Gesture Based Tool for Sterile Browsing of Radiology Images

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1. ABSTRACT

In this application we have used gestures to browse images that have been obtained during radiology. Gestures refer to non-verbal form of communication that have been defined using hands.

A major challenge involved in this approach is to provide doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work. Keyboards and pointing devices, such as a mouse, are today's principal method of human-computer interaction.

However, the use of computer keyboards and mouse by doctors and nurses in intensive care units (ICUs) is a common method for spreading infections. Humans can recognize body and sign language easily. This is possible due to the combination of vision and synaptic interactions thatwere formed along brain development.

In order to replicate this skill in computers, some problems need to be solved: how to separate objects of interest in images and which image capture technology and classification technique are more appropriate, among others. In this project Gesture based Desktop automation, First the model is trained pre trained on the images of different hand gestures, such as a showing numbers with fingers as 1,2,3,4. This model uses the integrated webcam to capture the video frame. isResized into (400,400), 5 - image is converted into grayscale etc.

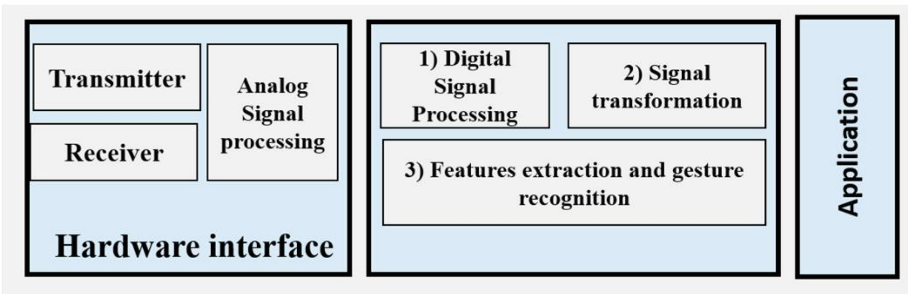
1.1 PURPOSE

It is used to browse through the images obtained using radiology using hand gestures rather than using mouse, keyboard, etc thereby maintaining sterility. The image of the gesture captured in the video frame is compared with the Pre-trained model and thegesture is identified. If the gesture predicts is 0 - then images is converted into rectangle, 1 -image is Resized into (200,200), 2 - image is rotated by -45°, 3 - image is blurred, 4 – image. In two brain surgeries at the Neurosurgery, procedures were observed by the authors to gain insights about the use of current technologies and how they affect the quality of the surgeon’s performance. We found that: (a) surgeons kept their focus of attention between the patient and the surgical point of interest on the touch-screen navigation system; (b) a short distance between the surgeon and the patient was maintained during most of the surgery; (c) the surgeon had to move close to the main control wall to discuss and browse through the patient’s MRI images.

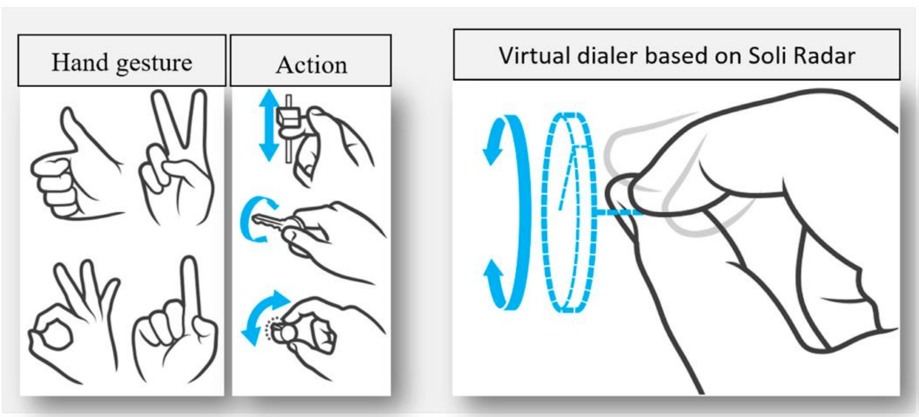
2. LITERATURE SURVEY

2.1 A Gesture-based Tool for Sterile Browsing of Radiology Images - research paper by nationallibrary of medicine

The hand gesture control system "*Gestix*" developed by the authors helped the doctor to remain in place during the entire operation, without any need to move to the main control wall since all the commands were performed using hand gestures.The sterile gesture interface consists of a Canon VC-C4 camera, whose pan/tilt/zoom can be initially set using an infrared (IR) remote. This camera is placed just over a large flat screen monitor .
Additionally, an Intel Pentium IV, (600MHz, OS: Windows XP) with a Matrox Standard II video-capturing device is used.



