Transfer Learning based Evolutionary Algorithm for Face Sketch Recognition

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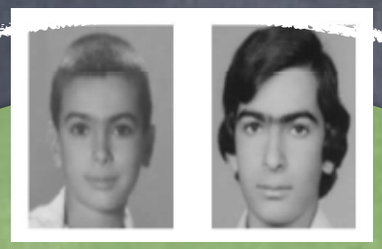
Challenges or covariates of face recognition

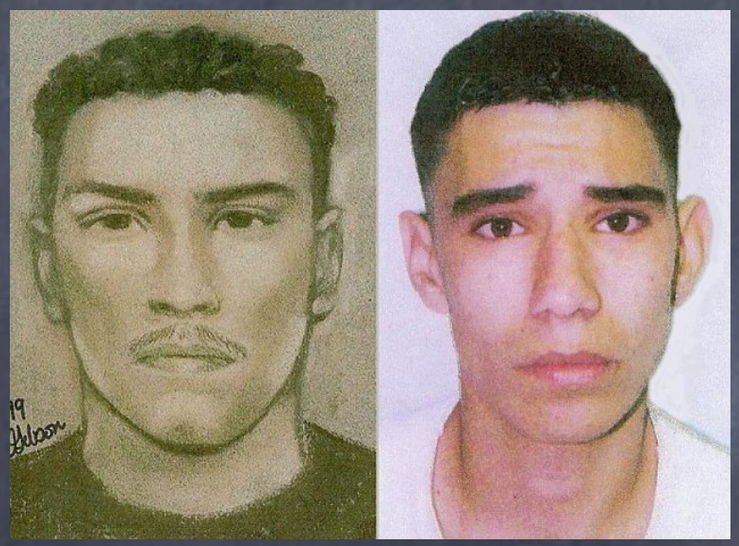
Alterations: International & Intentional



