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DETECT EXPLOSIVES BY INFRARED IMAGERY USING MERGING ANOMALY ALGORITHM AND IMAGE FEATURES

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ABSTRACT: A innovative tactic method used for Merging Different Anomaly Algorithm decisions with image space cell-structured features on a long wave infrared (LWIR) System with context of forward Looking (FL) buried explosive hazard detection along a road.A pre-screener is begin,widely helps to produce ensemble of trainable size contrast filters focusing in Universal Transverse Mercator(UTM) Space .Next,Features from different algorithm are mined from UTM confidence map along with average shift grouping in Universal Transverse Mercator (UTM) space. Features available in image chips demonstrating anomaly decisions from different algorithms are extracted from UTM confidence maps based on maximally stable extremal regions (MSERs) and Guassian mixture models(GMMs).Pre-scanner hits in UTM space are back projected into the video at multiple standoff distance and cell-Structured Local Binary Patterns(LBPs), Histogram of Gradients(HOGs) and Mean-variance descriptors are extracted. Experiments are conducted using Buried Volatiles with varying metal contents and depths in U.S.Army Test site. Results are extremely encouraging in FL imaging and show a significant decrease in the number of false alarms(Fas). Targests not currently detected by our system are also not detected by a manually under human visualization inspections.

INDEX TERMS: Anomaly Detection,datafusion,explosive hazard detection,forward looking infrared imagery.

I. INTRODUCTION

Exposure in detection and Identification of explosive hazards in an exponentially important and these hazards are widely accountable to numerous deaths and wounds to both militants in the world. Arrangements which detect explosive hazards include Ground-Penetrating-Radar., Infrared (IR) Cameras. Research group investigated and develops a variety of algorithm for forward Looking (FL) vehicle mounted explosive detection technologies., FL Ground Penetrating Radar and Infrared imagery. Early approach organized independently to test detection at every place. In this paper to modify new image space descriptors at pre-scanner locations.This paper is focused on, discovering buried explosive materials in Forward Looking Perspective infrared imagery.Five important criteria themes exists in this work .at first, Improve to detect find targets in FL Perspective imagery for a moving platform. Later, Multiple different anomaly detection algorithms to find different image clusters into groups. Third ,Ensemble of detectors to operate anomaly decisions across frames. To identify the cell structured image features for FAR reduction .Finding targets e.g. buried explosives in forward looking approach.. This paper is widely structured around the flow of information. The image space anomaly detection algorithms and their individual temporal aggregations. The extraction of cell-structured image space features by the back projection of hits at standalone distance. It is achieved by UTM Algorithm decision maps. The information sources are then combined and receiver

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operating characteristic (ROC) curve analysis is used to determine Positive Detection(PD) and reduce False Alarm Rate(FAR) at different operating levels.

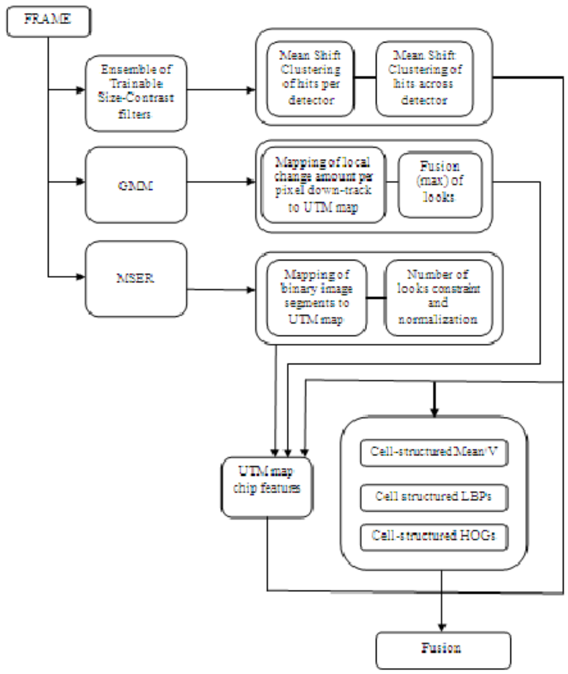

Fig 1.System Architecture

The main goal of this project is to detect and remediate the explosive hazards as these hazards are responsible for uncountable deaths and injuries to both civilians and soldiers throughout the world.This mission dedicated, but not partial to, discovering buried explosive materials in FL perspective infrared imagery. Five important general themes exist in this work.. First, it discusses a new way to detect difficult-to-find targets in FL viewpoint imagery for a moving platform (specifically ground-based).Multiple different anomaly detection algorithms are engaged to find different image artifacts at both the per-image level and across images (temporal change). Third, it discusses clustering within an image, across images and across an ensemble of detectors, as well as aggregation operators for combining anomaly decisions across frames.This project also presents a method of combining disparate system information that is multiple anomaly algorithm decisions and state-of-the-art cell-structured image-space features for FAR reduction. Lastly, the topic of finding targets (e.g., buried explosives) in LWIR is important in the remote sensing area.

To describe an algorithm based on an ensemble of trainable size-contrast filters and weighted mean shift clustering for the recognition of explosive materials (specifically buried targets). The core assumption made by this method is that evidence of buried targets appear in the LWIR imagery according to a known approximate size and that it exhibits high local image contrast. This approach is not restricted to LWIR .

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Fig.2 LWIR Automated Scanner.

II. METHODS PRE-SCREENER

Pre-screener hits in UTM space are back-projected into the video at multiple standoff distances and cell-structured local binary patterns (LBPs), histogram of gradients (HOGs) and mean-variance descriptors are extracted.

