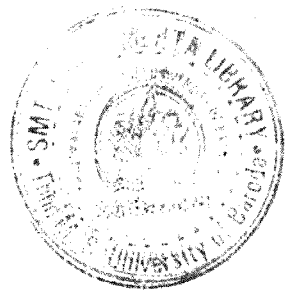

Abstract

Machine vision is the process of receiving and analyzing visual information by digital computer. The research on machine vision focuses on methods and systems for analyzing images. Visual analysis of the objects attempt to detect, identify and track the moving objects like people or vehicles. It also interprets the object behavior from image sequences involving the objects. Object motion analysis has attracted a great interest due to its promising application in the real world such as Visual Surveillance, Traffic Monitoring System, Perceptual User Interface, Animation Film, Video Games, Content based Image Storage and Retrieval, Video Conferencing, Athletic Performance Analysis, Virtual Reality, Biometric Security, Animal Behavioral Science, Human Assisted Motion Annotation, Video Compression, Medical Robots, Military Robots, Pick and Place Industrial Automation, Robotics etc.

Recognizing the objects and perceiving actions of the objects are prerequisites for Machine Intelligent System. The goal of this research work is to develop a generalized model that can identify the moving objects and also able to estimate the motion parameters such as location, direction and speed of moving objects from the image sequences generally captured with the help of CCD Camera for machine intelligence application. The Machine Intelligence System involves mainly two tasks that are Object Recognition and Visual Tracking.

Feature extraction is a key element for designing a Classifier used for Object Recognition. Feature extraction has been carried out in the frequency domain. For more efficient feature extraction, Unsharp Filter and binary threshold is used before applying feature extraction. Unsharp filter amplifies the high frequency components

which enhances the edges of an image. Feature extraction coefficients are extracted by applying Discrete Contourlet Transform that overcomes the problem of representing an image with smooth contours in different directions by providing two additional properties that are directionality and anisotropy as compared to the Discrete Wavelet Transform (DWT). Principal Component Analysis (PCA) has been carried out for dimensionality reduction to create the feature matrix. For feature matching, Euclidean distance classifier and back-propagation neural network have been used. The results of discrete Contourlet transform are compared with Discrete Curvelet Transform. The Discrete Contourlet transform is more efficient and robust method than the Discrete Curvelet Transform. Efficiency of the Classifier has been tested using various types of datasets like face dataset and vehicle dataset.

Visual tracking task has been implemented for single visual tracking and multiple object tracking. Two different approaches are used for both tasks. For single object tracking, a novel Block Matching Algorithm using Predictive Motion Vector based on 3D color histogram has been proposed and implemented efficiently. System tracks the single object selected by the user. Different conditions of the object like similar type of background and foreground, object moving near to frame boundary, object with no motion in the frame sequence etc. are efficiently implemented.

For efficient multiple object tracking, hybrid tracker is used. Hybrid tracker is a combination of color statistics and features of objects. Blob tracking algorithm is used for efficient tracking. The objects are tracked by temporal relationships between blobs without using domain-specific information. For further improvement in the conventional blob tracking, color segmentation is applied to retrieve color statistics of the object. To eliminate the effect of the shadow and lighting effect, all color space is converted to YC_bC_r color space which is widely used for video processing. Pre-processing is applied for better blob extraction.

A distinctive feature of the proposed algorithm is that the method operates on region descriptors instead of region themselves. This means that instead of projecting the entire region into the next frame, only region descriptors need to be processed. Therefore, there is no need for computationally expensive models. Object statistics

has been calculated using Blob Analysis Algorithm. Region tracking and matching is implemented using Color Histogram and 2D Moment Invariants. Contourlet transform features are used for matching, to overcome the tracking problem of same color objects (same histogram). Centroid Statistics is used to measure the distance and direction of the object with respect to the previous frame. Different statistical conditions are incorporated for making efficient algorithm. Vehicle classifier is also incorporated which displays the class of vehicle indicating car; bus etc in the visualization of tracking.

For calculating motion estimation parameters like actual speed of the object, the camera modeling parameters are calculated and converted from image space to the actual object space. For low cost development of the software model, simple digital camera is used. For Visual surveillance application, software model has been developed for calculating the actual focal length, distance between the object and camera and Magnification ratio from parameters of the camera.