Pose, Illumination, Expression

Heterogeneity: Resolution, Spectrum, Sketch

Sketch to Digital Photo Matching

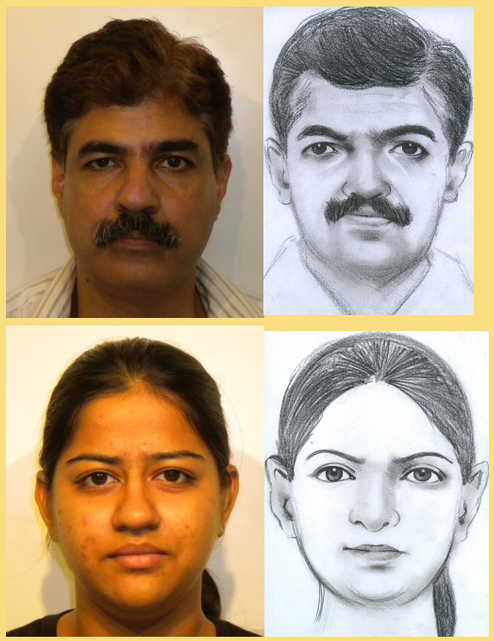


- Sketches are important in law enforcement applications

Different Types of Sketches

Digital Image | Viewed Sketch

Digital Image | Semi-Forensic Sketch



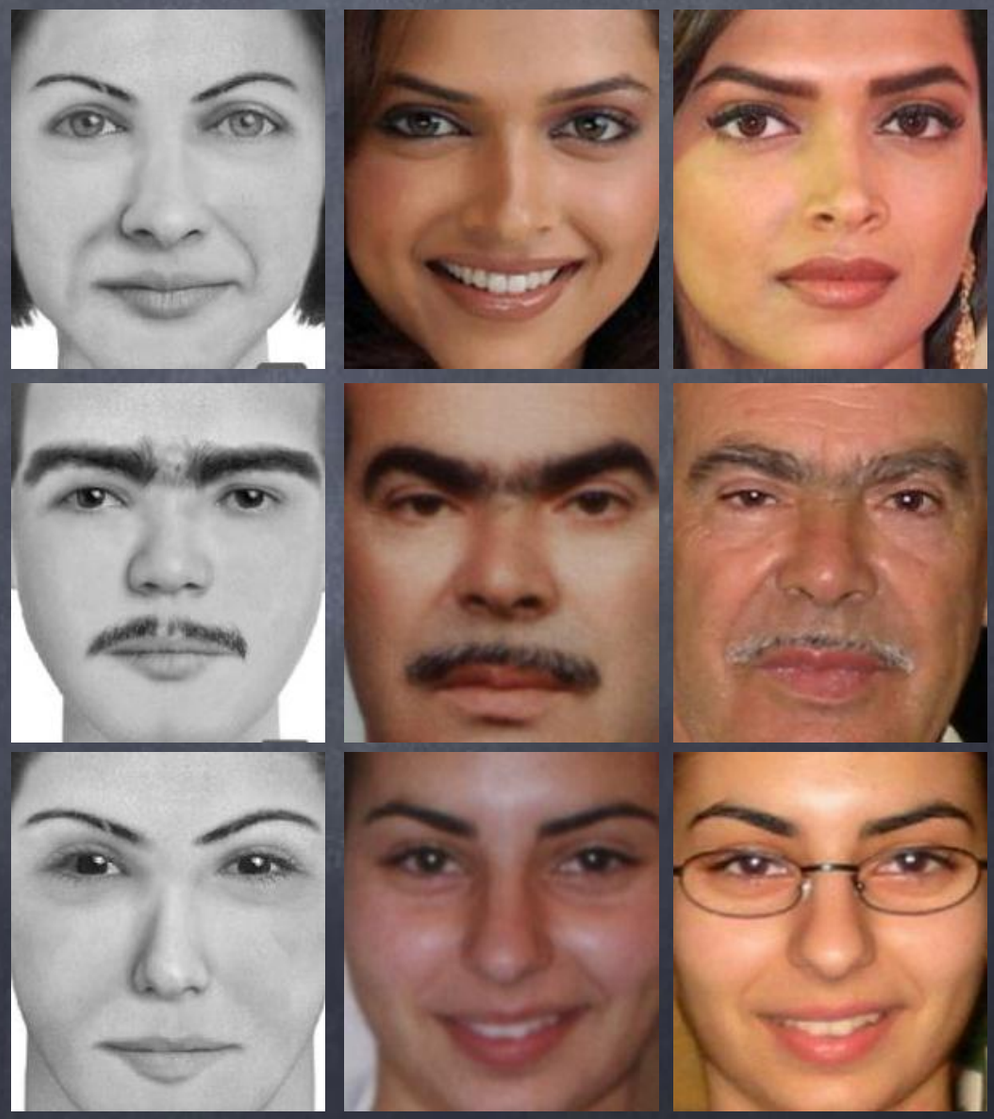
Digital Image | Forensic Sketch

Digital Image | Composite Sketch

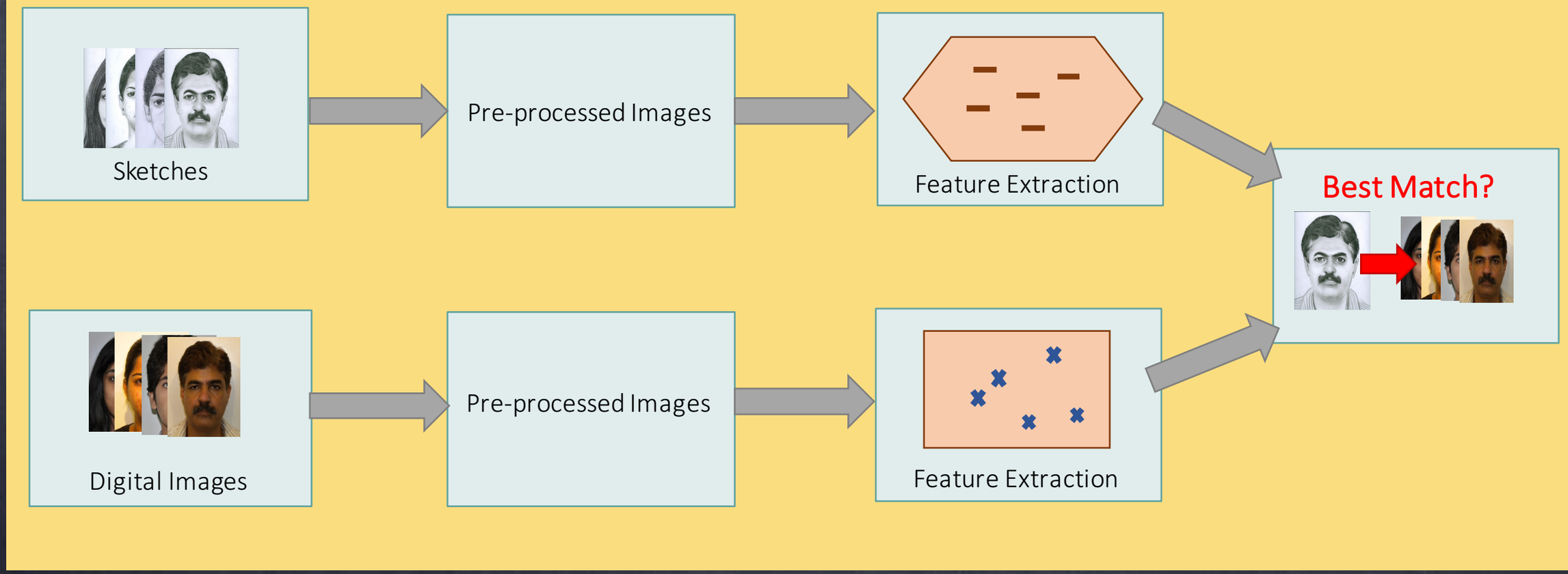
Viewed vs Semi-Forensics Matching Scenario

