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Human Movement Detection using B-Spline Curve

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***Abstract*— The overall goal of our work is to understand human movement representation using B-spline curve. In this we will observe the movement of a human and the representation of these movements. For this we need to do two things: Capturing the image of a person at different movements., After capturing images we put some points on those images (like on head, hand, legs etc.) and then we have find out the 3D coordinates(x, y, and z) of those points. By using those points we will draw 3D curve. For 3D curve we use B-spline and Bezier curve.**

***Keywords*— Bezier curve, B-spline curve, Computer Graphics, Human movement, 2d & 3d Object.**

I. INTRODUCTION

In the field of computer vision the automatic interpretation of human movements is one of the most challenging tasks. The main problem of analyzing such movements is due to the fact that the human body consists of body parts which are linked to each other at joints which allow different movements of the parts. The human body generally has to be treated as a nonrigid or more precisely as an articulated body. In addition, for general camera positions always some of the body parts are occluded. Although occlusions can provide important cues in a recognition task, the automatic interpretation is more difficult. Another problem that has to be dealt with is the clothing which can have a large influence on the appearances of a person .Clothing can also cause complex illumination phenomena that, in addition, change during movement.

These types of difficulties most existing when we analyzing human movements or when we use the synthetic images. When using real-world images often special gymnastic movements are analyzed but not locomotion. In this case, the interpretation is generally less difficult because the effect of self-occlusion is diminished, other approaches use stereo-images that restrict their analysis to certain parts of the body or analyze image sequences with more or less homogeneous background to diminish the segmentation problem.

Computer animation can be broadly defines as the specification and display of movements of objects. Animation of human movement requires a specification of the body as an object for display. A graphic object may be moved in several different ways. Movement representation is a topic in computer vision and image processing that studies methods and applications in which two or more consecutive images from an image sequences, are processed to produce information based on the movement in the images.[5][8] In some applications, the camera is fixed relative to the scene and objects are moving around in the scene, in some applications the scene is more or less fixed and the camera is moving, and in some cases both the camera and the scene are moving.

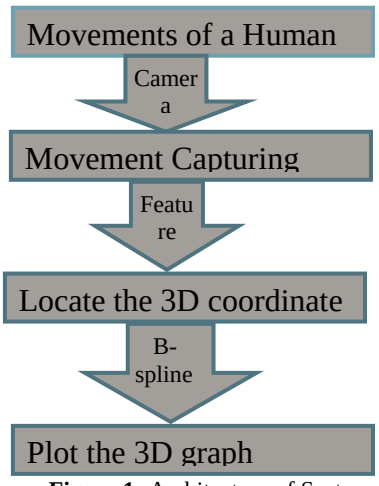


Figure 1: Architecture of System

This paper will provide the movement representation of a human body and to represent the movement of body

using b-spline curve. Following steps of generating the 3D curve are:

1. Capturing the image of a person at different movements. Suppose a person walking towards camera then we have to capture those movements from the front view and side view.

2. After capturing images we put some spots (tags) on those images (like on head, hand, legs etc.) and then we will find out the 3D coordinates(x, y, z) of those points. From the front view we will find value of x, y coordinates and from the side view we will find value of y, z coordinates. Value of y coordinated should be same in both images. By using those points we will draw 3D curve. For 3D curve we will use B-spline and we will draw this curve on the 3D graph. For drawing 3D curve we will use Curve modelling algorithms: Bezier curve, B-spline curve. These algorithms are used in computer graphics [6]. After representing all the movements of a human body we can compare and find the difference between images. When we will draw the curve according to the different movement we can easily identify the difference in the images [4].

II. B-Spline Curve

A **B-spline** is simply a generalization of a Bezier curve; it has two advantages over Bezier curve:
1. Degree of the B-spline polynomial can be set independently of the number of control point.
2. B-spline allows local control over the shape of a spline curve. B-spline is more complex than Bezier spline.

By using these curves we will design a 2D object and then we will extend it to a depth. First we have to learn Bezier curve to understand B-spline curve. Bezier curve is very popular curve, Bezier curve must have n control points, and degree of the Bezier curve will be n+1.If we want to create a longer curve then we have to connect multiple Bezier curves. In this case the last control point of one curve will be same as the first control point of the next curve. Bezier curves start from the first control point and end at last control points. [1][5].

The formula can be expressed as follows:

$$B(t) = \sum_{i=0}^{n} \binom{n}{i} (1-t)^{n-i} t^i P_i$$

$$= (1-t)^n P_0 + \binom{n}{1}(1-t)^{n-1} t P_1 + \ldots\ldots$$

$$= \binom{n}{n-1}(1-t)t^{n-1} P_{n-1} + t^n P_n, \quad t \in [0,1]$$

The idea behind Bezier curves is quite simple. If we want to draw a Bezier curve, first we will connect the four control points with lines, after connecting the control points we will calculate the midpoints of each line and Then we will draw new lines connecting to the midpoints, again we will follow the same process on the new lines to connect the midpoints of the new lines, and at the end when we will get a smooth curve we will stop this process.

