**Introduction**

**Question:** Given a biometric image, can we tell how...?

**Solution:** Joint biometric and sensor recognition

**Application:** Remote banking on smartphones (2-FA)

**Motivation**

Surge in biometrics-based smartphone verification (iPhone X) and remote banking (expected 2.3 B users by 2023)

Existing methods use separate routines – Limited performance and generalizability

**Results**

Siamese network with single-margin contrastive loss outperformed other training routines

Best performance on face images with joint identification accuracy 99.81% @ Rank 1 (Baseline 83.13%); joint verification accuracy 100% @ 1% FMR

**Summary**

Performed one-shot learning of joint biometric-sensor template for 3 modalities with promising results

**REFERENCES**

Marsico et al., PR 2018

Boulkenafet et al., FG 2017

Li, T-IFS 2010

Bromley et al., NeurIPS 1993

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**One-Shot Representational Learning for Joint Biometric and Device Authentication**

Sudipta Banerjee and Arun Ross

**Proposed Method**

**Objective:** Capture biometric-specific and sensor-specific details simultaneously from a biometric image to create a joint representation – **Joint biometric-device authentication**

\[ J(X) = B(X) \cap S(X) \]

**Properties of joint representation:**

- Can be used for the tasks of joint identification and joint verification – Both subject and device (sensor) identities should yield correct matches
- Implicitly privacy preserving – joint template cannot be trivially de-coupled
- Lower dimensional embedding compared to biometric and sensor templates
- Will generalize to different biometric modalities and sensors (Iris-NIR & Face-VIS)

**Experiments**

<table>
<thead>
<tr>
<th>Dataset</th>
<th>#Subjects, #Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iris (CASIA Iris V2)</td>
<td>60, 2</td>
</tr>
<tr>
<td>Periocular (MICHE-I)</td>
<td>75, 7</td>
</tr>
<tr>
<td>Face (OULU-NPU)</td>
<td>55, 6</td>
</tr>
<tr>
<td><strong>Total no. of images</strong></td>
<td><strong>14,451</strong></td>
</tr>
</tbody>
</table>

**Loss**

Cross-entropy loss, Contrastive loss, Triplet loss (offline and online triplet mining), Multi-class N-pair

**Analysis**

Used Classical, Siamese and Triplet training paradigms. Analyzed varying input resolution, distance metrics and embedding dimensionality

**Baselines**

Enhanced PRNU (sensor)

COTS and ResNet-101 (biometric)