

Automated Dental Identification System (ADIS)

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Law enforcement agencies have exploited biometrics for decades as key tools in forensic identification. With the evolution in information technology and the huge volume of cases that need to be investigated by forensic specialists, automation of forensic identification became inevitable. Postmortem (PM) identification requires use of biometric characteristics that resist early decay of body tissues as well as withstand severe conditions usually encountered in mass disasters. Dental features are the best candidates for PM identification.

The Criminal Justice Information Services Division (CJIS) of the FBI includes in its strategic plan the creation of an Automated Dental Identification System (ADIS), with similar goals and objectives to its Automated Fingerprint Identification System (AFIS) but using dental/teeth characteristics instead of fingerprints. ADIS will provide automated search and matching capabilities for digitized radiographs and photographic images.

Research teams from West Virginia University (WVU), Michigan State University (MSU), and University of Miami (UM) are developing, in coordination with CJIS, a research prototype of ADIS. To this end, we are not only looking at automating the steps taken by forensic experts to examine dental radiographs of subjects. But we are also looking at intelligent analysis of radiographs in order to utilize underlying image structures that are often difficult to be assessed merely by visual examination. In order to address the challenges imposed by ADIS, we introduce and use state-of-the-art techniques from a multitude of areas that include -but not limited to- digital image processing, pattern recognition, soft-computing and internet technology [4][8].

Prototype Architecture:

Prototype Architecture:

The architectural design of our ADIS research prototype is depicted in Figure 1 and is discussed in further detail in [4][8]. The main components of the prototype are:

1. The Preprocessing Server: this component is being developed by the research teams at WVU, MSU and UM and is primarily responsible for cropping dental records into dental films, enhance grayscale contrast of films, classify films into Bitewing, Periapical, and Panoramic views, segment teeth regions from films, extract teeth contours, and annotate teeth segments with labels corresponding to their location [1][3][5][6][7].
2. The Potential Match Server: this component is being developed by the research teams at MSU [1][3] and UM [4] and is primarily responsible for archiving and retrieval of dental records based on high-level dental features. These features include the number of teeth and shape properties of teeth among other features.
3. The Image Comparison Server: this component is being developed by the research team at WVU and is responsible for low-level tooth-to-tooth comparison of the subject case against those of candidate [1][8]. Micro decisions based on tooth-to-tooth comparisons are then combined to produce case-to-case macro decisions.
4. The Database Server: This component facilitates access to the feature database, which is used in conjunction with the potential matcher. It also provides access to the image database, which is linked with

the feature database so that each archived case has a feature record as well as an image record. Image records are used with the image comparison matcher.

The ADIS Server: This component acts as the access point to the application from the outside world and provides a seamless interface with the components of ADIS.

Proposed Demo:

We will illustrate the operation of the prototype ADIS as an instance of a flexible integrated environment, which may be configured to use different component realizations, to probe outputs of components, and to test the overall performance of system as well as its individual components. Some components may require excessive time to complete their operations, and for the sake of the demo time we will abridge these components using playbacks of their executions.

References

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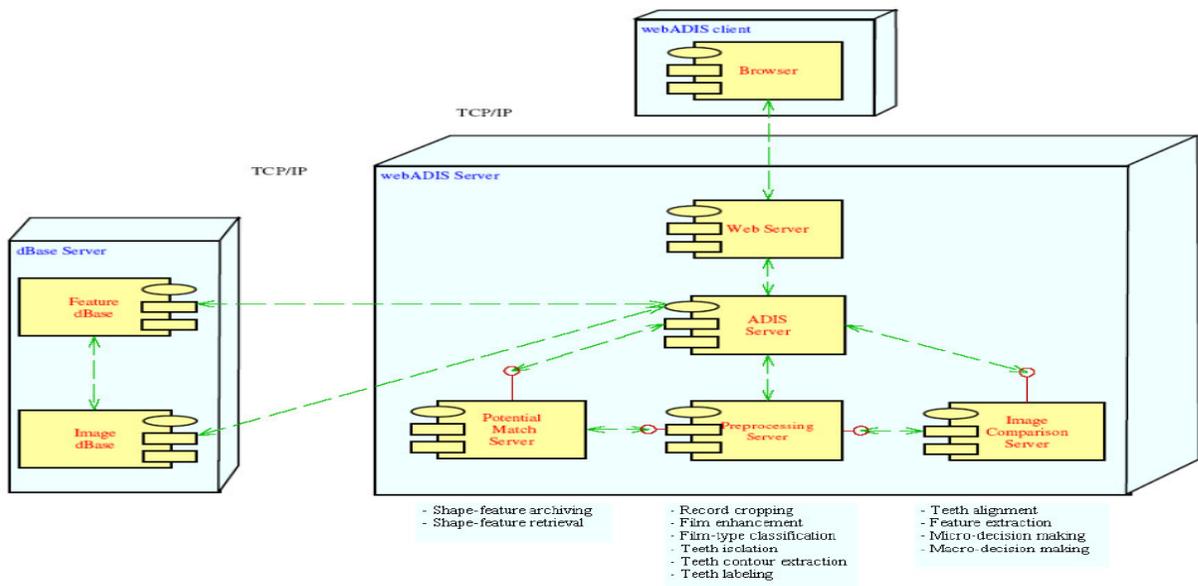


Figure 1: Architecture of webADIS; the web accessible ADIS environment.