Warning System for Landslides through Modified Particle Filtering Algorithm

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ABSTRACT To prevent the pilgrims or local people before falling of landslides we create an alert system for it by using modified particle filtering algorithm.in this we detect the change in position and velocity in the video image of rocks of mountain using modified particle filtering algorithm by tracking the movement of particles by using its likelihoods.

KEYWORDS Probability density function, sampling, bins

I. INTRODUCTION

Landslides are one of the disasters that happening badly affects the life of the people. Landslides can occur either natural or human error. By the means of natural landslides occur like occurrence of earthquake, heavy rainfall etc. whereas human errors are like in which due to the human error or mistakes landslides are fall like mass cutting of trees or mining in mountain with the mean to extract minerals these are the reason due to which landslides are prone to occur. Either of these reasons of landslides humans is not able to stop them but we can create an alert system through which before happening of landslides we get to know about this disaster and people or army crops take preventive steps to save human lives. In this we continuously track the that object either by video or sequence of image or by still image of mountain or rocks we can easily track the that object .so that we came to know disaster may happen for this object tracking we used modified particle filtering algorithm that helps identify change in position with its acceleration in a particular state and also able to identify its next future state or it may predict next movable state according to their likelihood.

Whenever there is any movement occur in mountain or rocks the algorithm identify the moving object and predict next state so that we can easily able to identify where disaster can occur.

II. RELATED WORK

There are many algorithms which are used identifying the object but particle filtering provides us results based on their likelihood. Particle filtering algorithm works on of non-linear and non-Gaussian systems.

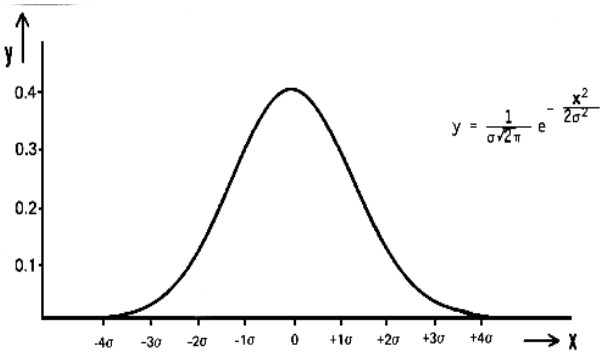

Figure 1

Particle filtering is a representation of pdf i.e. probability density function Based on point mass representation and i can apply it to any state model.

State equation of particle filtering algorithm is

$$x_{t+1} = f_t(x_t) + w_t(x_t) \quad \ldots\ldots\ldots\ldots \text{(i)}$$

Where X_t is estimator of the state.

Its weights particles are based on likelihood score and propagate these weights according to the model.

$$. y_t = h_t(x_t) + v_t(x_t) \ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

In particle filtering algorithm prediction are dependent on current state

Measure equation of this algorithm is where it is the observation of the state.

Particle represents the object state. Any of nonlinear function we can apply to predict the states.

Particle filtering algorithm having a two process in it

- sequential importance sampling
- selection

Sequential importance sampling step: for each particle at time t we calculate the next transition state for each particle. Then for each particle we calculate and normalize the weight correspondingly.

Selection step in selection we used the color based probability density to identify the weight where the probability is high of color pdf i.e. known as likelihood this next target location to move the particle.

III. MODIFIED PARTICLE FILTERING ALGORITHM

Steps

- Create a bins that helps to identify the different [R, G, B] values initially on still image or the first frame of the video.
- On the basis of that image we are able to identify our target location
- When we define our target location than we apply particle filtering algorithm to identify the next location of moving object.

In modified particle filtering we start with we image that creates a bins that is basically a color. I identifying the kernel randomly on the basis of RGB values then we identify nearby kernels any value that depends on the color and distance from it. It creates a group of cluster depends on colors that we are proceed this algorithm until it convergence.so its gives an image that show RGB values color depending on the number of bins we created so that particle filtering algorithm easily track the object that are moving and identify its next predicting state fast

We apply bins to firstly identify the location of that area of mountains or rocks so we can easily identify each color and location of each particle of that scenario that's only the reason we require them to create bins to more clearly to identify the result. When any time the displacement occurs either in position or velocity then particle filtering algorithm started to identify the target location so we can know there may be landslides can fall.

IV. RESULTS

We implemented this code in MATLAB R2012b by having image acquisition tool box and image processing tool box. These are different figures no 2 and 3 showing x axis, y axis z axis in which its represents mean of estimated state', 'mode of estimated state', 'particle paths respectively. On the basis of it I calculate evolution of state density by using different tools.

