification

Based on Discriminative Inherited Facial Features

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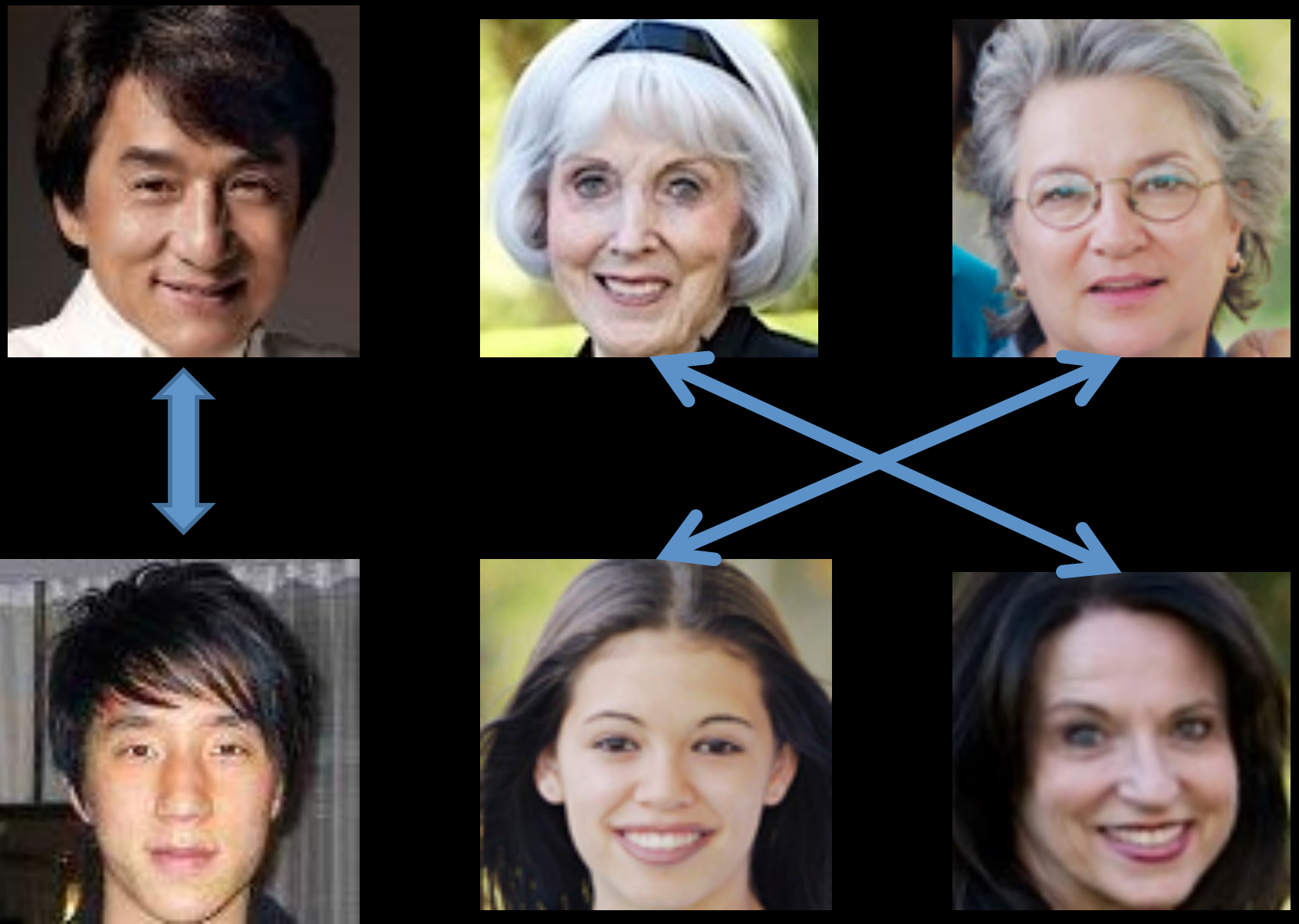
Motivation



Kinship Verification Past & Future

- Conventional parentage verification
  - ABO blood grouping type
  - PCR
  - DNA testing
- A better, faster, and affordable method?
  - Discriminative inherited facial features

HARD PROBLEM!

