Image Fusion of Tomography Based on K-Means Algorithm

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Abstract: In order to get optimized output, accuracy of image and get target feature in multiphase pipelining system by using fusion method of Hybrid M-DS Evidence theory. Process tomography system due to small angle of projection. Computer tomography and Electrical capacitance tomography process for capture the image from pipeline, In difference characteristics Modified DS Evidence theory using for fusion of two images computer tomography and electrical capacitance tomography image. K-means algorithm for clustering similarity can be taken From two images .Basic probability assignment function is indicated by the distance between the gray value and cluster center.

Index Terms **- K-means algorithm, Fusion method, Process Tomography, Modified D-S Evidence theory, Multi Layer Perception Neural Network.**

1. INTRODUCTION

In Industrial pipeline lot of two phase (or) multiphase problem occurs, this can be avoid monitoring the pipeline (or) accurate detection of the pipelining system , First capture the image by process tomography such as computer tomography and electrical capacitance tomography, computer tomography originally used in the field of flow ,density and phase holdup measurement in medical and Industry, Electrical capacitance tomography images for non-invasive measurement and image resolution is lower than the computer tomography, clustered similarity can be taken from each individual image, This can be achieved by using K-Means Algorithm. It is set of rules can provide for taking clustered similarity, It solve the well known clustering problem. The procedure follows a single and easy way to classify a given data set through a certain number of clusters (assume k-clusters). Each reconstructed image assigns the value(0,1) for analysis of gas and oil by using Basic probability assignment function is indicate the Distance between the gray value and clustered center. Hybrid Modified D-S Evidence theory is the fusion method ,each image having different characteristics and each similarity combined and provide accurate image and the resulting fusion similarity is taken, The Resulting Reconstruction of computer tomography and Electrical capacitance tomography Fusion image, Multi Layer Perception Neural Network was used, because of error checking and correcting the errors before and after the reconstruction.

2. PROCESS TOMOGRAPHY

Process tomography consists of tomography imaging of system, such as processing of pipes in Industry. In tomography the 3D Distribution of some physical quantity in the object is determined. There is a widespread need to get tomography.

2.1 COMPUTER TOMOGRAPHY

Computer tomography is create detailed image of industrial pipeline .The cross-sectional images generated during a computer tomography process can be reformatted in multiple planes , and can even generate three-dimensional images which can be viewed on a computer monitor, printed on film (or) transferred to electronic media. computer tomography process is often the best method for detecting many different distribution problems since the images was using in flow density, phase hold up measurement and it is the non-invasive and accurate Image. The liquids and gases concerned may be crude oil, natural gas petrochemical products, water and other liquid (or) gaseous products. Pipeline monitoring solutions, pipelines can also effectively be deployed for multi-batch pipelines to monitor the movement of different fluid compositions.

Obey Beer-Lambert's law according to the ay attenuation, That is

$I=I_{0e^{-\mu x}}$

Where I - is the radiation through after the count, I_0 Is through media before radiation count, x-thickness of the absorber.

P=RX

P-Measured projection data; R-Projection matrix

2.2 ELECTRICAL CAPACITANCE TOMOGRAPHY

Electrical capacitance tomography is a method for determination of the dielectric permittivity, distribution in the inertia of an object from external capacitance measurements. It is close relative to electrical impedance tomography and is proposed as a method for industrial process monitoring ,although it has yet to see widespread use, potential application include the measurement of flow fluids in pipes and measurement of the concentration of one fluids in another (or) the distribution of a solid in a fluid.

Although capacitance sensing methods were in widespread use the idea (or) using capacitance measurement to form images. In which high resolution images are formed of slices of a material. The measurement electrodes, which are metallic plates, must be sufficiently large to give a measurable change in capacitance. This means that very few electrodes are used and eight (or) twelve electrodes is common.

$\nabla [\varepsilon (x, y) \nabla \emptyset (x, y)] = 0$

E(x,y)-Is the dielectric constant

$\lambda_{m*1} = S_{m*n} * G_{M*N}$

U-Normalized capacitance measurement;

S-sensitivity coefficient matrix;

G-Image gray-scale;

3. K-Means Algorithm

K-means clustering is a vector quantization, it aims to process n observation into k-clusters and consider each cluster with the nearest mean. It is usually similar to the fuzzy c-means clustering; however k-means clustering tends to find clusters of comparable spatial extent, while fuzzy c-means allows clusters to have different shapes.

In this algorithm loose relationship between to the k-clusters to the k-nearest neighbor classifier.