IIITD Composite Face Sketch Dataset

- 150 subjects
- 150 composite sketches and 300 digital face images
- One image used to create sketch image, the other used for matching
- Sketches are created using FACES software
- Dataset will be made publicly available for research



Transfer Learning based Evolutionary Algorithm



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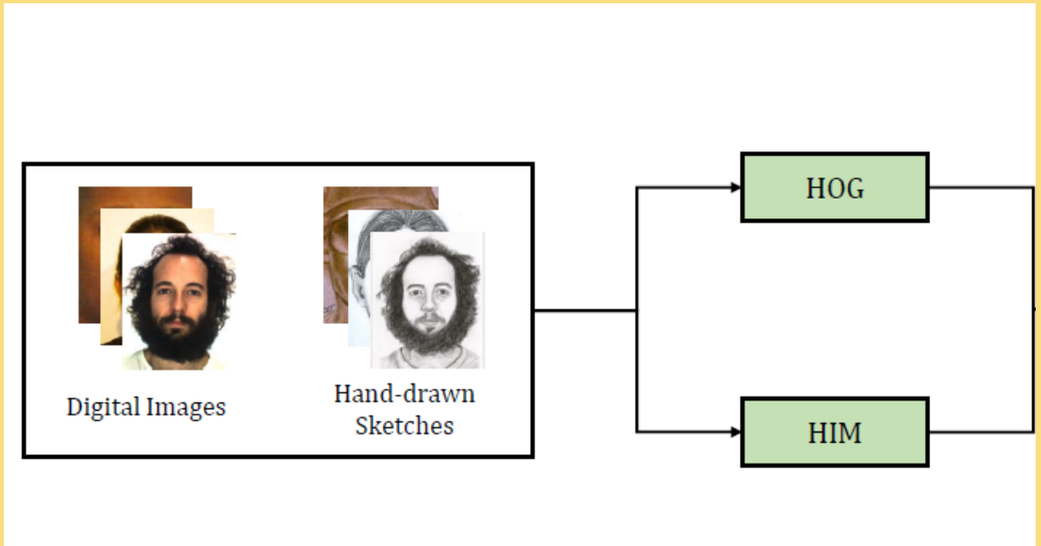