Database Collection

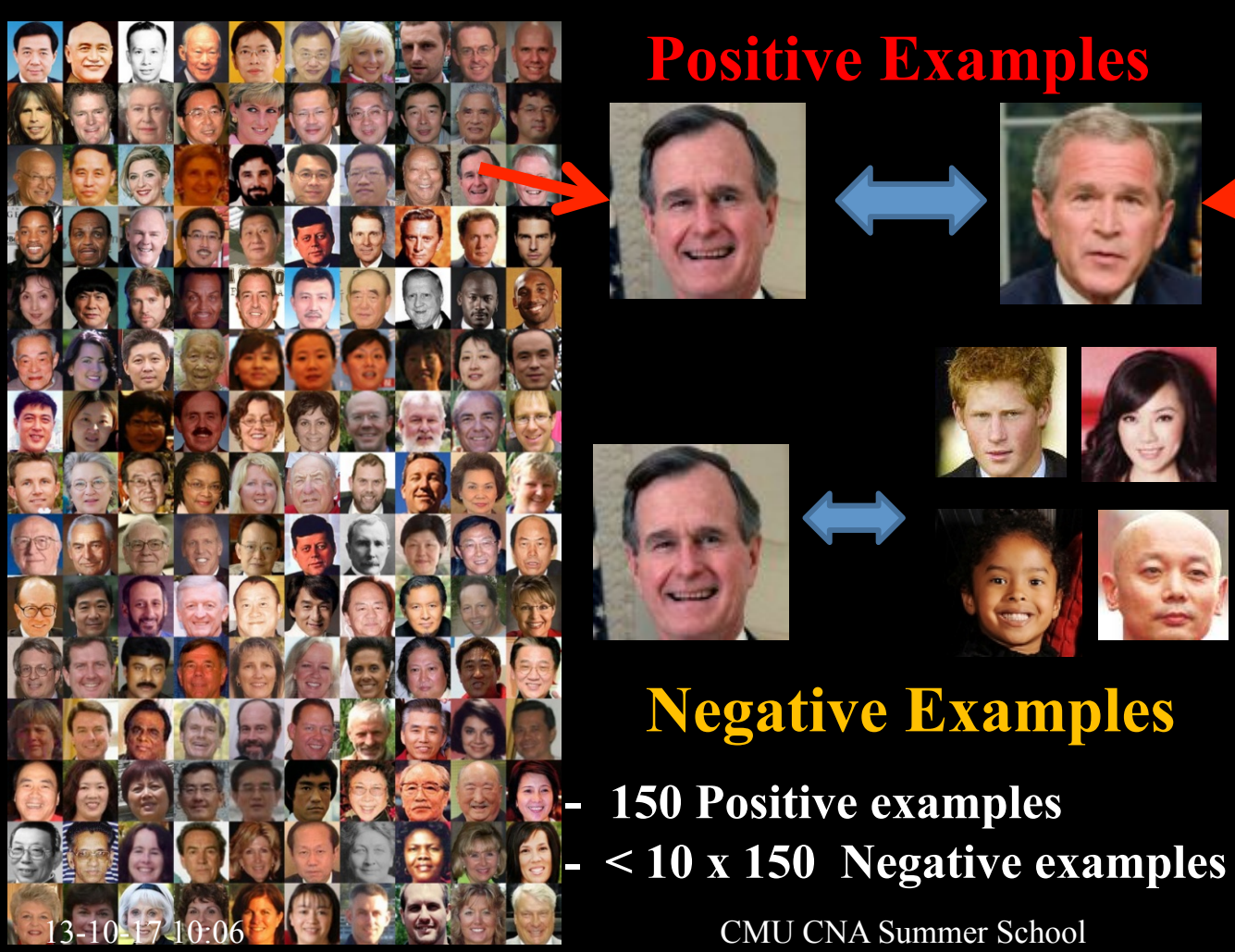
- 150 pairs of parents and children collected from Internet (celebrities, public figures, etc.)