Assignment step:Assign each observation to the cluster whose mean has the least squared Euclidean distance

$S_i^t = \left\{ x_{p:\left\| x_p - m_i^t \right\|^2 \le \| x} \right\}$

Update step:new means to the centroids of the clusters

$$m_i^{t+1} = \frac{1}{|s_i^t 1|} \sum_{x_j = s_i^t} x_j$$

The algorithm has converged when the assignment no longer change.

Step 1: k-initial means that is k=3.

Step 2: k clusters are created by nearest mean.

Step 3: The pipeline each k-clusters becomes the new mean.

Step 4: steps 2, 3 are repeated until convergence has been reached.

3.1 clustered similarity level

Clustered similarity is measure takes into consideration the position , span, and content of symbolic option, it can two symbolic objects are merged (or) maximum and minimum similarity values are merged, it can determination of number of clusters in the dataset[2]. It can capable of discerning clusters in datasets made up numeric and symbolic objects consisting for qualitative and quantitative objects.

3.2 Unclustered similarity level

Unclustered similarity is, two symbolic objects are merged it can determine the number of un clusters in the dataset.

4 Image fusion using Hybrid M-DS Theory

Image fusion is the process of combining to multisource imagery into one enhanced Image. The main purpose of fusion complementary data to enhance the information. It is for increase the reliability of interpretation. In this image is suitable to perception of machine and human, the generic image fusion Method based on Modified Dempster shafer theory , Indepentent Images can be converted to dependent image by using basic probability function ,It should be developed to model uncertain information. In this Evidence theory considering the frame of discernment in an open world system .

Several types of uncertain and incomplete Information, Ignorance , uncertainty measures shanon entropy , fuzzy set. Hybrid methods for uncertainty weighted Hardly entropy, Holes confusion measure , Klir & Ramer's Discord measure , Klir & Praviz 's strife measure . Mass function in Evidence theory is use Basic probability assignment function , It is generalized probability assigned in the power set of FOD

Ω={θ1,θ2,,,,,θi,,,,Θn}

Finite non empty Ω-The power set

2^{Ω}={ϖ1,{θ1},{θ2},,,,,{Θn},{θ1, θ2},,,,{θ1,θ2,,,,,θi},,,Ω} ->(1)

A Mass function m is defined as a mapping from the power set 2^{Ω} the interval [0,1]

M(ϖ)=0 ->(2)

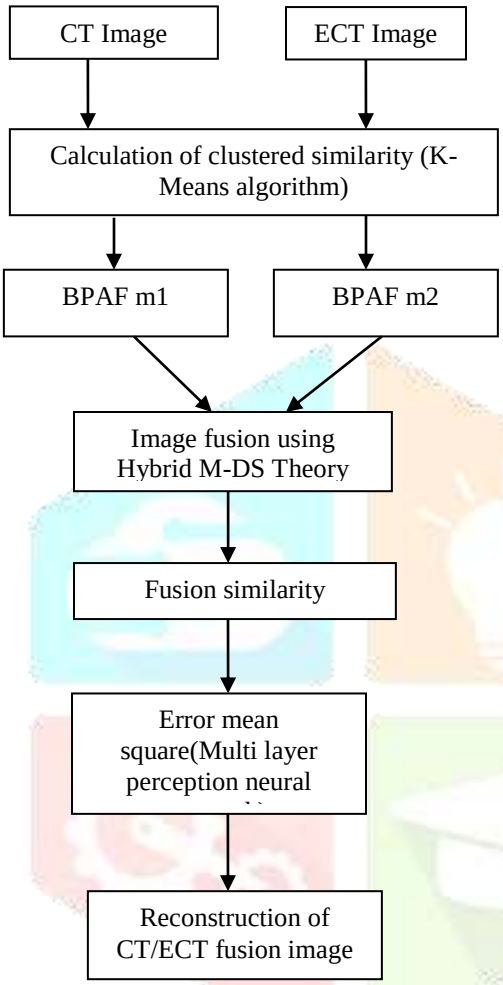

Figure: 1 Image fusion of Tomography process

4.1 BASIC PROBABILITY ASSIGNMENT FUNCTION:

Basic probability assignment function is measure distance between the gray value and clustered center and it can solve the image fusion problem , It assigns two values [0,1]

1) It represents the pixels surrounding neighborhood , gray value of gas phase is 0 .
2) It represents the pixels surrounding neighborhood, gray value of oil phase is 1.

Φ-It is the set of clusters;$|ϖ| = c$ is number of clusters ;2^{c}-all possible clusters;

Fuzzy clustering is performing for image histogram , considering two fuzzy membership curves $\mu_{K(G)}$ And μ_{l}(g) this point is high ambiguity

We use the following consideration

ß=$max_{1<i<c}(\mu_{i}(g))$; -> (1)

α=$max_{1<i<c}(\mu_{i}(g))$; ->(2)

$\sum_{i=1}^{c} \mu_i(g)=1$;
I-Cluster indices;
Arg(β)=arg$max_{1<i<c}\mu_i(g)$
It is fuzzy membership de fuzzyfication rule
$\sum_{Hi\epsilon c} m(Hi)=1$,using Image histogram
The mass value affected to compound hypothesis is propositions to the sum of fuzzy membership degrees.