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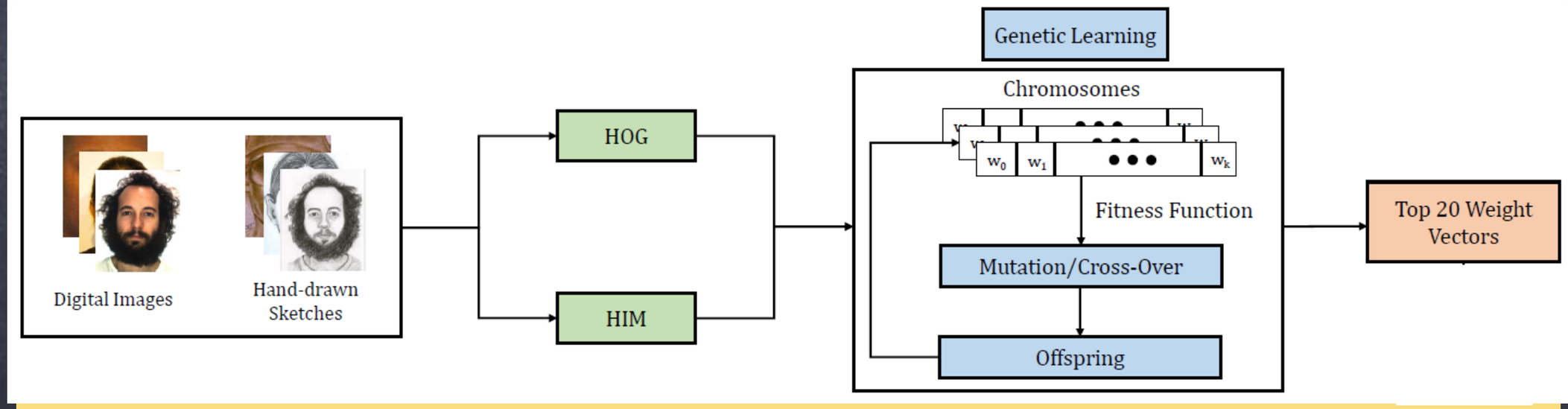

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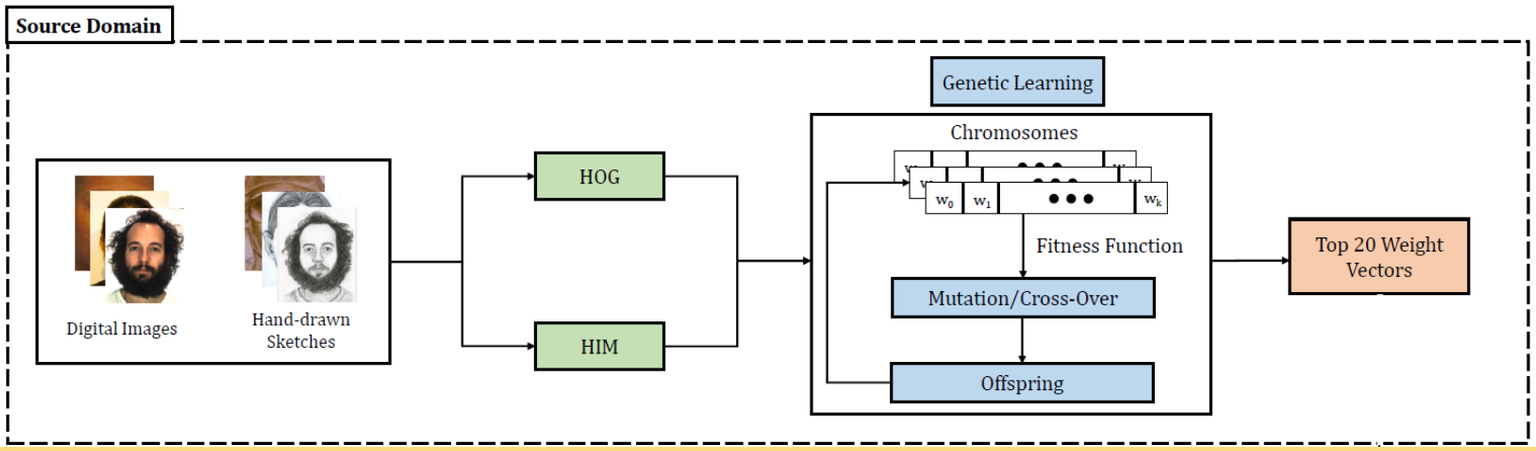