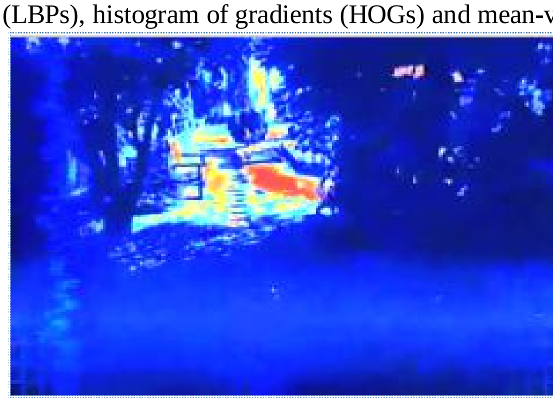

Fig.3 Infra red Video Frame.

2.1 TRAINABLE SIZE CONTRAST FILTERS

Trainable size-contrast filters and weighted mean shift clustering for the recognition of explosive materials (specifically buried targets). The core assumption made by this method is that evidence of buried targets appears in the LWIR imagery according to a known approximate size and that it exhibits high local image contrast.

2.2 GAUSSIAN MIXTURE MODELS

To Detail an image space algorithm based on the concept of detecting local recent change (anomalies) in a road, specifically down track, while a vehicle is in motion. The method is based on Stauffer and Grimson's Gaussian mixture model (GMM) algorithm. The GMM is a low-levelcomputer vision tool from the video surveillance domain for change detection.

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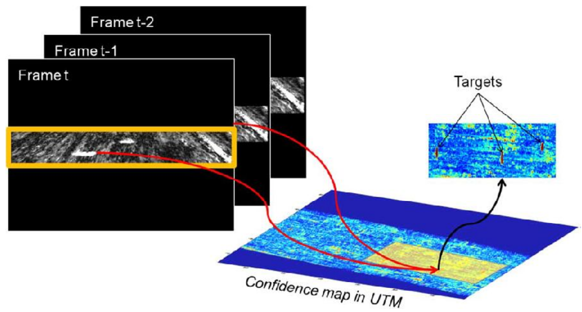

Fig 4 Gaussian Mixture Model

2.3 MAXIMALLY STABLE EXTREMER REGION

The final image space anomaly detection algorithm explored does not assume a target shape. It like the other two algorithms discussed, is not restricted to LWIR. Themotivating idea behind the MSER approach is to search for buried explosive hazards in LWIR by looking for spatially coherent connected regions of expected approximate size using the maximally stable extremal regions (MSER) segmentation algorithm.

2.4 CELL STRUCTURED MEAN

The utility of two state-of-the-art texture features and a contrast feature is explored. Specifically, weighted mean shift cluster centers (pre-screener hits) are subject to a second round of classification based on image features. The reason for this second stage of classification is further reduction of the FAR.

Algorithm 1

Input video frame starts from {frame1,frame2,frame3..framen}

For every Frame hit individual frame contrast detector($1<H(F)<5$)

Initialize temporary frame of every hit frame , initialize at $H(F)=0$

$D_b(x,y)=(\mu p-\mu q)^2/4(\rho^2p+\rho^2q)+0.5*\ln((\rho^2p+\rho^2q)/2\sqrt{(\rho^2p\rho^2q)})$ where (μp, $\rho^2 p$)and (μp, $\rho^2 q$) are the means and variance of the outer and inner windows.

Later ,calculate $D_M(x,y)=(\mu p-\mu q)^2$

If $D_M(x,y)>$ hit frame of range more than 5 frames accuracy and $D_B(x,y)$ hit frame of range more than 5 frames

Calculate UTM Co-ordinate pixel (x,y) hits in every frames.

End if

Find Shift cluster the temporary frame list hit $H_{t,k,}$ Which results in new set of clusters ,i.e mean of clusters

End If.

Algorithm 2

Hit aggregation across frame per every detection

Mean shift cluster {Frame(H1},…Frame (Hn)}, Which results in a clusters of mean

End

Hit aggregation across frames and across detectors

Run weighted mean shift clusters at center

Calculate final hit confidence is the sum of individual detector for all frames.

Specify GMM Parameters: Random means,normalized random importance values,fixed initial standard deviation amount and maximum allowable number of standard Deviations.

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Use to identify the matching factors of Stauffer and Grimson criteria according to their models
Maximally stable extremal regions Algorithm
Initialize discrete UTM Algorithm evidence map
Input video of frames of {set of frames frame1,frame2}
Calculate UTM Coordinate for Pixel(x,y),
Which is the sum of the individual detector weights for the set of hits from the radius .

III. CONCLUSION

This paper proposed a novel approach for combining multiple anomaly algorithm decisions with image space cell-structured features in a long wave infrared (LWIR) system in the context of forward looking (FL) buried explosive hazard detection along a road. FA reduction is the main benefit of the proposed work. It is predominately in the range of [0%, 85%] detection rates that this project shows the greatest improvement.

IV. FUTURE WORK

In future work, it will investigate optimization strategies to learn system parameters currently specified by humans. While it has done some initial sensitivity analysis during development, not for all parameters, a more exhaustive and formal analysis is needed. Future work will also include the continued exploration of different image space algorithms, features and classifiers. Specifically, additional image space algorithms and perhaps other sensors are needed to address the current set of missed targets (what the pre-screener does not identity at any operating level).

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