- The database includes around 50% Caucasians, 40% Asians, 7% African Americans, and 3% others; 40% of the 200 images are father-son pairs, 22% are father-daughter, 13% are mother-son, and 26% are mother-daughter.

Has a wide spread distribution on facial characteristics which depend on race, gender, age, career, etc.

Data Preparation

- 150 pairs of parents and children collected from Internet (celebrities, public figures, etc.)



- 150 Positive examples
- < 10 x 150 Negative examples

Facial Features

- Compiled list of potentially important features

List of Compiled Features		
Color cues:	Left eyebrow length	Left ear subwindow
Skin color	Left eyebrow thickness	Right ear subwindow
Hair color	Left eyebrow size	Left cheek width
Left eye color	Right eyebrow length	Left cheek height
Right eye color	Right eyebrow thickness	Right cheek width
Left eyebrow color	Right eyebrow size	Right cheek height
Right eyebrow color	Left eyebrow subwindow	Chin shape
Facial parts features:	Right eyebrow subwindow	**Distance features:**
Left eye width	Mouth width	Eye distance
Left eye height	Upper lip thickness	Nostril to mouth
Left eye size	Lower lip thickness	Left temple to eye corner
Right eye width	Mouth subwindow	Left eye corner to nose
Right eye height	Left cheek width	Right temple to eye corner
Right eye size	Left cheek height	Right eye corner to nose
Left eye subwindow	Right cheek width	**Statistical features:**
Right eye subwindow	Right cheek height	Histogram of Gradients

Simple Facial Features

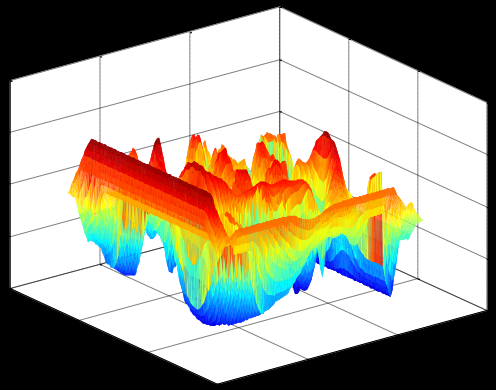
- Color cues : Skin color, hair color
  - Mode filter at predetermined locations

Skin color

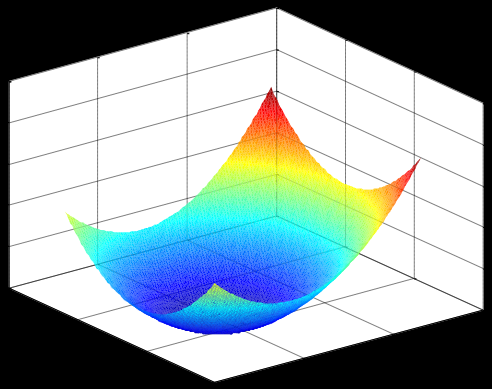
Hair color

Pictorial Structures

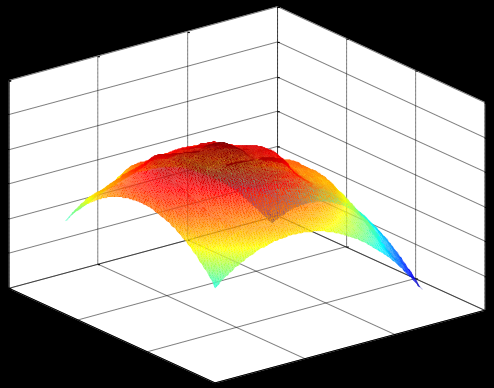
- Energy functions (match, dist, total) for left eye part