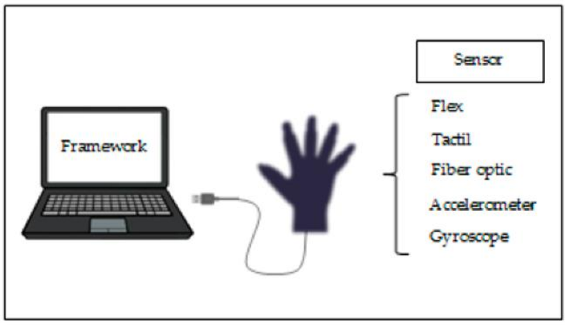
(a)



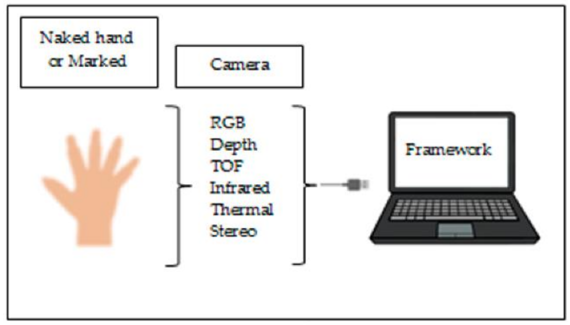
(b)

The "*Gibson*" image browser is a 3D visualization medical tool that enables examination of images, such as: MRIs, CT scans and X-rays. The images are arranged over a multiple layer 3D cylinder. The image of interest is found through rotating the cylinder in the four cardinal directions. To interface the gesture recognition routines with the "*Gibson*" system, information such as the centroid of the hand, its size, and orientation are used to enable screen operations in the "*Gibson*" graphical user interface.

3. PROPOSED SYSTEM



(a)



(b)

Approach 1: Tracking Algorithm:

After a short calibration process, where a probability color model of the doctor's hand is built, images of the surgeon's hand gesturing are acquired by video-camera and each image is back-projected using a color model. The hand is then tracked by an algorithm which segments it from the background using the color model back-projection and motion cues.7 This is followed by black/white thresholding, and a sequence of opening and closing morphological operations resulting in a set of components (blobs) in the image. The location of the hand is represented by the 2D coordinates of the centroid of the biggest blob in the current image.

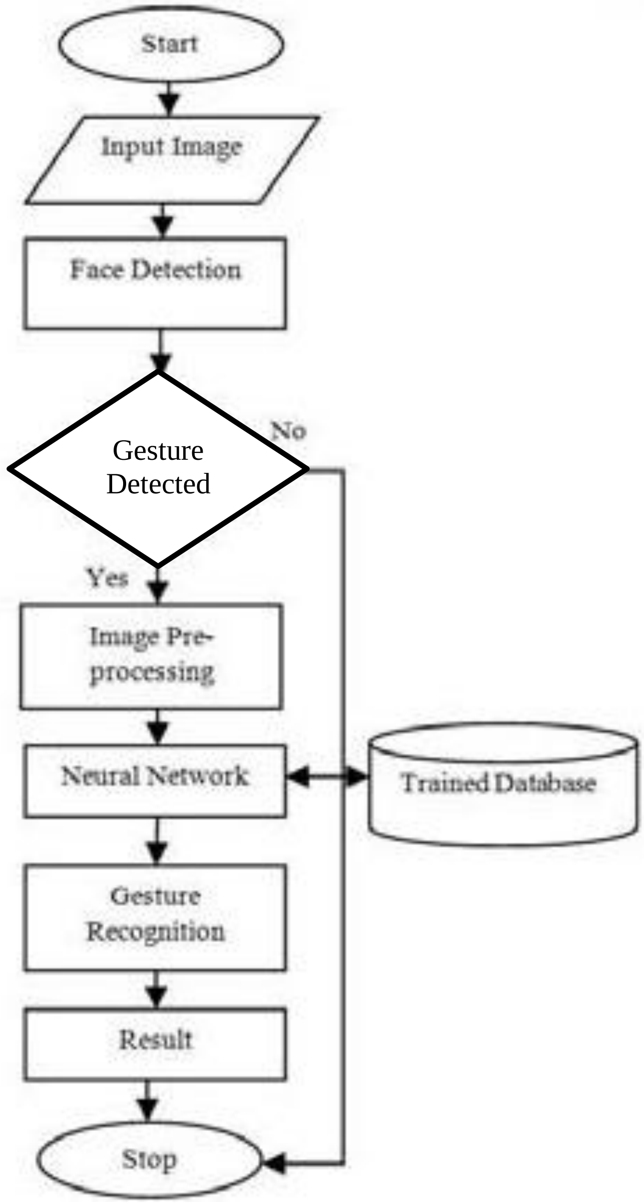
Approach 2: Gibson Image Browser:

The "Gibson" image browser is a 3D visualization medical tool that enables examination of images, such as: MRIs, CT scans and X-rays. The images are arranged over a multiple layer 3D cylinder. The image of interest is found through rotating the cylinder in the four cardinal directions. To interface the gesture recognition routines with the "Gibson" system, information such as the centroid of the hand, its size, and orientation are used to enable screen operations in the "Gibson" graphical user interface.