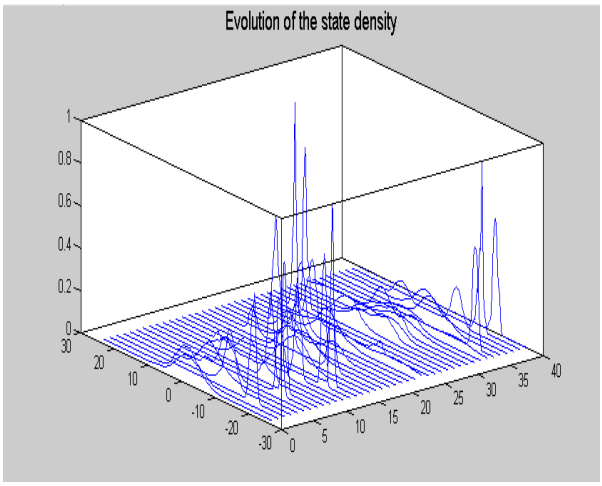

Figure 2

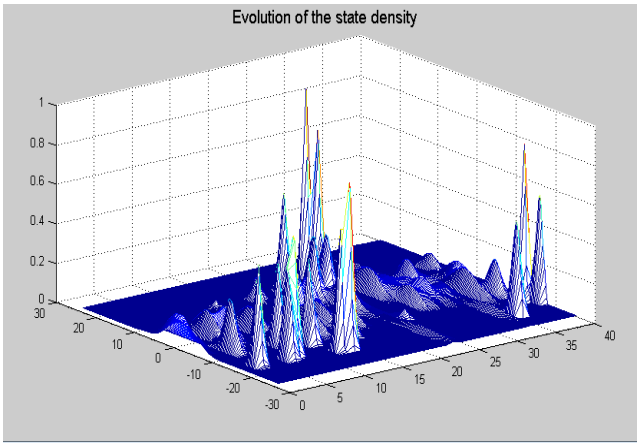

Figure 3

Now in figure no 4 it represents the mean and mode values between a particle filter paths with modified particle filter path. Whereas figure no 5 represents observed particle through particle filtering and modified particle filtering.

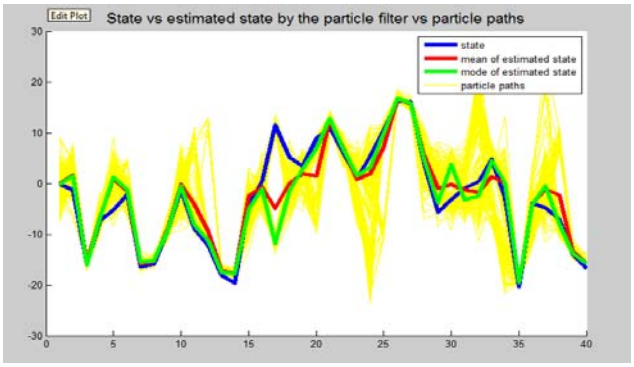

Figure 4

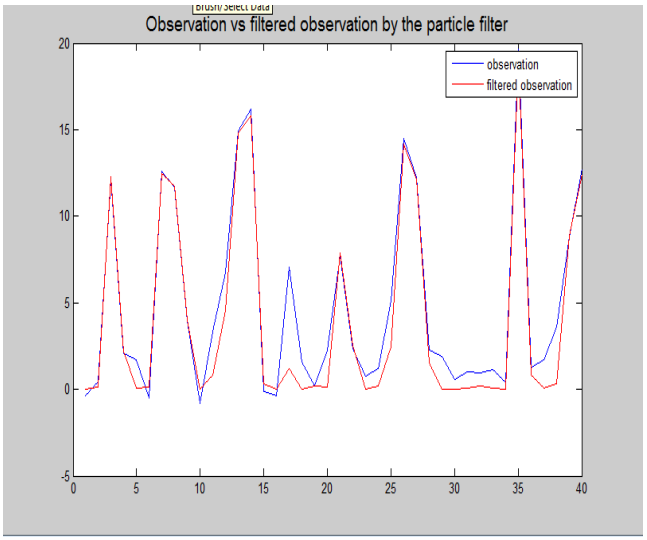

Figure 5

Now figure 6 is input image from the sequence of the video. I took an image from video create a bins for the picture so that we can apply modified particle filtering algorithm in it whereas in figure 7 is corresponding output figure for that image by using create bins. Now we need to track the object that is moving in nature for that we proceed with algorithm

