Title:	Spatiotemporal Denoising of Thermal Video by Total Variation Minimization
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Keyword(s):	Night Vision Surveillance Denoising Total Variation Minimization
Subject(s):	Thermal Imaging Denoising

Abstract: In this work, we present a novel and very simple approach of infra-red video denoising for additive white Gaussian noise (AWGN) in infra-red imagery utilizing spatio-temporal information of a video sequence. There are a number of fundamental differences between information content of visible and infra-red sequences like very poor (Signal to Noise Ratio) SNR, low dynamic range, dynamic nature of target signatures, dependence upon scene ther- modynamics and effect of sun glint which make job of denoising more challenging in infra-red domain. we propose a methodology which is based on Total Variation (TV) regularization of 3-D video cube.This regularization is done on different slices of thermal video cube depending upon motion information in that particular portion of video cuboid.The motion part is separated by detection and tracking algorithm. The regularization parameter(λ) for total variation minimization is different for motion portion of thermal video cuboid than that of the still portion. The performance of this noise reduction technique was evaluated using PSNR (Peak Signal-to-Noise Ratio) and MAE (Mean Absolute Error) quality measure, greater value of the PSNR and lower value of the MAE indicate better noise reduction.
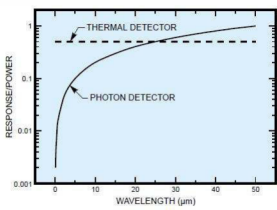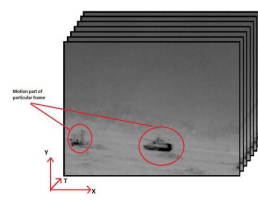
Figure 2.2: Detector

Figure 4.1: Decomposition of a video cube into two portions- one with motion parts and other still part (frame by frame motion detection)
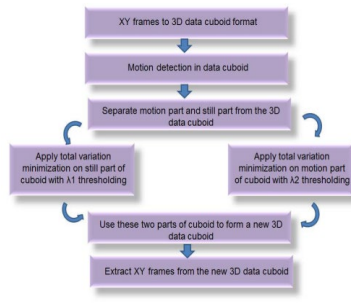

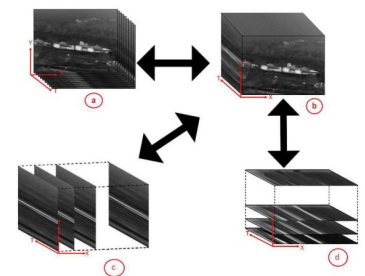Figure 4.3: Block diagram of system model

Figure 4.2: (a) collection of XY frames from a video sequence (b) 3D data cuboid (c) YT slicing of data cuboid (d) XT slicing of data cuboid
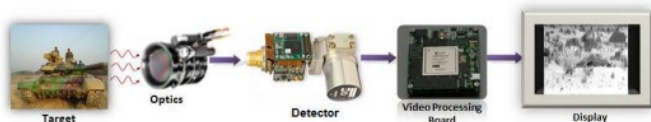

Figure 2.1: Block diagram of Thermal Imaging System

Figure 4.4: Image consisting moving region of cuboid shown in white colour

(a1)   (a2)   (a3)

(b1)   (b2)   (b3)