Approach 3: Hand Tracking and Operation Modes:

Gesture operations are initiated by a calibration mode in which a skin color model of the user's hand or glove, under local lighting, is constructed. In a browse mode, superimposed over the image of the camera's scene is a rectangular frame called the "neutral area." Movements of the hand across its boundary constitute directional browser commands. When a doctor/surgeon wishes to browse the image database, the hand is moved rapidly out of the "neutral area" toward any of four directions, and then back again. When such a movement is detected, the displayed image is moved off the screen and replaced by a neighbor image. To evoke a zoom mode, the open palm of the hand is rotated within the "neutral area" clockwise/counterclockwise (zoom-in/zoom-out). To avoid the tracking of unintentional gestures, the user may enter a "sleep mode" by dropping the hand. To re-arouse the system the user waves the hand in front of the camera. The selection of these gestures was designed to be intuitive, expressing the "natural" feeling of the user. For example, the left/right/up/down gestures evoke the actions used to turn pages in a book left/right, or flip notepad pages up/down. The rotation gesture (zoomin/zoom-out commands) reminds one of a radio knob to increase or decrease volume. Dropping the hand (stoptracking command) is associated to the idea of 'stop-playing', while the waving gesture ("wake-up" command) is associated with 'greeting a new person'.

4. FLOWCHART



➢User interacts with the UI (User Interface) to upload the image as input.

➢Depending on the different gesture inputs different operations are applied to the input image.

➢Once model analyses the gesture, the prediction with operation applied on image is showcased on the UI.

To accomplish this, we have to complete all the activities and tasks listed below:

- ❖ Data Collection.
  - ○ Collect the dataset or Create the dataset
- ❖ Data Pre processing
  - ○ Import the ImageDataGenerator library
  - ○ Configure ImageDataGenerator class
  - ○ Apply ImageDataGenerator functionality to Trainset and Testset

❖ Model Building
  ○ Import the model building Libraries
  ○ Initializing the model
  ○ Adding Input Layer
  ○ Adding Hidden Layer
  ○ Adding Output Layer
  ○ Configure the Learning Process ○ Training and testing the model
  ○ Save the Model

❖ Application Building
  ○ Create an HTML file
  ○ Build Python Code Following software, concepts and packages are used in this project

➢ Anaconda navigator

➢ Python packages:
  ○ open anaconda prompt as administrator
  ○ Type "pip install TensorFlow" (make sure you are working on python 64 bit)
  ○ Type "pip install opencv-python"
  ○ Type "pip install flask"

5. ADVANTAGES & DISADVANTAGES

Advantages:

- ✓ Major advantage of this tool is that it helps to maintain the sterility of the environment.It is also easy to use and is quicker than the existing methods to browse images.
- ✓ It can also be performed even if the surgeon is a bit far away from the system, this helps to save time.
- ✓ The tool does not need the person using it to have an apparatus or any devices on them to use it.They can simply move their hands to browse through the images.

Disadvantages:

- ✓ The tool can be quite expensive as it requires cameras and other expensive devices to captureimages and process it.

6. APPLICATIONS

This hand based gesture tool developed can be mainly used in the medical industry to browse images without compromising the sterility. However it can also be used in different industries while presenting certain ideas, duringmeetings, and can be used by teachers while teaching.

7. CONCLUSION

In this project we developed a tool which recognizes hand gestures and enables doctors to browse through radiology images using these gestures. This enables doctors and surgeons to maintain the sterility as they would not have to touch any mouse or keyboard to go through the images.
This tool is also easy to use and is quicker than the regular method of using mouse/keyboard.
It can be used regardless of the users location since they don't have to be in contact with any

device. It also does not require the user to have any device on them to use it.
Further this technology can be extended to other industries like it can be used by presenters, by teachers for show images in the classroom, etc.

8. FUTURE ENHANCEMENT

The tool can be made quicker by increasing the recognition speed.
More number of gestures can be added thereby increasing this tool's functionality and useability for different purposes.
Tracking of both hands can be added to increase the set of commands.
Voice commands can also be added to further increase the functionality.

9. BIBILOGRAPHY

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