**FIREACH**

**[JITCSISPRO001]**

**Facial Image Reconstruction Using Elliptical Approximation and Convex Hull**

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Description

Computer Vision along with Image processing is one of the most interesting and rapidly developing fields in computer science. It has many applications like face detection and recognition, character recognition, finger print matching, body imaging etc. One of the main application areas in image processing methods is to extract the pictorial information for human face interpretation.

Face Recognition confronts innumerable hurdles in the form of variations in lighting conditions during image capture, Occlusions, damage in facial portions due to accidents etc. The application of Facial Image Inpainting also fails when the occlusions or the deformities are present across the boundary of the object of interest (face), since the bounds for the application of the inpainting algorithm is not precisely defined. Hence recovery of the complete picture of a human face from partially occluded images is quite a challenge in Image Processing.

Facial imaging is the method of generating 3D body data of a subject. This process involves receiving one or more images of the subject from a digital imaging device (Cameras in Smartphone, tablet or PC) and applying algorithms for edge recovery of the face. Then the segments of one or more images are analysed to determine the probability that the subject is located in the segment. Then the process of facial imaging continues with identifying one or more distributions within each partitioned image, where each distribution relating to a property of those images is selected. Then to produce one or more unique probability maps representing the subject, the probabilities and distributions are utilized. Then followed by comparing one or more unique probability maps with a database of representations of 3D bodies is carried out to determine the best mapping between each unique probability map. Finally the representation determined from the database is used to generate 3D facial data of the subject based on the best mapping.

Product Function

From the user’s perspective, this is an application that accepts the image that is captured from any of the device on to database and runs algorithms to generate the 3D model of the face. The 3D model generated might have regenerated the dormant segments of the original image uploaded.

From the programmer’s perspective,

* This application takes image as input that is provided by the user and compares it with the multiple instances of the same persons image available in the database.
* Applies background removal algorithm (such as; canny edge detector, convex hull) to remove the background and extract facial portion of the image.
* Marks the silhouette on the image once face is recognised.
* Reconstruction of the face by Elliptical approximation method.
* Maps the 2D image to 3D model by reconstruction for dormant or missing segment of the face.
* All these factors fitting in a user friendly interface.

Assumptions and Dependencies

Based on the algorithms used for facial image reconstruction and facial image recognition

* The image provided as input should at least have face exposed up to 60%-70% for reconstruction.
* To recognize the facial part in the image at least 3 of the facial salient features.
* The facial image should have at least 10% difference in light intensity with its background.

WORK FLOW

IMAGE

SCENE BUILDER

JAVA FXML

* Canny edge detector.
* Background removal.
* Silhouette marking.
* Extraction of face.
* Applying symmetry.
* Replacing the missing part of the face.

APPLICATION

3D MODEL

3D MODELING OF THE 2D IMAGE

User Interface

The user interface is very minimalistic with a simple dialog box containing a “load/browse” button to load the image from the file system. And it has a “submit” button to submit the selected image as the input to the software.

Hardware Interface

The software can be run on any PC, but basically we need:

* Digital Camera
* Memory
* RAM with Minimum of 2GB
* Photo Capturing Device
* GPU(Graphical Processing Unit)
* Other, basic computer components like mouse, keyboard, etc.

Software Interface

The software interface comprises of all basic software built in to the O.S,

Other than that the specific requirements are:

* Java JDK for running basic application.
* Scene Builder for providing user UI.

External Resource Requirements

Hardware Requirements

* Digital Image Capturing Devices (Digital camera, Smart Phones, Web Cams, etc.).
* Computer with minimum configurations and basic hardware’s.
* At least 90 GB memory storage.

Software Requirements

* Windows 7+ Operating system.
* Java JDK latest version.
* IDE for java (Eclipse Mars 2[recommended]).
* Image viewer.
* Open CV Image Processor Library Kit Latest version.
* Scene Builder Latest version.

Functional Requirements

* Image Handling Function
* To recognize facial image.
* To detect percentage of occlusion in the image.
* Convex Hull system
* To draw the shape of the occluded part of the image.
* Elliptical approximation for finding facial portion.
* 2D to 3D Conversion
* To map the 2D image with a 3D model.
* Later reconstruct the missing facial part.
* Providing Better User Interface
* Using a scene builder application for providing user interface.

Non-Functional Requirements

* Efficiency -
* In order to analyse statistical process for estimating the relationships among the variables through elliptical approximation.
* Accuracy –
* As with the bonding between elliptical boundaries through agile procedure to end up with a final face reconstruction accurately.
* Delay Handling –
* It defer to put off the later time or to postpone, that means to maintain the status until the completion.

Future Scope for Development

* To provide 3D model of the face with various skin tone and other facial features modification functions as simulation.
* To enhance the user interface to make all the functionalities of the application easily accessible.