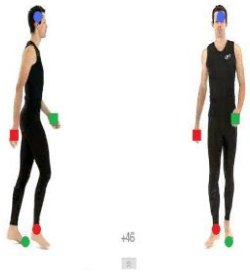
B-spline curve is the generalization of Bezier curve; spline is the flexible strip by which we can draw a smooth curve. Using these curve we can design a 2D object and. For 3D object we need to apply projection on the 2D object, using projection we can see 3 views of an object top view, side view and front view. B-splines were investigated as early as the nineteenth century by Nikolai Lobachevsky. A fundamental theorem states that every spline function of a given degree, smoothness, and domain partition can be uniquely represented as a linear combination of B-splines of that same degree and smoothness, and over that same partition.B-splines can be evaluated in a numerically stable way by the de Boor algorithm numerically stable means the calculations in which there is no approximation errors are called *numerically stable.* Although de Boor's algorithm is a standard way for computing the point on a B-spline curve that corresponds to a given *u*, we really need these coefficients in many cases. A B-spline is simply a generalization of a Bezier curve [7].

III. Experiments & Result

The purpose of experiment is to calculate the 3d B-spline curve and match with the same curve which is stored in the database, and find the person is genuine or not, first we take the snap shot of the movement of the genuine person and mark point on the specific location on his body as shown in fig1, after that we generated the tabular data according to his movement of that point which are fixed in his body as shown in fig2.

(a) (b)

(c) (d)



(e)

Figure2: Different Movement of a Human

mypoint

PointName	x	y	z
1st.jpg	160	305	158
2nd.jpg	203	349	129
3rd.jpg	259	359	73
4th.jpg	310	383	84
5th.jpg	357	414	201

Figure3: Values of x, y, z of figure2

After generating the tabular data of the movement of his body. We generate the 3d B-spline curve according to this movement and above values which are shown in figure 2 as and then finally we generated the curve which shown in figure4 [8][3].After that we match this curve with the stored curve which is stored in the past for that person. If the curve is similar with the stored curve than the person is genuine and if it's not match with that curve the person may be the fake or imposter.

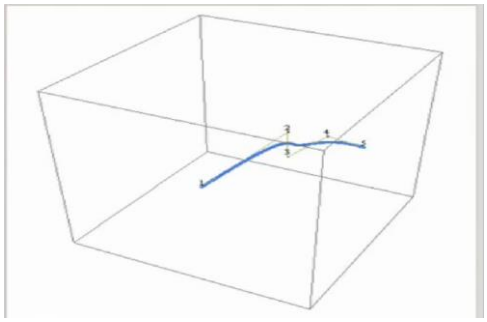


Figure4: 3D B-Spline Curve Generated Using values of figure 3

IV. Application

The Application of the project is in many places these places are as follows:

1. **Gesture Recognition**:-Gestures can originate from any movement or state of a human body. But face and hand is more useful to originate gestures than other body parts. Image processing technique can be used for Gesture recognition and it enables humans to interface with the machine. Here we have generated a 3d B-spline curve according to various movements of a human; with the help of these curves we can recognize a person.

2. **Video game Console (Kinect)**:-The capability to track the skeleton image of one or two people moving within the Kinect field of view for gesture-driven applications. One of the advantages of facial recognition is that you can sign into your account just by stepping in front of the camera in the Kinect sensor. Here 3d b-spline curve which we have generated can be use to track images of person so that person can be identify, and he can sign into his account.

Security:-As we have discussed above applications of human movement representation, these are very useful for security purpose, in gesture recognition person can be identify by his body movement. And in video game field system will recognize a person by the curve which is generated using body movements of a human and then person can login or access his account.

V. Conclusions

The movement representation of a human body is enabled by capturing various movements of body parts at different time interval. For representing those movements we have used 3D B-spline curve, which is the generalization of the Bezier curve, both are used in the field of computer graphics. In our approach for analyzing human movements in real-world image sequences we exploit knowledge about the human body

as well as its movement. One of the most important advantages of our system is that there are no restrictions on the input devices means we can fix any number of cameras to capture movements. But the main thing is that we have to fix the position of cameras, so that Y axis should not be change. Here we have used two cameras: one for capturing front view images and second for capturing side view images. As we have used 3d b-spline curve to representing movements so we need value of x,y,z coordinate for all control points of b-spline curve. Thus we obtained value of x, y coordinate from the front view and value of y, z coordinate from the side view as shown in fig 3 and then we generated the 3d B-Spline curve.

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