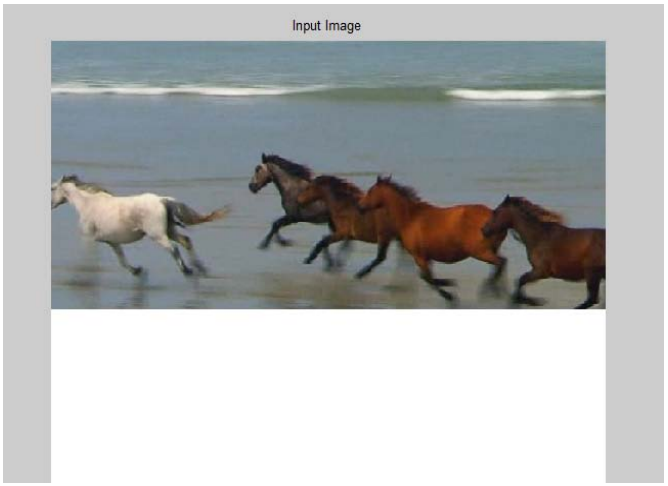

Figure 6

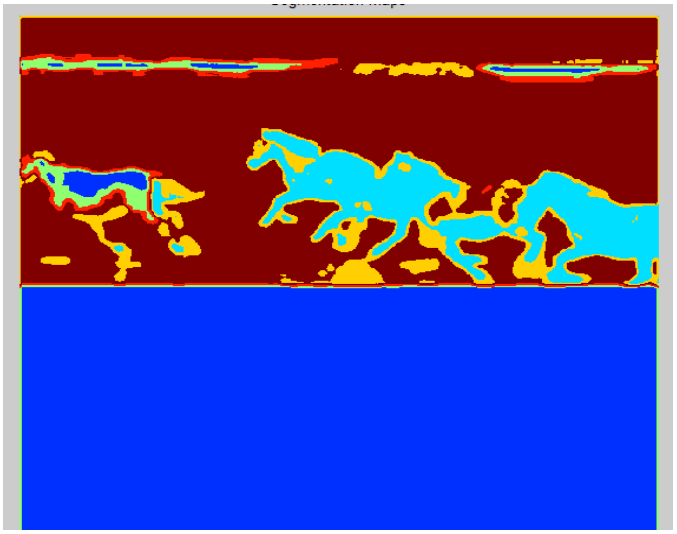

Figure 7

Now the sequence of image from the videos that always track a moving object particle and its resembles with '.' A dot symbol in which we took a red color to detect the moving object from the video. Figure 8-11 are showing the moving object particle through tracking the red color from the whole image.

Figure 8

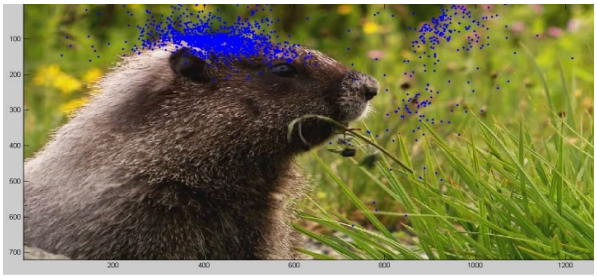

Figure 9

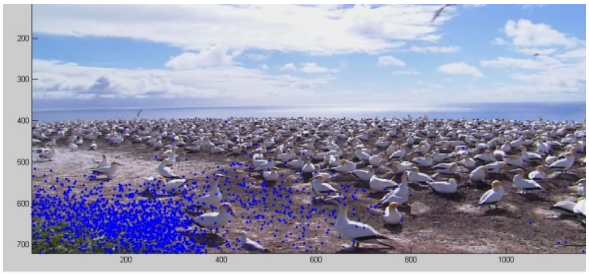

Figure 10

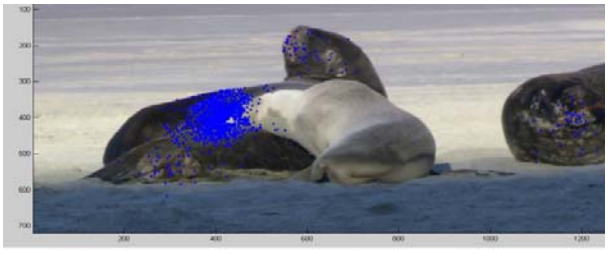

Figure 11

V. CONCLUSION

Since when we are able to detect the image by bins and using different color segments initially then we easily track the object so whenever its move. So if any movement in landslide is occur we can easily track the location and its movement so that we can able to know that particular area is unsafe and provide safety measures to all.

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