Efficacy of Fingerprint Modeling Using Structured Light 3D Scanning
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Overview

Our Motivation
- Validate and increase knowledge of the microscopic 3D scanning system by exploring novel applications.
- Determine if structured light 3D scanning can be used for fingerprinting.
- Investigate a potential threat of misusing technologies like 3D scanning and 3D printing for criminal activities.

Structured Light 3D Scanning (SLS)
- SLS uses one camera and one projector (Figure 1).
- Most SLS systems can’t capture microscopic details.
- We use a telecentric lens to improve accuracy when scanning microscopic objects [1].

Methods

- Scan fingerprints using SLS system (Figure 1).
- Convert 3D scan to PLY (Figure 2).
- Create watertight 3D models (Figure 3).
- 3D print resin mold and cast in PDMS and silicone.
- Scan with optical fingerprint scanner.

Results

- Fingerprint models were successfully created using 3D scanning and replication pipeline.
- Silicone and PDMS fingerprints were recognized by optical fingerprint scanner (Figure 4).
- Fingerprint phantoms were capable of matching actual fingerprints (Figure 5).

Discussion

Implications
- Potential for contactless fingerprint phantom spoofing with our method.
- Positive applications include better fingerprinting of atypical fingerprints.
- Spoofing may allow for criminal activity.

Limitations
- When testing PDMS and silicone against an optical scanner, approximate tissue optical properties of the fingerprint “phantom” can affect the clarity of ridge resolution [2].
- Motion artifacts can occur when scanning [3].

Future Work
- Examine potential for detecting spoofed fingerprints using methods such as BSIF [4].
- Test method on a broader demographic range.

References