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Shape Recovery of Stationary and Rotating Object using Spatio-Temporal Images

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Abstract: **It is propose in this paper a method to find multi dimensional shape of a stationary object in a particular space. A spatio-temporal image is collection of sub-images considered in a given space and time. The projections of multi-dimensional image are taken as intensity values. Analyzing intensity values will discover the position of stationary object and tracking. The analysis report with stationary images shows the effectiveness of this method.**

Index Terms*:* **Spatio-temporal image, intensity values, stationary object.**

I. Introduction

Multi dimensional objects are used in designing, archeology and computer graphics. Laser technology is very expensive for multi-object trajectory. Images which are ordinary and related to passive methods will be easier to handle.

The sub-images of a stationary image taken by camera are advisable instead of normal movable images. Each stereo vision gives a one-side projection only. Previous methods on image [1,2] cannot discover real and inverted images. Methods which extract features of an image and locate them in a space [3]. In [1, 2, 3] the surface intensity point features are discovered, if they change in space then it is not discovered.

To find out the intensity value of a sub image in change of space utilizes original feature value or information. Our method first frames the spatio-temporal image and then finds the intensity values of each projection as values. After getting projection values then the shape of the image can be easily translated.

II. Methodology

Sub images are captured at equal intervals of time values using the camera. Intensity value of each stationary image is known. Then a spatio-temporal image is created with a constant angle representing the space and at a constant time slot. The object will be considered in three cases.

Case 1:-image taken at angle where intensity values are changing with temporal data.

Case 2:-image taken at angle where intensity values are always constant at any temporal data.

Case3:- For image moving or rotating in space will have x-intensity values at various temporal‘t’ values.

If the object is moving, then the captured image will be having any one sub image as cross sectional parallel to the original image values. For our study captured image taken the sub image parallel to the image plane and the image features are compared with the parallel intensity values. The rotation of the object amplitude is the radius of the surface point intensity. The real and inverted image is important to be detected which will be discussed in the next section.

III. Real and Inverted Image Detection

The rotation axis is taken as the projection area of the image at t=t0, that is the total area of the image represented with sine curve intensity levels taken at t=t0.

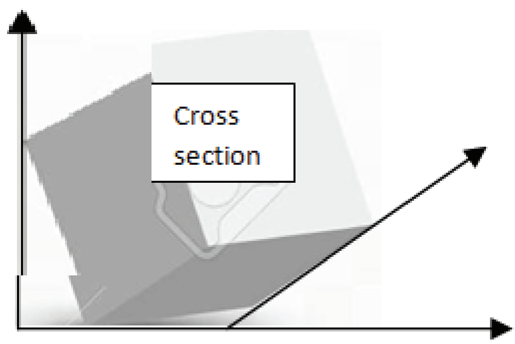

Figure1. Rotating object with captured devices

Image considered with projection points along the line at t=t0 as reference points and identify the intensity values at the cross section that is the reference point. Let the projection point be (t0, angular value) and its intensity values are noted at each angular value (0 to 360). Considering any point of projection in the image and if the selected value passes through the (t0, angular point) it is represented by the following equations.

$$t = v\sin\ (\theta(t) - \theta) + v$$

or

$$t = v\cos\ (\theta(t) - \theta) + (t - v)$$

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Where t is the reference point at angular value θ, as the value of the project matches with the actual intensity values the curve is generated at t-v values and if the project matches only start and end point then a curve is generated at v values.

The intensity values of each projection are almost equal for our example image. So, in evaluation the real projection points and intensity values are passing through the point (t0, angular value[0 to 360]) . The summation of each difference is actually used as visible projection points. The strategy is taken as matching projection to intensity values of image at all angular values each projection point matches corresponding v values from equation of t. The match values are computed as follows.

$$Z = \exp\left(\sum - \frac{(\text{intensity } (t, \theta) - t0)}{2v - (t - \theta)} \right)$$

After calculating the match values at all angular points or projected points (0 to 360) , the radius of rotation of the projection point is taken as {v,[angular point/(each projected point-match point value)]} represented as below.

Angular arc value (Z)= arg min$[\int_{v0}^{v1} \exp\{-(intensity(t,\theta)\frac{t}{2v} - d\theta)$

After calculating the match values at all angular points or projected points (0 to 360) , the radius of rotation of the projection point is taken as {v,[angular point/(each projected point-miss match point value)]} represented as below.

Angular arc value (Z)= arg max$[\int_{v0}^{v1} \exp\{-(intensity(t,\theta)\frac{t}{2v} - d\theta)$

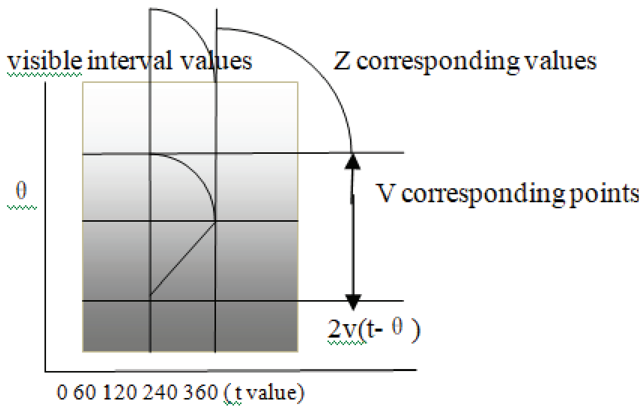

Figure 2. Intensity values Z and v at t values.