5. EXECUTION AND RESULT

The simulation result can be seen from MATLAB Software, In this process Tomographical Images such as computer tomography and Electrical capacitance tomography image, Two Images clustering similarity is taken by using the set of easiest rule K-Means Algorithm.

It can resized the tomography input image1 for reconstruct the image and filtering operation will perform for reducing blur, and after the result extract the image for enhancing the Image quality, In this output result apply fuzzy Basic Probability Assignment Function And same operation perform to input image-2 Resized the input image and filtered the resized image and extract the filtered image, two tomography process result apply Hybrid M-DS Theory for measure fusion similarity and reconstruct the image and reduce performance requirements. Fuzzy BPF For measure distance between gray scale and clustering center and after the simulation result error detection and error correction is performed by using multi layer perception neural network. In this Error checking before and after the fusion process And get the optimized output.

E(N)=$\frac{1}{2}\sum e^2 j(n)$
In this formulae for reducing the error from fusion process result.
Multiple layer perception of neural network is reducing the error rate ,value of 0.08. Minimum of error rate in this method.

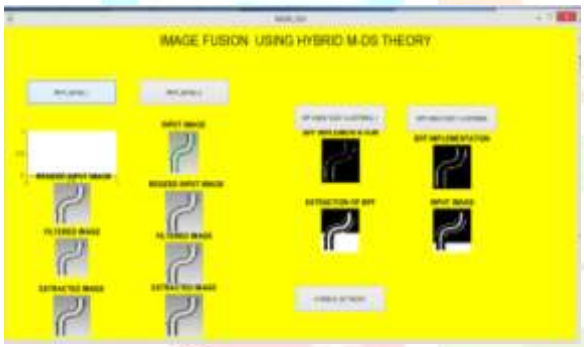

Figure: 2 simulation result of CT/ECT Image

5.1 MULTI LAYER PERCEPTION NEURAL NETWORK

It is a linear activation functions in pipelining and reducing Mean square error . It is represented in the form of
Y(vi)=tanh (vi)
Y(vi)=$(1+e^{-vi})^{-1}$
The minimizes the entire output error
E(N)=$\frac{1}{2}\sum e^2 j(n)$
It contains many perception that are organized into layer

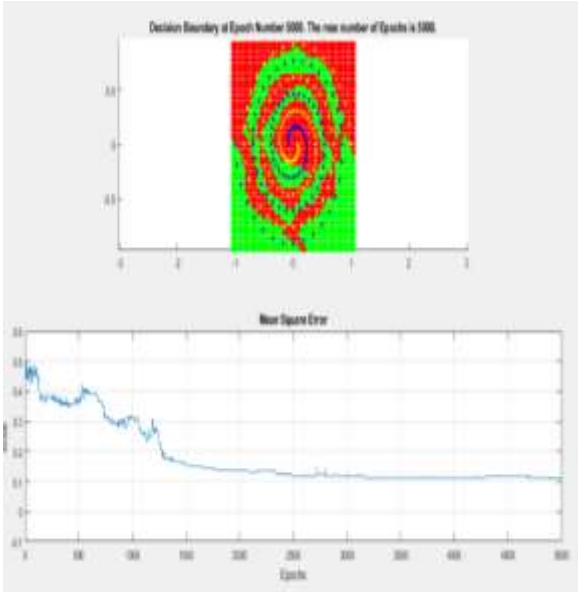

Fig: simulation result of Mean Square error

Comparison of Root Mean Square Error:

Image	D-S Evidence theory	Hybrid M-DS Theory
Pipeline input image	Error Rate:0.5	Error Rate:0.08

5.2 CONCLUSION

In Industrial monitoring system using image fusion , To get optimized result and reducing the performance requirements, CT/ECT Tomography images clustered similarity can taken by(K-Means Algorithm) , It reducing ill-posed problem of reconstruction of image. The fusion process for enhancing the image quality and capture the original pipeline internal structure . Two tomography methods to improve the reconstructed image , accuracy.

In this project applying K-Means algorithm and Hybrid M-DS Theory for reliability is applied to CT/ECT Image Fusion. Basic Probability Assignment Function is measure distance between the gray value and clustered center and after performing Error Detection and Error correction by using Multi Layer Perception Neural Network, It greatly improve accuracy of Reconstructed Image and Reduce performance Requirements.

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