IMAGE DIMENSIONALITY CONVERSION WITH DOPPLER BASED RPM TECHNIQUE USING UWB MILLIMETER WAVE RADARS

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Abstract

Achieving vision on foggy, smoggy and cloudy environment is a worthy challenge for experts. Ultra wide band millimeter radars are used to gather the information from such environment. To analyze the static information gathered on object from such multi object background and to formulate the same into a three dimensional understanding, we propose a Doppler based RPM technique. Post-processing the input image frame a quality distortion analysis is made.

Key Words: Doppler Based RPM, Ultra wide band millimeter radar

INTRODUCTION

Millimeter wave radars are used in variety of research fields such as defense, scientific, social and commercial organizations. These
can be used for providing better range resolution and also holds an advantage of penetrating through fog, smoke and other obscurants. Compare to Infrared sensors Millimeter wave radars are much better for object detection[13]. The shape estimation algorithm based on Boundary scattering transform and the scattered waves are extracted directly based on reversible transform [4]. Hence these methods had been applied to sensor applications and 3-D ultrasonography imaging, has fundamental drawbacks [8]. The system overcomes the above mentioned disadvantages by implementing the Doppler based RPM and Thresholding based method for image segmentation. The proposed Work also provides the efficient results for conversion of objects from 2-D to 3-D and we also provide the estimation of distortion during the conversion.

**LITERATURE SURVEY:**
Francesco et.al proposed multi-mono-static configuration and the 2-D geometry. This method is based on Kirchhoff approximation, that can provide singular value decomposition[3]. Takuya SAKAMOTO et al. proposed the high-speed "SEABED" imaging method which is deployed to apply UWB pulse radar in fields that require real time operations. The SEABED algorithm is based on a reversible BST (Boundary Scattering Transform) between the target shape and the received data body passing stationary antennas [15]. Juan M. Lopez-Sanchez et al. proposed stepped frequency radar that produces a two-dimensional planar aperture. This leads to the implementation of SAR algorithm [2]. S. Kidera et al. proposed the near field radar employing Ultra Wide Band (UWB) signals with its high range resolution has great promise for various sensing applications. It can identify the invisible target objects [12]. Zavorotny et al introduced a method of radar scattering from steep and breaking ocean waves, we developed an efficient and fast 2-D numerical full-wave approach to model both wave evolution and radar scattering from these waves [11].

**PROBLEM DEFINITION**
Various methods for reconstruction of particular shapes in short-range 3-D imaging had developed based on DAS approach, includ-
ing beam forming and Kirchhoff techniques. Although DAS-based methods provide accurate pointwise targets, they cannot offer sufficient accuracy for non-point wise targets. Moreover, the complexity becomes enormous in 3-D imaging due to signal synthesizing approach with all received signal in each voxel evaluation.

**BLOCK DIAGRAM:**

![Block Diagram](image)

**PREPROCESSING**

Preprocessing images commonly involves removing low-frequency background noise, normalizing the intensity of the individual particles images, removing reflections of images. Image preprocessing is a technique for improving the information of digital images. The preprocessing functions have two steps. First the pixel values of the image is calculated and then the corresponding techniques like contrast enhancement is applied to increase the brightness of image. Then by using the Gaussian filter and mean or median filter image noise are removed.

**IMAGE SEGMENTATION**

Image segmentation is one of the important process, the main use of this step here is to separate the image into foreground and background. There are different techniques used for image segmentation, few of the most used methods are thresholding, watershed transformation and Otsu Segmentation. The thresholding method calculates the histogram value of the image and converts the image into binary form.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Regions in which each and every pixel is similar with respect to some characteristic or computed property like color, depth...
or texture. Adjacent regions are significantly different with respect to the same characteristic(s). 3D reconstructions are created by image segmentation with the help of interpolation algorithm like marching algorithm when applied to a stack of images, particularly in medical imaging. To perform image segmentation, the input image is divided into different pixel blocks and a threshold value for segmentation is chosen. Then the pixel value is compared with the threshold value and with respect to that the regions are segmented.

**DOPPLER BASED RPM:**
The RPs migration (RPM) method achieves a batch conversion from RPs (a set of antenna location and observed RPs) to scattering center points with one-to-one correspondence. The method converts each RP (referred to as Main RP) to each scattering center by assessing the focusing degree using all surrounding RPs (called Sub RPs). Notably, this method resolves an inherent paring problem between the range and direction of arrival using a Gaussian kernel-based statistical approach. Thus, the RPM is free from complicated preprocessing involving connecting or paring RPs. This feature confers the significant advantages of both lower computational cost and higher accuracy for locating scattering centers on continuous boundaries, even in richly interfered cases.

**METHODOLOGICAL PROCEDURE**

**STEP 1:**
Data are acquired as the outputs of the WEINER filter

\[ S(L_T, L_R, R^0, \tau) \]

Wiener filter is used in image processing to estimate resultant random process by using linear time-invariant (LTI) filtering method. The LTI is well applicable on noises with known noisy spectra and stationary signal. The filter outstands as the mean square error between the desired and estimated mean is comparatively minimal.

The Wiener filter however, is formulated in such a way that the filter is applicable on the scenarios where the noise signal is un-
known. This is achieved by processing a relativity function on the target signal and the known actual signals. Wiener filter is a statistical analyzer type of filter. For a signal that is inflicted by any noise, it checks for the underlying signal interest by making relative analysis with the noise spectra thereby producing a statistical computation result as a result.

STEP.2

\[ S(L_T, L_R, R^0, \tau)_D \]

is obtained by applying the 1-D discrete Fourier transform \[ S(L_T, L_R, R^0, \tau) \] to \( \tau \) This step computes the Fourier transform of the filtered output and computes it to \( \tau \)

STEP.3

RPs are extracted from local maxima,

\[ S(L_T, L_R, R^0, V_0) \]

as to \( R \) and \( V_D \), and a set of all RPs is defined as \( Q_{\text{all}} \). Range points had been calculated from the set of subsets

STEP.4

RPs are clustered by the criteria expressed as

\[ (q_i, q_j) \equiv |V_{D,i} - V_{D,j}| \]

From this we can get the clustered scenes, and the object points will be detected.

STEP.5

Finally, \( q_i \) is converted to a target point \( p(q_i) \) by the RPM and for each target point \( p(q_i) \), the associated Doppler velocity \( V_D \), \( i \) is calculated. Further, the image conversion from 2d to 3d takes place.

**EXPERIMENTAL RESULTS**

The proposed work had been implemented using MATLAB R2015a, the implementation results shows that the proposed work is much
more effective in converting the images into 3-D, and also with respect to the dimensional measurement.

**CONCLUSION**

The system proposed an algorithm to achieve accurate and high-speed 3-D imaging from the live video frames. The numerical simulation assuming the system proposed shows results for conversion from 2-D to 3-D image that resulted with improved conversion accuracy.

**References**