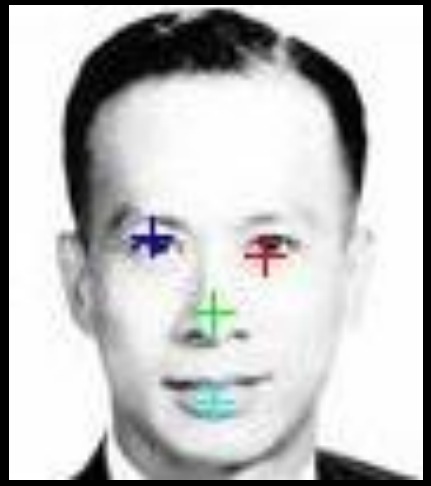
Match Energy Function



Dist Energy Function



Total Energy Function



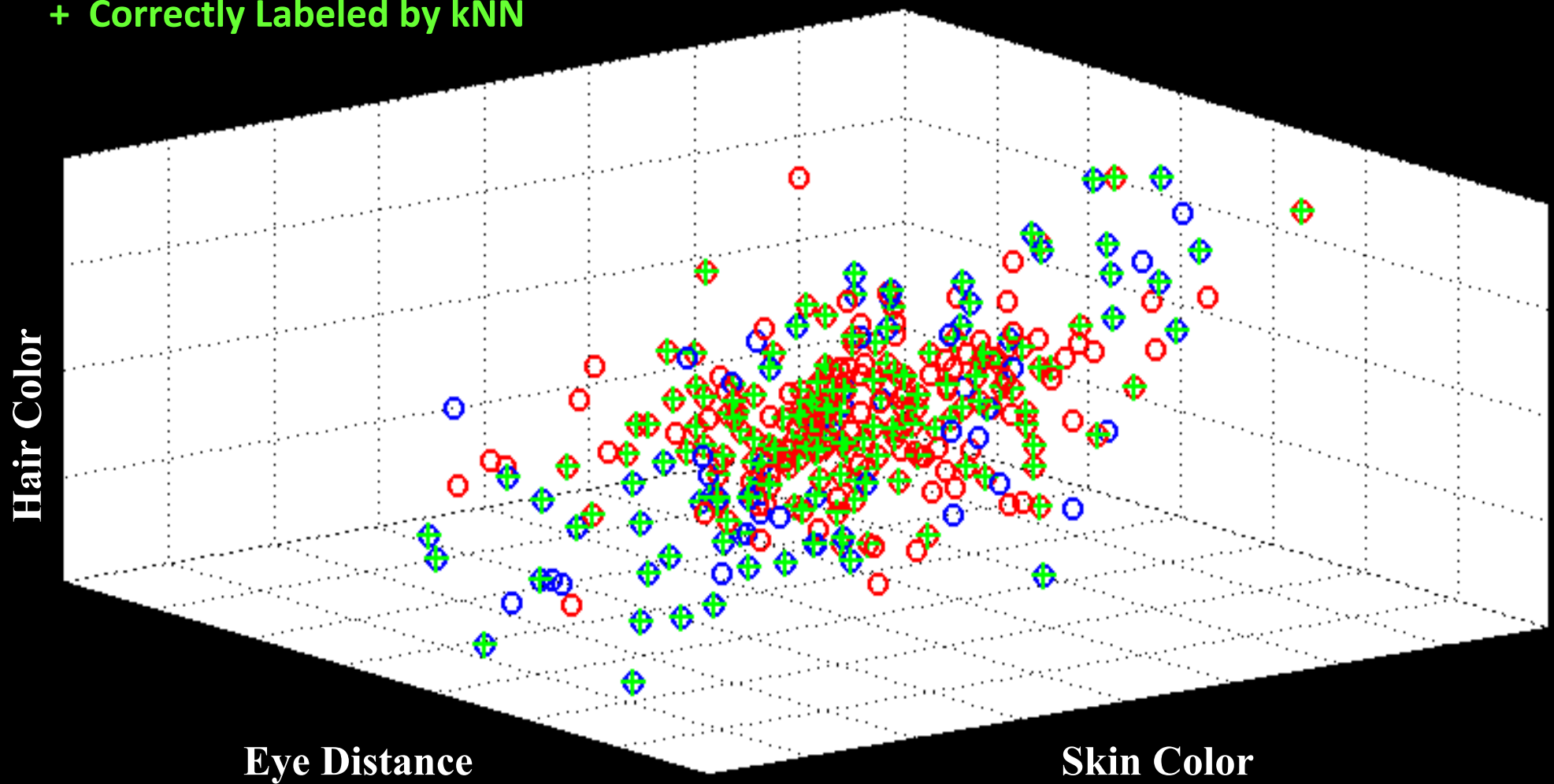
Extracted Facial Part Positions

