SOFTWARE REQUIREMENTS SPECIFICATION

for

EAR LANDMARK DETECTION AND CONVEX HULL EXTRACTION

Group 1.0

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1 Introduction

1.1 Project Purpose

The purpose of an ear landmark detection and convex hull extraction project can vary depending on the specific application or context. Here are some possible purposes:

Biometric identification: The unique shape and features of an individual's ear can be used as a biometric identifier, similar to fingerprints or facial recognition. Landmark detection and convex hull extraction can be used to extract important features from ear images that can then be used for identification purposes. Medical diagnosis: Cer-

tain medical conditions can affect the shape or structure of the ear, and detecting these changes can help with diagnosis and treatment. Landmark detection and convex hull extraction can be used to accurately measure and analyze the shape and features of the ear.

Anthropological research: The study of ear morphology can provide insights into human evolution and development. Landmark detection and convex hull extraction can help researchers accurately measure and analyze the shape and features of the ear across different populations and time periods.

Biomechanics research: Understanding the mechanics of how the ear functions can have applications in areas such as audiology, speech pathology, and even robotics. Landmark detection and convex hull extraction can help researchers accurately measure and analyze the shape and features of the ear to better understand its biomechanics.

Overall, the purpose of an ear landmark detection and convex hull extraction project is to accurately analyze and extract important features from ear images for various applications and contexts.

1.2 Project Scope

The scope of an ear landmark detection and convex hull extraction project includes collecting and preprocessing ear image data, identifying landmarks and extracting the

convex hull, analyzing features, and exploring various applications and use cases. This involves finding key points on the ear image, extracting features, and analyzing them for purposes such as biometric identification, medical diagnosis, anthropological research, or biomechanics research.

1.3 Overview

The ear landmark detection and convex hull extraction project uses computer vision to identify key points and extract the minimum enclosing convex shape from ear images for analysis. It involves collecting and preprocessing data, identifying landmarks and extracting the convex hull, analyzing features, and exploring various applications. The project aims to extract important features from ear images for different purposes.

2 Overall Description

2.1 Product Functions

The product functions of the ear landmark detection and convex hull extraction project include the following:

Image preprocessing: This function involves preparing the ear images for analysis by applying various techniques such as noise reduction, image enhancement, and normalization.

Landmark detection: This function involves identifying key points or landmarks on the ear image that can be used for further analysis. These landmarks could include points on the helix, lobule, tragus, or antitragus.

Convex hull extraction: This function involves finding the minimum enclosing convex polygon or shape that covers all the landmarks identified in step 2. This convex hull can be used to extract important features from the ear image, such as its size and shape.

Feature extraction and analysis: This function involves extracting various features from the ear image using the landmarks and convex hull, and analyzing these features for various applications and contexts.

Graphical user interface (GUI): This function provides a user-friendly interface that enables users to visualize and interact with the ear images and analysis results.

Security and privacy: This function ensures that the software complies with relevant regulations and standards and protects the confidentiality and integrity of the data, especially if it is used for biometric identification or medical diagnosis.

Overall, the product functions of the ear landmark detection and convex hull extraction project enable accurate and efficient analysis of ear images for various purposes, while ensuring user-friendliness, security, and privacy

2.2 User Problem Statement

Users, such as researchers, medical professionals, and biometric identification experts, face the challenge of accurately analyzing ear images for various purposes. The current methods for identifying key points and extracting features from ear images are often time-consuming, error-prone, and require specialized expertise. As a result, users require a user-friendly software tool that can accurately detect landmarks and extract convex hulls from ear images, and provide a graphical user interface (GUI) to visualize and interact with the results. Additionally, users require a system that ensures the security and privacy of the data, especially if it is used for biometric identification or medical diagnosis.

2.3 User Objectives

The user objectives for the ear landmark detection and convex hull extraction project can be described as follows:

Accurate and efficient analysis of ear images: Users require a software tool that can accurately detect landmarks and extract convex hulls from ear images, and provide a reliable analysis of features such as size, shape, and texture.

