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FINGER TRACKING IN REAL TIME HUMAN COMPUTER INTERACTION

SHREEDHIVYA.G,II MCA
DR.E.Pandiyan,HOD/MCA
Dr.L.JOSEPHINE MARY,Professor,MCA

Sri Muthukumaran Institute Of Technology

Abstract:

Finger-tracking is usage of bare hand to operate a computer in order to make human-computer interaction much faster and easier. Fingertip finding deals with extraction of information from hand features and positions. In this method we use the position and direction of the fingers in order to get the required segmented region of interest.

The aim of “Finger pointing systems” is to replace pointing and clicking devices like the mouse with the bare hand. These applications require a robust localization of the fingertip plus the recognition of a limited number of hand postures for “clicking-commands”. Finger-tracking systems are considered as specialized type of hand posture/gesture recognition system.The typical Specializations are only the most simple hand postures and recognized. The hand usually covers a part of the on screen. The finger positions are being found in real-time.Ideally, the system works with all kinds of backgrounds. The system does not restrict the speed of hand movements.

keywords:

Finger, Hand, Gesture, Tracking, Positions, Hand movements

I.INTRODUCTION

In finger –tracking systems except that the real-time constraints currently do not allow sophisticated approaches such as 3D-model matching or Gabor wavelets. The finger tracking system is focused on user-data interaction, where the user interacts with virtual data, by handling through the fingers the volumetric of a 3D object that we want to represent. This system was born based on the human-computer interaction problem. The objective is to allow the communication between them and the use of gestures and hand movements to be more intuitive, Finger tracking systems have been created. These systems track in real time the position in 3D and 2D of the orientation of the fingers of each marker and use the intuitive hand movements and gestures to interact.

II.LITERATUE SURVEY

Explicit shape models are widely used in 3D tracking, as kinematic constraints and known target types facilitate the quantification and analysis of three dimensional movements [1]. The following sections describe the implementation details of the finger tracking and gesture recognition system, which is primarily based on real time hand tracking presented in [2]. The system can extract the 3D position and 2D orientation for the right hand index finger. From an interaction perspective, most of the hand tracking work to date has focused on 2D interfaces. In [3], a finger was tracked across a planar region using low-cost web cameras in order to manipulate a traditional graphical interface without a mouse or keyboard. Similarly, in [4] infrared cameras were used to segment skin regions from background pixels in order to track two hands for interaction on a 2D tabletop display. Their method then used a template matching approach in order to recognize a small set of gestures that could be interpreted as interface commands. However, no precise fingertip position information was obtained using their technique. Recently, some studies of integrating various cues such as motion, shading and edges were proposed.

III.FINGER TRACKING IN REAL TIME HUMAN COMPUTER INTERACTION

3.1 Human computer interaction

Two approaches are commonly used to interpret gestures for Human computer interaction. They are

- **Contact Based**: This method employs sensors attached to a glove that transducers finger flexions into electrical signals for determining the hand postures. Contact based devices are based on physical interaction of user with the interfacing device.
- **Vision Based:** Computer vision based techniques are non intensive and based on the way human beings perceive information about their surroundings .Although it is difficult to design a vision based interface for generic usage, yet it is feasible to design such as an interface for a controlled environment. This approach is easier as the person doesn't need to wear hardware.

3.2. Finger Tracking Algorithm

While developing the project, we had the following facts in mind: the algorithm should be able to track both hands and also know who those hands belong to. The SDK provides us with information about the human bodies. The finger tracking algorithm should be able to extend this functionality and assign fingers to specific Body objects.

Existing finger tracking algorithms simply process the depth frame and search for fingers within a huge array (512×424) of data. Most of the existing solutions provide no information about the body; they only focus on the fingers. The step by step Finger Tracking Algorithm is shown in **Fig1.**

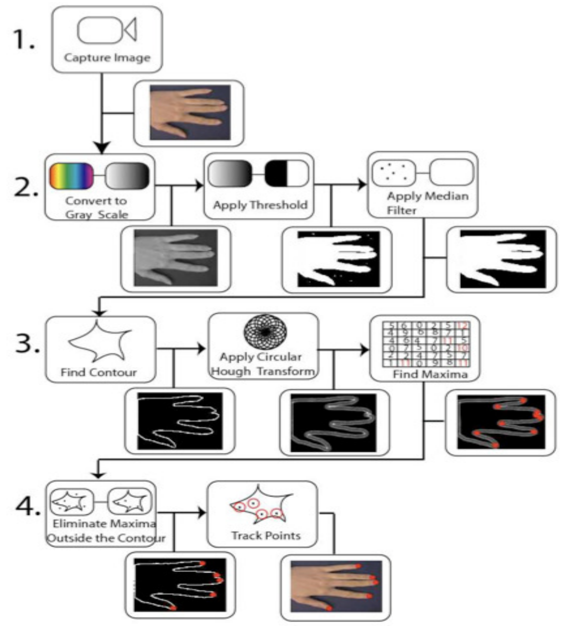

Fig.1. Finger Tracking Algorithm

Step 1 – Detect the Hand joints

This is important. The algorithm starts by detecting the Hand joints and the HandStates of a given Body. This way, the algorithm knows whether a joint is properly tracked and whether it makes sense to search for fingers. For example, if the HandState is Closed, there are no fingers visible.If you've been following my blog for a while, you already know how to detect the human body jo ints.

Joint hand Left = body. Joints [Joint Type. Hand Left];
Joint hand Right = body. Joints [Joint Type. Hand Right];

Step 2 – Specify the search area

Since we have detected the Hand joints, we can now limit the search area. The algorithm only searches within a reasonable distance from the hand. What exactly is a "reasonable" distance? Well, I have chosen to search within the 3D area that is limited between the Hand and the Tip joints (10-15 cm, approximately).

Step 3 – Find the contour

This is the most interesting step. Since we have strictly defined the search area in the 3D space, we can now exclude any depth values that do not fall between the desired range! As a result, every depth value that does not belong to a hand will be rejected. We have an, almost perfect, shape of a hand. The outline of this shape is the contour of the hand!

Step 4 – Find the Convex Hull

The contour of a hand is a big set of points. However, only five (or less) of these points correspond to valid fingertips. The fingertips are the edges of a polyline that contains all of the contour points. In the Eucledian space, this is called "convex hull".

Consequently, the edges of the convex hull above the wrist define, well, the fingers.

The output data consist of:

- position and orientation of the back of the hand
- Number of tracked fingers as well as a distinguishing value for right and left hands.
- Position and orientation of the outermost phalanx, given in the hand coordinate system - Together with a radius, the position and orientation of the finger tip can be estimated.
- Angles between the single phalanxes as well as their lengths - These values are estimated using tracked markers and empirical data.

IV.CONCLUSIONS AND FUTURE ENHANCEMENT

The system works on light background with small amounts of clutter. The maximum size of the search area is about 1.5 x 1m but can easily be increased with additional processing power. The system works with different light situations and adapts automatically to changing conditions. No set-up stage is necessary. The user can just walk up to the system and use it at any time. There are no restrictions on the speed of finger movements. No special hardware, markers or gloves are necessary. The system works at latencies of around 50ms, thus allowing real-time interaction. Multiple fingers and hands can be tracked simultaneously. Especially the Brainstorm system demonstrated, how finger tracking can be used to create "added value" for the user. Other systems that allow bare-hand manipulation of items projected to a wall, as done with Brainstorm, or presentation control with hand postures, as done with Freehand Present. It is possible, though, that the same applications could have been built with other finger-tracking system

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