3-D Visualization of kNN Classification

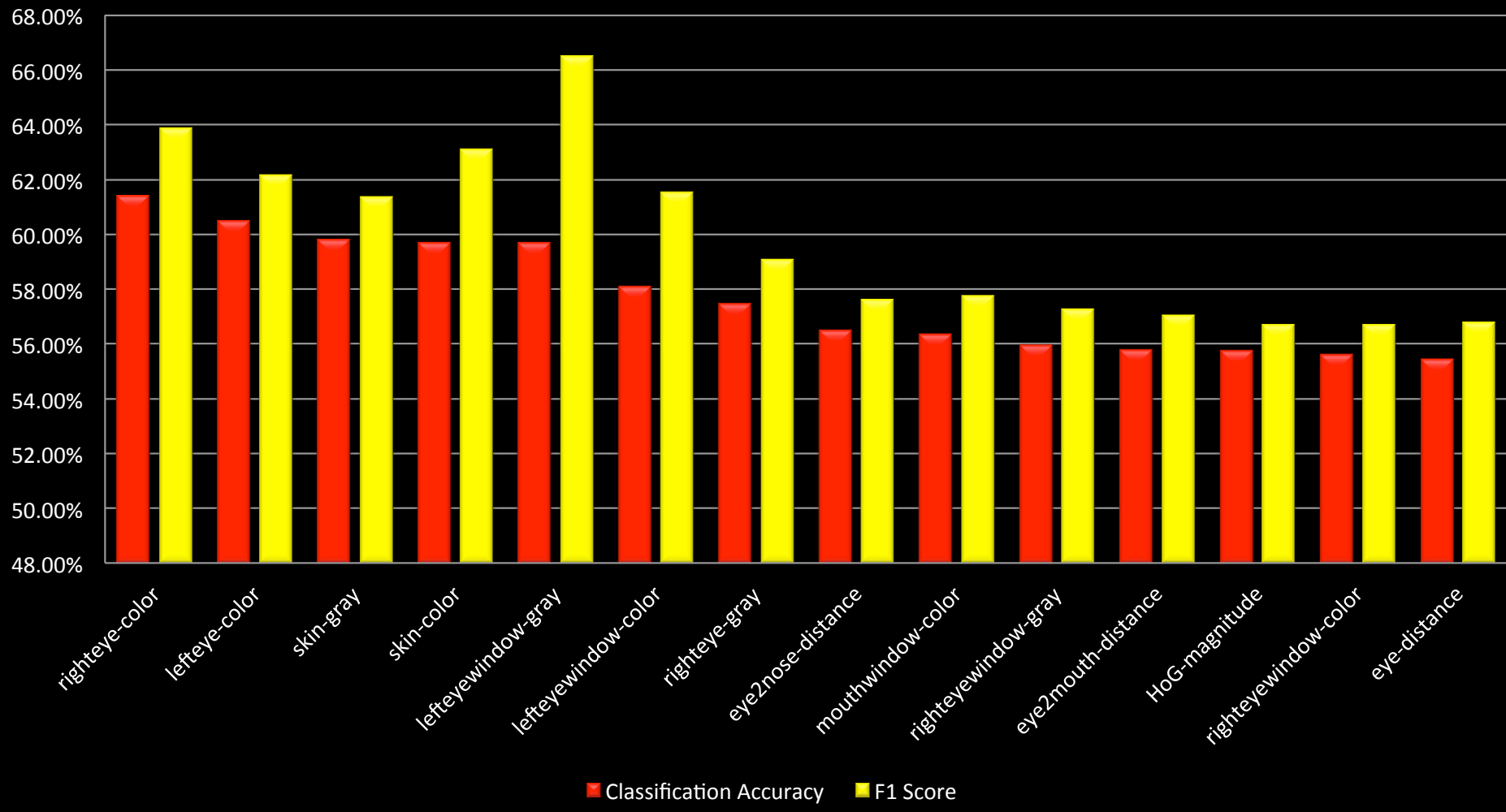
O Positive Examples

O Negative Examples

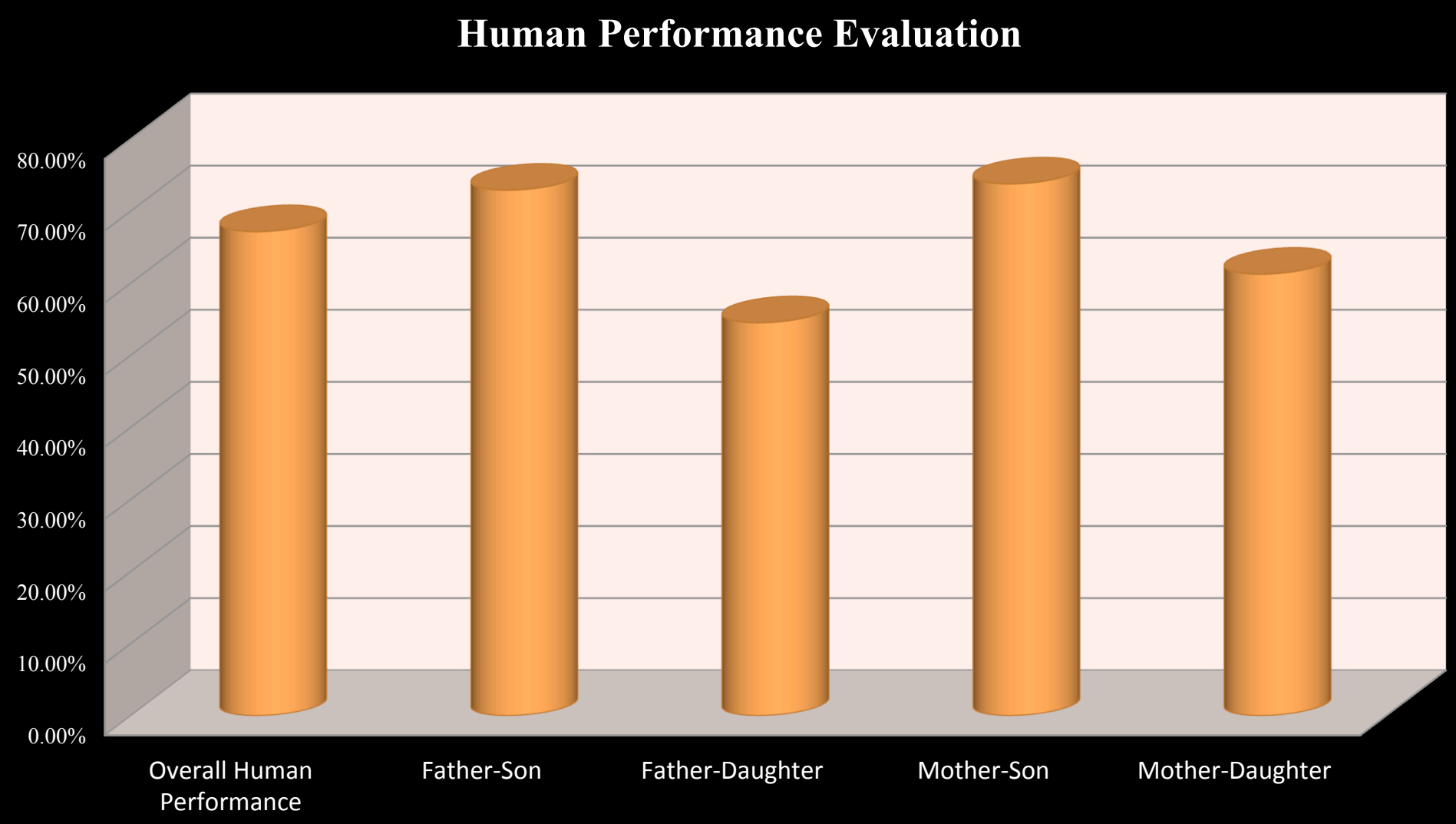
\+ Correctly Labeled by kNN