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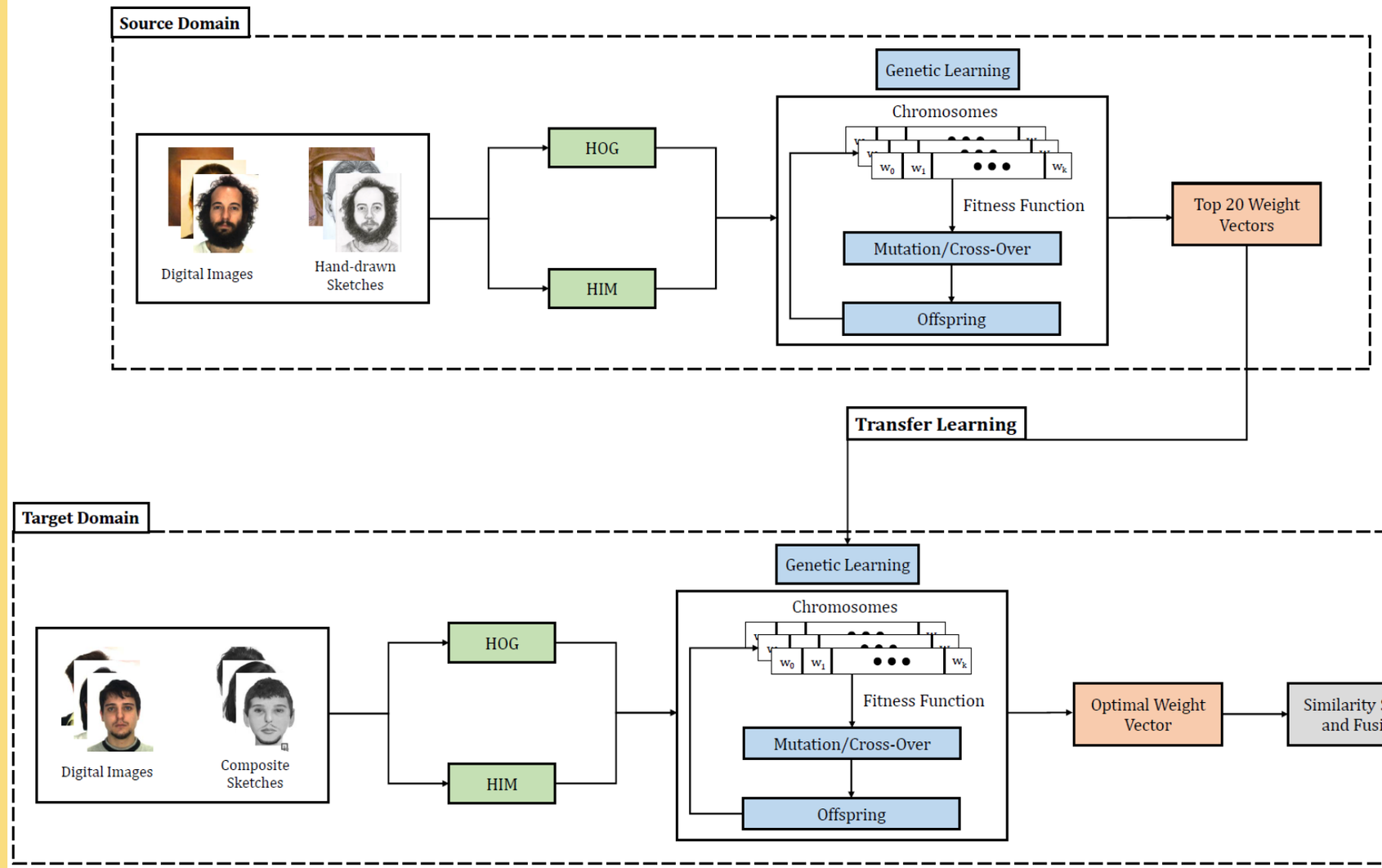
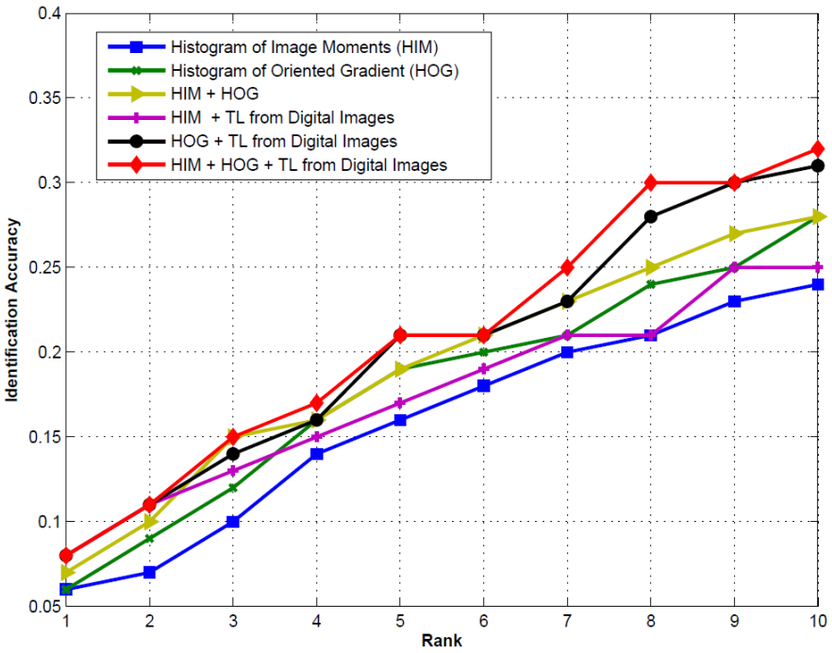


