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Music Controller Based on Hand Gestures

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Abstract: The paper provides a solution to create a method to recognize hand gestures and control music player using pattern recognition technique. It does not involve the use of any other hardware except computer equipped webcam. Hand can be used as an input device and by making its gesture understandable to computer, the music player can be controlled. The functionality is a detection mode developed to capture hand gestures and trigger event of interests, such as windows media player. Gesture Recognition uses MATLAB to emphasize on easy and swift communication using minimum tools which can be easily accessible which leads to reduction in time consumption and error scope as well as the easy operation of the system.

Keywords: Hand detection; gesture recognize; matlab image processing tool

I. INTRODUCTION

Gesture recognition is a field, in which there is large number of innovations. Gesture can be defined as a physical action, which is used to convey the information. There are various input – output devices for interacting with the computer, but now a days emphasis is given on, how to make human – computer interaction more easy going, and for that purpose, hand gesture recognition comes in light. Gestures are the way by which one can communicate non -verbally. Computer recognition of hand gestures may provide a more natural-computer interface. With the Adoption of built-in camera in laptop, mobile phone and tablet, the huge number of applications of hand detection have been designed and demonstrated. This paper demonstrates a method to recognize hand gestures based music player, based on a pattern recognition technique employing histograms of local orientation. The orientation histogram will be used as a feature vector for gesture classification and interpolation.

Hidden Markov Models (HMM) approach has been used. An HMM consists of a number of hidden states, each with a probability of transitioning from itself to another state. The transitioning probabilities are modelled as nth order Markov processes.

An important feature of the topology is that states are allowed to transition themselves. Alternatively, models based on finite state machines, have been used to capture the sequential nature of gestures by acquiring a series of states estimated from visual data to match in order, to a learned model of ordered states.

A captured image is fetched from the webcam or browsed images already stored in the computer and the image is then, pre-processed. The gesture recognized is then classified among the gestures stored and this further, commands the application controller to play the desired track in the music player.

II. GRAPHICS AND GUI PROGRAMMING

MATLAB supports developing applications with graphical user interface features. MATLAB includes GUIDE (GUI development environment) for graphically designing GUIs. It also has tightly integrated graph-plotting features. A

Matlab program can produce three-dimensional graphics using the functions surf, plot3 or mesh. In Matlab, graphical user interfaces can be programmed with the GUI design environment (GUIDE) tool.

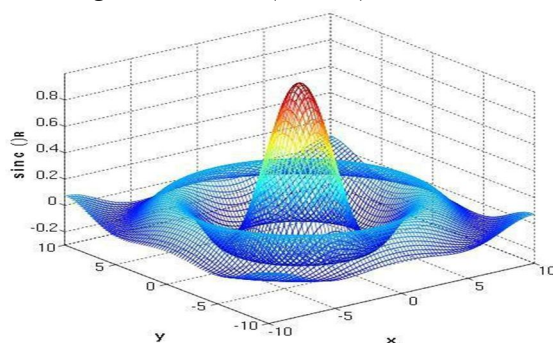


Figure 1: Wireframe3D plot of 2D sinc function

A. Interfacing with other languages

MATLAB can call functions and subroutines written in C programming language or FORTRAN. A wrapper function is created that allows MATLAB data types to be passed and return. The dynamically loadable object files created by compiling such functions are termed as "MEX-files" (for MATLAB executable).

Libraries written in Perl, Java, ActiveX or .NET can be directly called by MATLAB, and many MATLAB libraries (for example XML or SQL support) are implemented as wrappers around Java or ActiveX libraries. Calling MATLAB from Java is more complicated, but can be done with a MATLAB toolbox which is sold separately by MathWorks, or using an undocumented mechanism called JMI (Java-to- MATLAB Interface), (which should not be confused with the unrelated Java Metadata Interface that is also called JMI). As an alternative to the MuPAD based Symbolic Math Toolbox available from MathWorks, MATLAB can be connected to Maple or Mathematica. Libraries also exist to import and export MathML.