Top 14 Features & Accuracy



Computer 70.67% vs. Human 67.19%



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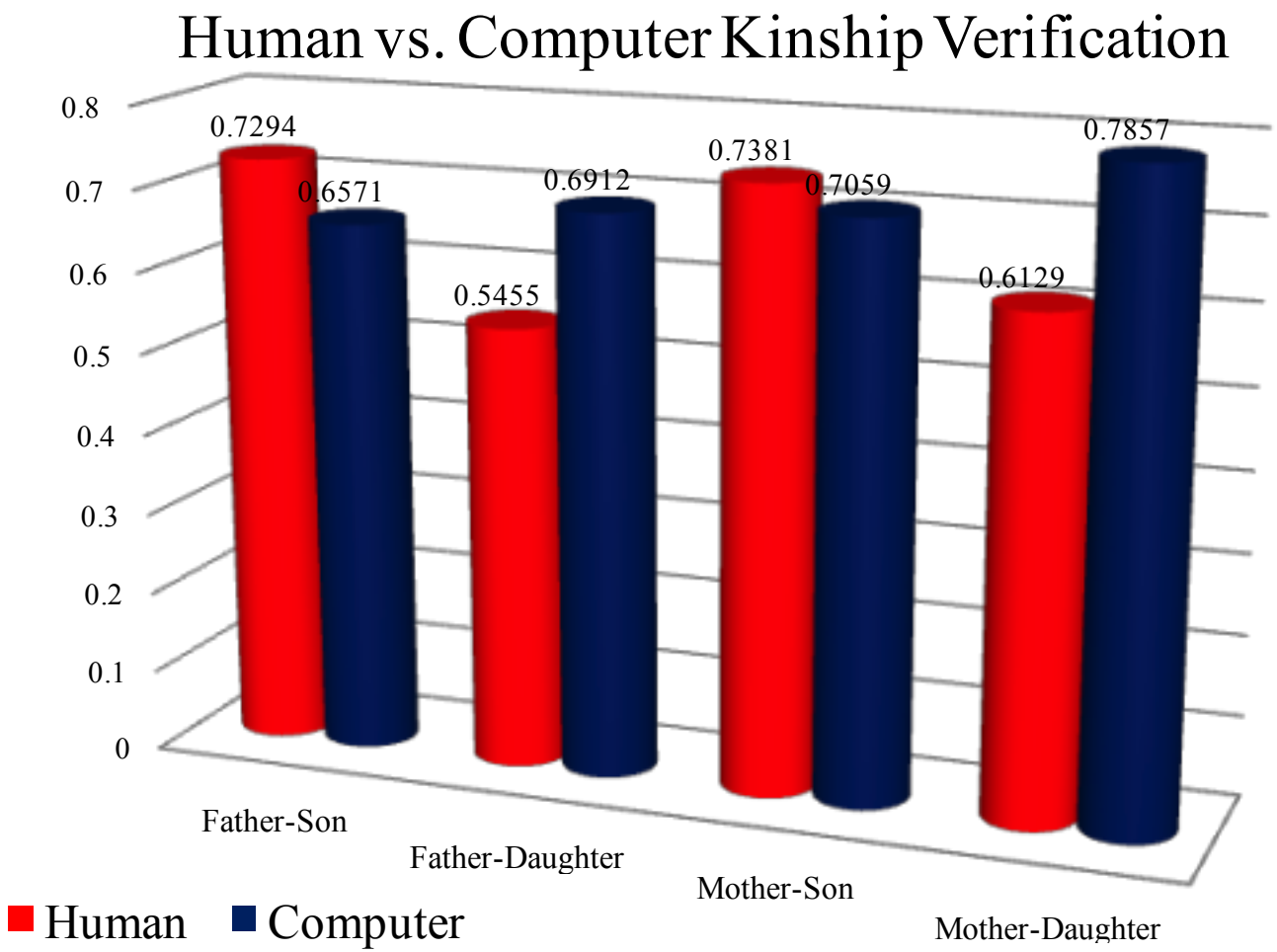

Conclusion

- Collected a large parent-child dataset of face images
- Light-load feature localization and selection methods
- Classifier training and testing
- Human performance evaluation and comparison