CERTIFICATE

This is to certify that the work contained in this dissertation entitled "**A novel technique for Foreground Segmentation and Object Tracking"** submitted by **Indu Sirohi (03/SPD/10)** of Delhi Technological University in partial fulfillment of the requirement for the degree of Master of Technology in Electronics & Communication is a bonafide work carried out under my guidance and supervision in the academic year 2010-12.

The work embodied in this dissertation has not been submitted for the award of any other degree to the best of my knowledge.

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ABSTRACT

An elementary goal of computer vision lies in its ability to analyze motion, which ranges from the simple task of locating or tracking a single rigid object as it moves across an image plane. It recovers the full pose parameters of a collection of non-rigid objects interacting in a scene. Automation is a need of today's growing demands and machine vision has proved itself to be a rudimentary tool to accomplish it. Machine vision deals with the study and implementations of systems that allows machines to recognize objects from acquired image data and perform useful tasks from that recognition. It is an application of the vast area of computer vision which has got detection and classification of moving objects as its important area of research. Computer Vision enjoys numerous of astounding achievements varying from their use in mobile robots, human-computer interactions, security systems, surveillance, activity analysis, event recognition, interpreting facial expressions, optical motion capture, enhanced reality and many more. Computer Vision aims at imitating a computer to be a human wherein the Digital camera plays the role of the eye and Image Processing Software as the human Brain. Thus, there is a need to imbue in them the flexibility to handle new inputs, and to adapt automatically without the manual intervention of human engineers. Our work addresses this aspect of the computer vision application. We begin with the discussion of the challenges of foreground segmentation and tracking a rigid object in video. Our work is based on learning a tensor based appearance model, which is having wide importance for background modeling and object tracking. Various subspace learning based algorithms are available that have been used to model the appearances of objects or scenes. In this work we have proposed an advanced adaptive algorithm for robust and efficient background modeling and tracking in colored video sequences that has the capability of capturing the intrinsic spatiotemporal characteristics of scenes. The proposed method is named as 3D-ITSL (3-Dimensional incremental tensor subspace learning) algorithm that effectively works with the spatiocolortemporal (SCT) information by adaptively updating the means and the basis vectors of the corresponding flattened analogue in an online manner. The proposed method employs the wavelet transformation to an optimum decomposition level in order to reduce the computational complexity by working on the approximate counterpart of the original scenes. Our tracking method is an unscented Particle filter that utilizes appearance knowledge and estimate the new state of the intended object.

INDEX

LIST OF FIGURES

LIST OF ABBREVIATIONS

PCA -Principal Component analysis

LDA- Linear Discriminant analysis

ICA- Independent Component analysis

NMF- Non-negative matrix factorization

HMM- Hidden Markov Model

PDE-Partial differential equation

SOM-Self-organizing map

ANN -Artificial Neural Network

DWT -Discrete wavelet transforms

CWT -Continuous wavelet transforms.

SVD -Singular Value Decomposition

3D-ITSL- 3-Dimensional Incremental Tensor Subspace Learning

SIS -Sequential importance sampling

PSO -Particle Swarm Optimization

BBO-Biogeography-based optimization

ACO -Ant colony optimization

KFDA- Kernel Fischer discriminant analysis

MOG -Mixture of Gaussians

GMM -Gaussian Mixture Model

ESS -Efficient Sub-window Search

EM -Expectation Maximization

MOT- Multiple Object Tracking

MRF -Markov Random Field

SGG -Single General Gaussian

MOGG- Mixture of general Gaussians

CBIR -Content based image recognition

HSI -Hyper spectral Image analysis

HOS -Higher order statistics

OTA -Offline tensor analysis

DTA -Dynamic tensor analysis

STA -Streaming tensor analysis

WTA- Windowed tensor analysis

MACA -Multi-Aspect Correlation Analysis

HOSVD-Higher-order tensors is obtained by

IRTSA -Incremental Rank tensor based subspace learning algorithm