III. OBJECT RECOGNITION

A. Large Object Tracking

The large-object-tracking method uses a low-cost detector/processor to quickly calculate moments. This is known as artificial retina chip. This chip combines image detection with some low-level image processing. The chip can compute various functions useful in the functioning of fast algorithms for interactive graphics applications.

B. Shape Recognition

If the hand signals fell in the predetermined set, and the camera view the close-up of the hand, example-based approach can be used combined with a simple method to analyze hand signals called orientation histograms. These example-based applications involve two phases; *training and running*. In the training phase, the user shows the system one or more examples of a specific hand shape. The computer forms and stores the corresponding orientation histograms. In the run phase, the computer compares the orientation histogram of the current image with each of the stored templates and selects the category of the closest match or interpolates between templates as appropriate. This method should be robust against small differences in the size of the hand but probably would be sensitive to changes in hand orientation.

IV. IMAGE DATABASE

The project starts with the creation of a database with all the images that would be used for training and testing. The image database can have different formats.

Images can be either hand drawn, digitized photographs or a 3D dimensional hand. Photographs are used, as they are the most realistic approach.

Images come from two main sources: Various ASL databases on the Internet and Photographs taken by a digital camera. This means that they have different sizes, different resolutions and sometimes almost completely different angles of shooting. Two operations are carried out in all of the images. Firstly they are converted to grayscale and secondly the background is made uniform.

The databases from internet already have uniform backgrounds. Camera is to be processed in Adobe Photoshop. Drawn images can still simulate translational variances with the help of an editing program (e.g. Adobe Photoshop).

The database itself changes constantly throughout the completion of the project as this will decide the robustness of the algorithm. Therefore, it is to be done in such way that different situations could be tested and thresholds above which the algorithm didn't work correctly are decided.

An example is shown below. In the first row are the training images. In the second, the testing images.



Figure 3: Training Images



Figure 4: Testing Image

V. ORIENTAL HISTOGRAMS

To have the gestures same regardless of where they occur with the images borders, position is ignored altogether, and a histogram is tabulated of how often each orientation element occurred in the image. Clearly, this throws out information and some distinct images will be confused by their orientation histograms. In practice, however, one can choose a set of training gestures with substantially different orientation histograms from each other.

Figure shows the orientation histogram calculation for a simple image. Blurring can be used to allow neighboring orientations to sense each other.

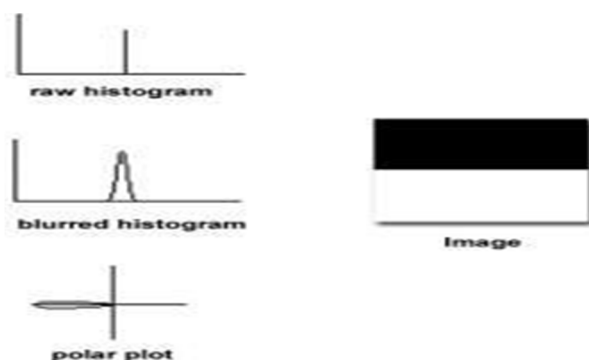


Figure 9: Orientation histogram

VI. CONCLUSION

We proposed a simple hand gesture based music player algorithm, followed by various steps like pre-processing, image converted into RGB, so that varying lightening conditions will not cause any problem. Then, smudge elimination is done in order to get the finest step. After performing the pre-processing on the image, the second step is to determine the orientation of the image, only horizontal and vertical orientation is considered here and images with uniform background is taken.

This paper presents a real time hand gesture controlled music player. The recognition of the image is done by determining the orientation of the image, ie horizontal or vertical and images with uniform background are taken. The strength of this approach includes its simplicity, ease of implementation and that it does not require any training to use this device. Gesture control is an extensively developed technology available designed to identify human position, action and manipulation.

The future scope lies in making this algorithm applicable for various orientations of hand gestures, also different classification scheme can be applied. Gesture recognition could be used in many settings in the future.