As per the integration values of v defined along the projection of each candidate r, θ and v along with the desired interval from the captured device is noted. The visible interval value depends on the local surface values as per t values noted in above figure.

If the surface normal passes along the radius values of projection the symmetric curve is visible otherwise and asymmetric curve as cos with arg max is visible and it is not in range of the angular projections. Since points of images are not know the orientation or surface value as x-axis or y-axis in our study computation have taken projection as the image base is on x-axis. Suppose specifically stating the radius is purely perpendicular to the visible interval values that y-axis, the study is as follows:

Case 1:-image taken at angle where intensity values are changing with temporal data.(y-axis as base value that is t value)

Case 2:-image taken at angle where intensity values are always constant at any temporal data.(y-axis as visible value that is θ values (0 to 360))

Case3:- For image moving or rotating in space will have x-intensity values at various temporal't' values.(only considering the z values computing with match values of rotation)

Matching values of the radius to the angular rotation is given as

M(x)=arg min[max{(Z,v)}]

Where the Z and v values are taken as intersecting values of projection to intensity values in all three cases visualized can have M(x). If the object is real and inverted, a surface point can be seen for an angular period (0 to 360). So the image is shorter than the visible points taken into account to the real image. It should be decided to take a real and inverted image or convex image.

Probability projection point to the noted intersection point taken as follows:

P(z)=v-[∑{p(v)} +(t-intersecting point at angular valueθ)]

If the equation is considered with the three cases taken have according to the visible intensity values resulting with the probability of each projection to image is different.

IV. Possibilites of Image Capturing

Case 1: image taken at angle where intensity values are changing with temporal data.(y-axis as base value that is t value)

Considering the image as parallel to the y-axis so the angle of incidence will be taken as intensity values changing at each θ values. Here data points also consider the time interval for each image intensity value recording. So, any one either time or intensity value will be taken as the x-axis.

Y-axis is image base value
X-axis is either time or intensity values.

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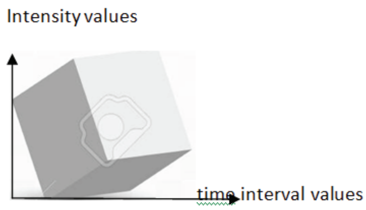

Figure 3. Time and intensity values image

Case 2: Image taken at angle where intensity values are always constant at any temporal data.(y-axis as visible value that is values (0 to 360))

In this considering image at x-axis resting on and the intensity values are at y-axis the temporal values will be taken with corresponding intensity values as pair {(0,t0), (60,t1), (120,t3)…… up to 360 angular values}. The recording values will be depending on pair-wise selection in optimized taken first from pair and then taking x-axis value correspondingly.

y-axis is optimized pair wise intensity values at angular and temporal data.

x-axis is image base values.

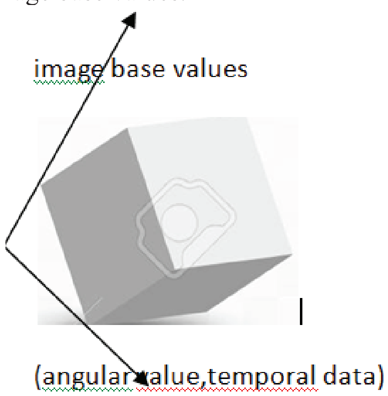

Figure 4. Base and temporal angular values of image

Case3: For image moving or rotating in space will have x-intensity values at various temporal‘t values. (only considering the z values computing with match values of rotation)

In this considering the image is not constant and rotation with radius values at equal intervals of temporal is taken into consideration. X-axis is taken as intensity values at t and y-axis taken as radius value at match intensity of z.

x- axis is intensity values

y-axis is the z values

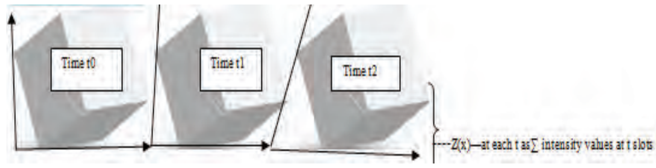

Figure 5. Temporal values with intensity of image

V. Experimental Results

Experimental results by using original images. Figure is the cube captured by camera. An image of pixel size 480 X 640 pixels and the total number of images taken is 10 per each rotation.


Figure6. Original image

The visible solid image is as taken at angular section ∏/2. The 3-D surface points are solid lines with horizontal sections of the object surface with less intensity level values. Shape of the image is best recovered with real and inverted characteristics of the image, then convex. Some features like edge projections with less intensity values are missing.

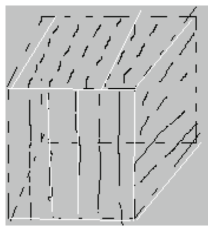
Figure 7. Captured image with Z and v values computing

The white surfaces are noted output for our given image at values z and v. Visualization of output have given black shading to make user to understand the intensity of image to be clear at all visible time values.

VI. Conclusions

In this paper, presented a method to recover 3-dimenional shape of the object which is constant and also rotating at equal interval of temporal values. To get clear and dense image data points taken match intensity values at each rotation of object at angular values. This is an absolute vision recording with a max and min of size intensity of matching window. If image is matched the matching window will be suitable to spot all white cells in recording. If image is mismatch, then matching window will not be suitable at any edge of white cells in recording. Stating the image for recovering this has led the ability for revering fine local shapes.

Although the shape is quite featureless as some image measurements are missing, future task might include developing the way to deal with a surface with no intensity change values.

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