User-friendly interface: Users require a graphical user interface (GUI) that is easy to use and navigate, and allows for visualizing and interacting with the ear images and analysis results.

Scalability and adaptability: Users require a software tool that is scalable and adaptable to different use cases and applications, and can handle large volumes of data.

Compliance with regulations and standards: Users require a system that ensures compliance with relevant regulations and standards, and protects the confidentiality and integrity of the data, especially if it is used for biometric identification or medical diagnosis.

Time and cost-effectiveness: Users require a software tool that is time and cost-effective, and reduces the need for specialized expertise and resources.

Overall, the user objectives for the ear landmark detection and convex hull extraction project aim to provide users with an accurate, efficient, user-friendly, scalable, adaptable, and compliant software tool for analyzing ear images for various purposes.

2.4 Constraints

Data quality: The accuracy of the analysis heavily relies on the quality of the input data. Poor quality images may result in inaccurate landmark detection and convex hull extraction, and ultimately affect the reliability of the analysis.

Computational resources: The performance of the software tool is dependent on the computational resources available. Large datasets may require significant computational resources, which can limit the scalability and adaptability of the software tool.

Availability of data: Access to ear image datasets for training and validation of the software tool may be limited, especially if the dataset is not publicly available or if there are restrictions on its use.

3 System Features And Requirements

3.1 Functional Requirements

The functional requirements for an ear landmark detection and convex hull extraction project could include:

Image input: The system should be able to accept input images of ears from various sources, including cameras, scanners, and pre-existing image files.

Image processing: The system should be able to process the input image to detect the landmarks and extract the convex hull. This may involve techniques such as edge detection, feature extraction, and pattern recognition.

Landmark detection: The system should be able to identify and locate specific landmarks on the ear, such as the helix, antihelix, and tragus. These landmarks will serve as the basis for further analysis and feature extraction.

Convex hull extraction: The system should be able to extract the convex hull of the ear, which is the smallest convex polygon that contains all of the landmarks.

Visualization: The system should be able to display the input image along with the identified landmarks and extracted convex hull.

Accuracy: The system should have a high level of accuracy in detecting the landmarks and extracting the convex hull, even in cases where the ear is partially obscured or distorted.

3.2 Interface Requirements

The interface requirements for an ear landmark detection and convex hull extraction project could include:

User interface: The system should have a user-friendly interface that allows users to upload input images, view the output results, and adjust settings as necessary.

Image preview: The system should provide a preview of the input image so that users can confirm that the correct image has been selected.

Output visualization: The system should provide a visualization of the identified landmarks and extracted convex hull overlaid on the input image.

Configuration options: The system should allow users to configure various options, such as the number of landmarks to detect, the size of the convex hull, and the level of detail in the output.

Compatibility: The system should be compatible with a range of input image formats and operating systems.

Documentation: The system should provide clear and concise documentation, including user guides and technical documentation, to assist users in using the system.

Support: The system should have a support system in place, such as a helpdesk or online forum, to assist users with any issues or questions they may have.

3.3 Non-Functional Requirements

The Non-functional requirements for an ear landmark detection and convex hull extraction project could include:

Performance: The system should be able to perform the required tasks in a timely manner, with minimal latency or delay.

Scalability: The system should be able to handle a large number of input images and process them efficiently.

Reliability: The system should be reliable and consistent in its performance, with minimal downtime or errors.

Usability: The system should be easy to use, with a clear and intuitive user interface.

Security: The system should be designed with appropriate security measures to protect the privacy and confidentiality of the data being processed.

Maintainability: The system should be easy to maintain and update, with clear documentation and modular code design.

Compatibility: The system should be compatible with a range of input image formats and operating systems.

Portability: The system should be easily portable between different environments and platforms.

Accessibility: The system should be accessible to users with disabilities, including those who use screen readers or other assistive technologies.

Interoperability: The system should be able to interoperate with other software and systems, such as medical imaging software or biometric authentication systems.