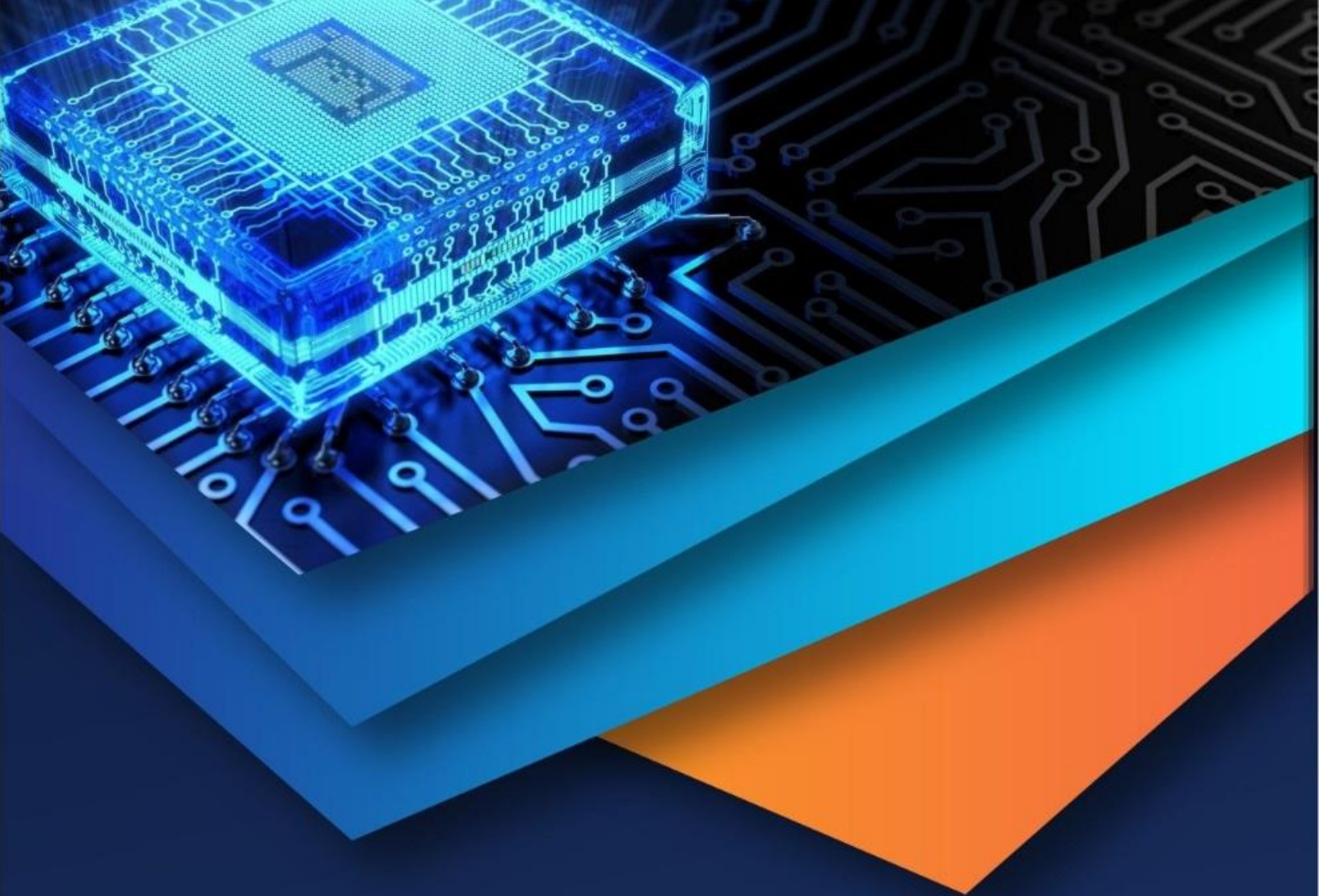
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