Experimental Protocol

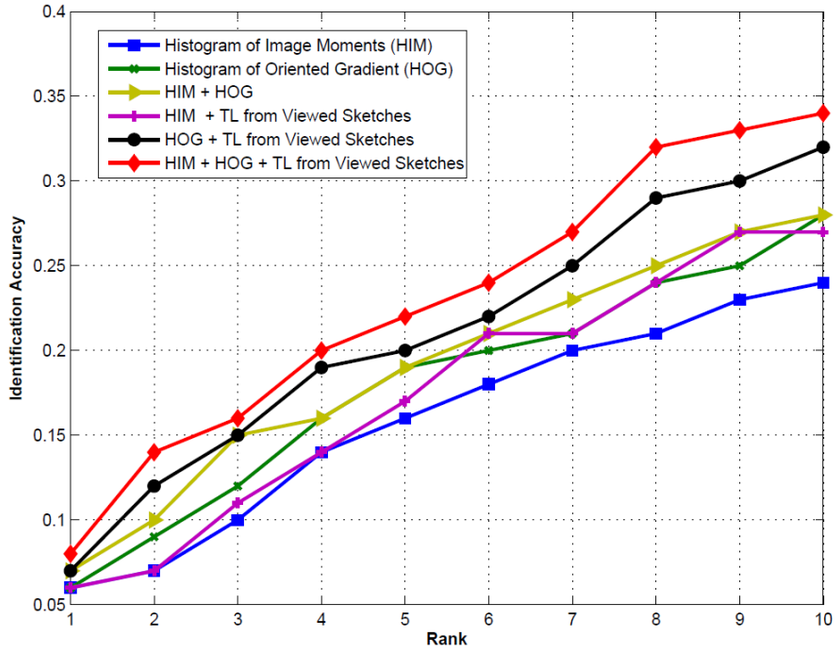
Experiment	Source Domain	Pairs in Training	Target Domain
1	Digital Image	250	Composite Sketch Images (Proposed IIITD Composite Face Sketch Database)
2	Viewed Hand Drawn Sketch	482	
3	Semi-Forensic Hand-Drawn Sketch	106	
4	Forensic Hand-Drawn Sketch	190	
5	Composite Sketch	25	

Proposed IIITD Composite Face Sketch
CMU Multi-PIE (Gross et al.)
IIIT-Delhi Sketch (Bhatt et al.)

