Countermeasures Against Iris Spoofing with Contact Lenses

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Threat: Patterned Contact Lenses

- Obscure natural iris pattern

- During enrollment in positive-ID (registration) applications:
  
  Create transferable identity

- During verification in negative-ID (watch list) applications:
  
  Hide true identity
Sample CL Images

color changer

color changer
CL’s under Infrared Illumination

naked  color enhancer

The New Look of Security
CL’s under Infrared Illumination

color changer

color changer

The New Look of Security.
Handpainted Contact Lens

under visible light

under infrared

The New Look of Security.
Data Collection

• 5 subjects
• 13 contact lenses
• 10 images per eye and lens

• 1300 contact lens images
• 450 naked-eye images from these and other subjects
Solution Approaches

1. Enroll known contact lenses and recognize against this list
   - Allow full 360° range of rotation
   - Allow inside-out flip

2. Detect deviation of lens pattern from natural iris patterns
   - Statistical texture analysis
Results: Lens recognition

Equal-error rate = 12%
(adjusted to 95% confidence)
Results: Lens detection

Equal-error rate = 5%
(adjusted to 95% confidence)
Summary

- Image-based detection of commercial patterned contact lenses is feasible and effective

- Can be aided during enrollment by visual inspection

- Can be complemented by hardware-based countermeasures