Odontological Biometrics

**Motivation**

- Forensic odontology is a well-established 2D X-ray image analysis technique based upon the recognition of features assumed to be unique to each individual’s dental structure.
- Inspired by forensic odontology, we propose a novel 3D automated non-forensic odontological biometrics system which could operate in real-time for biometric identification and verification.
- Investigation of the temporal variability of the dental biometric data.
- Forgeability investigation.
- Recognition performance evaluation.

**Research Questions**

- Suitability of 3D optical and ultrasound imaging modalities for rapid, reproducible, and reliable capture of dental imagery.
- Suitability of the optical sensors for intra-oral application to inspect oral cavity.
- Investigation of the use of high frequency ultrasonic transducer to provide maximum depth of resolution and accuracy.
- Integration or simultaneous analysis of the optical and ultrasound imagery.
- Development of a robust biometric recognition algorithm based on tooth shapes recognizable from partially occluded 3D surface.
- Enlargement of the feature space to improve the stability of the features for dental biometrics.
- Liveness detection based on voice sample analysis, intra-oral vein and blood flow pattern in tissues, pulse detection and movement of the tongue and lips.
- Investigation of the temporal variability of the dental biometric data.
- Forgeability investigation.
- Recognition performance evaluation.

**3D Image Segmentation and Feature Extraction**

- 3D data acquisition of 3 dental casts using Bluecam optical system of Sirona GmbH.
- The system constructs the 3D surface of the dentition and generates STL dataset.
- Tooth segmentation algorithm (active contour method) is applied to the dataset.
- The relative position of each tooth to a defined reference system is calculated to compute the feature vector.

**Application Scenario**

- Unattended access control at critical infrastructures. The capture subjects are staff members who access on a daily basis, thus the biometric reference parameters can be adapted regularly.

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**Fig. 1:** Teeth segmentation of the 3D dental cast model. Source: Thomas Kronfeld