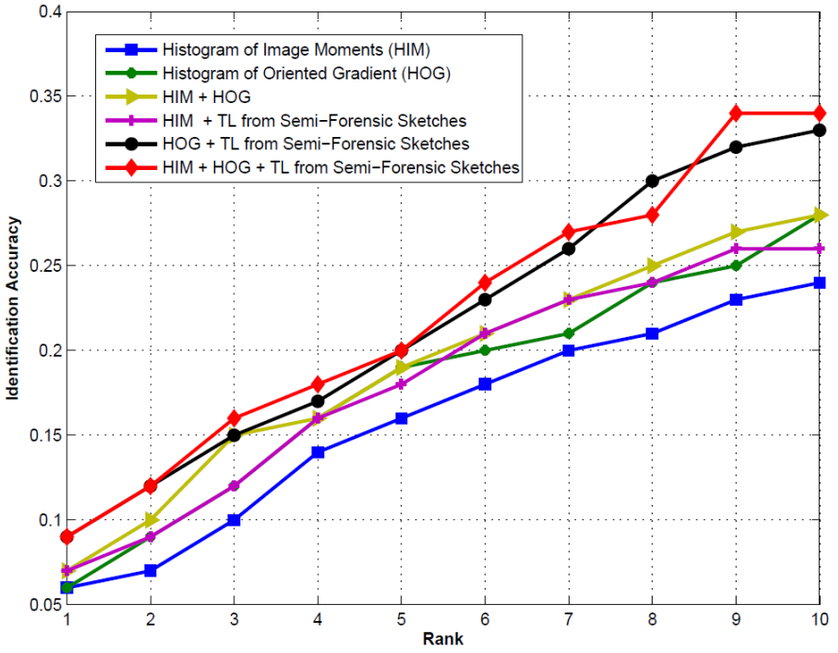
Results



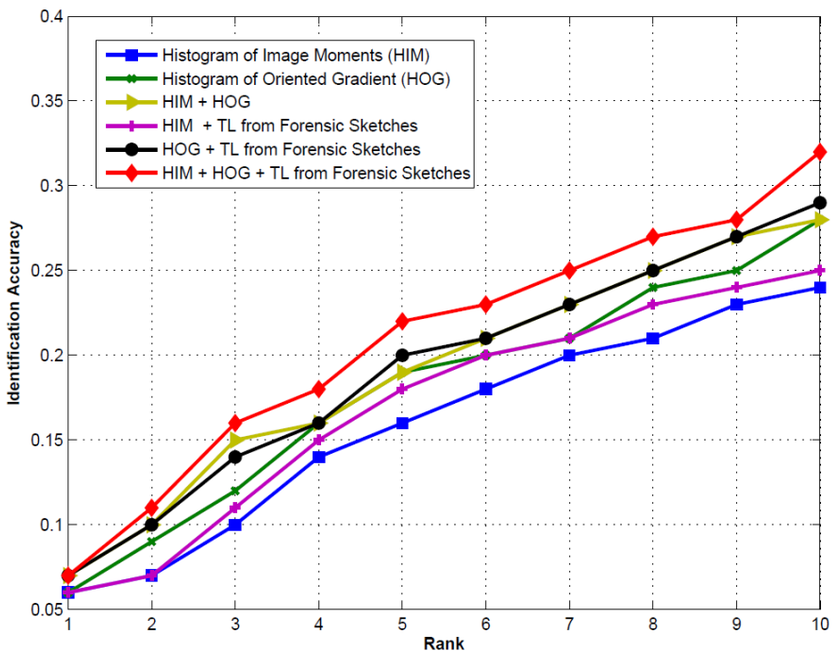
(a) Experiment 1: Digital Image



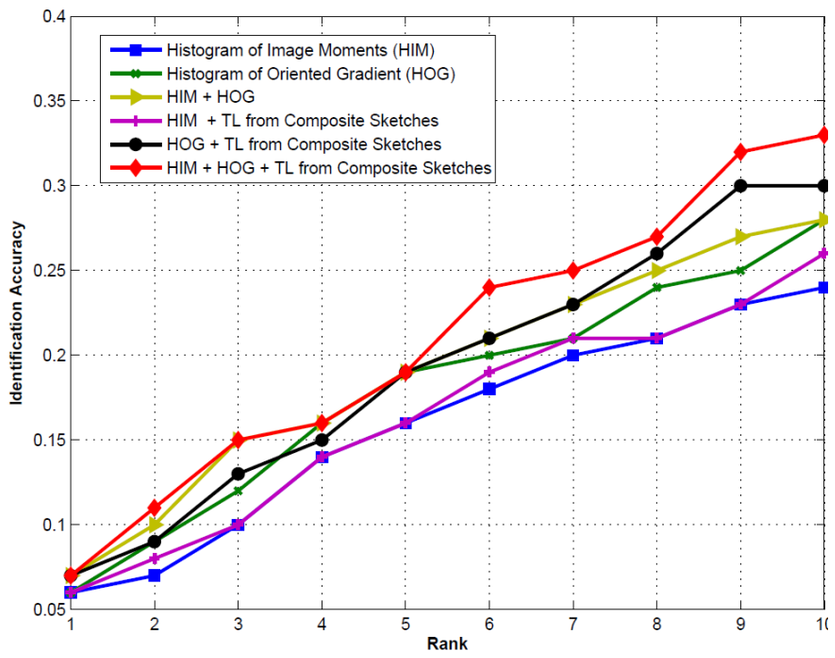
(b) Experiment 2: Viewed Image



(b) Experiment 3: Semi-Forensic Image

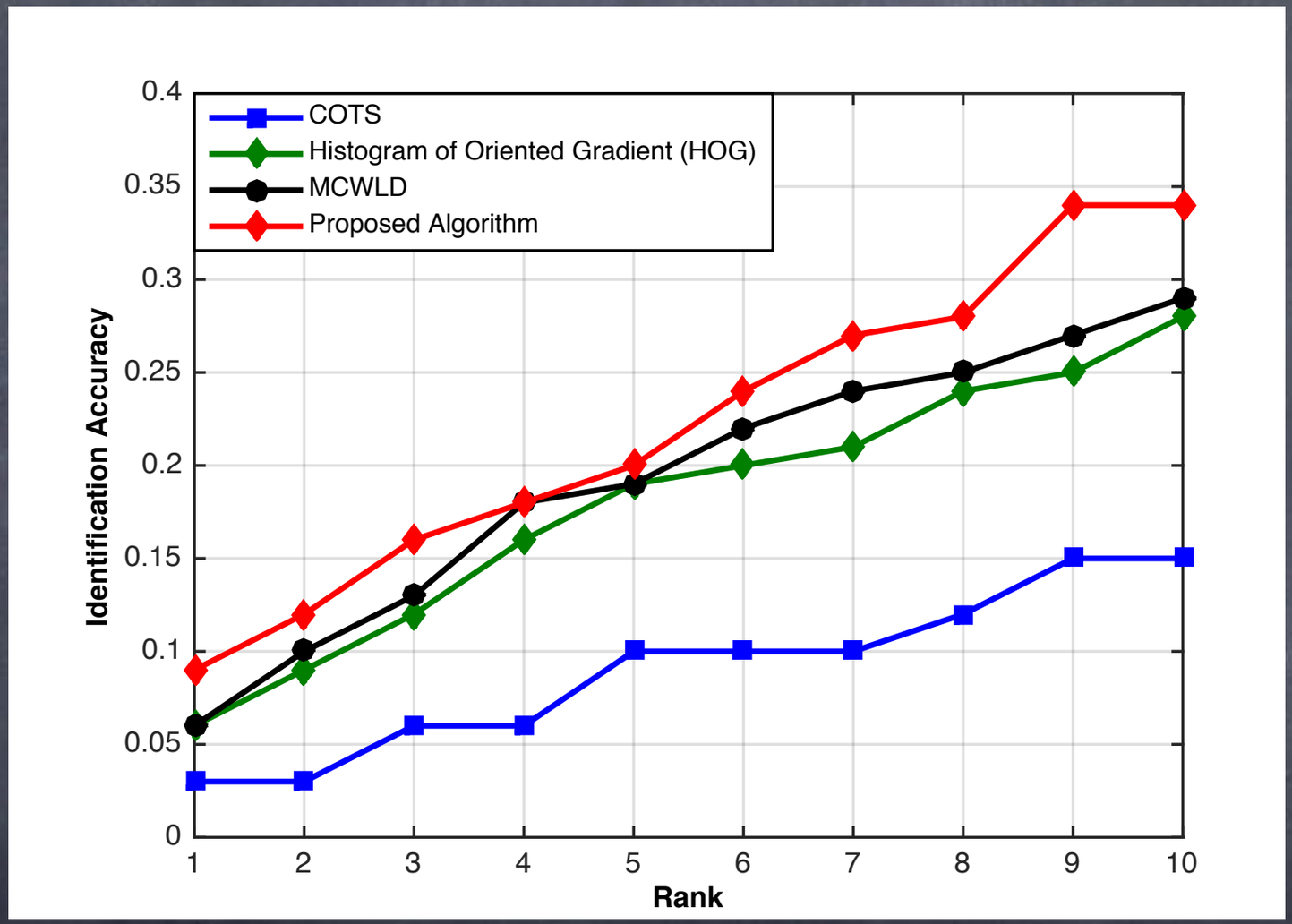


(d) Experiment 4: Forensic Image



(e) Experiment 5: Composite Image

Results



Best performing Results:
when source domain is semi-forensic sketches

Key Observations

- Rank-10 identification accuracy improves by 5-10% after applying the transfer learning technique
- Training with forensic sketches yields lower accuracy than semi-forensic sketches
- However, Rank-1 (even Rank-10) accuracy is very low

Next (Future) Step

- Try representation-learning with domain adaptation (transfer learning) for very small sample size

S. Nagpal, M. Singh, R. Singh, M. Vatsa, A. Noore, and A. Majumdar, Face Sketch Matching via Coupled Deep Transform Learning, International Conference on Computer Vision, 2017

Thank You!!!