

Chapter 9

Swarm Intelligence for Automatic Video Image Contrast Adjustment

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ABSTRACT

Video surveillance has become an integrated part of today's life. We are surrounded by video cameras in all the public places and organizations in our day to day life. Many useful information like face detection, traffic analysis, object classification, crime analysis can be assessed from the recorded videos. Image enhancement plays a vital role to extract any useful information from the images. Enhancing the video frames is a major part as it serves the further analysis of video sequences. The proposed paper discusses the automatic contrast adjustment in the video frames. A new hybrid algorithm was developed using the spatial domain method and Artificial Bee Colony Algorithm (ABC), a swarm intelligence based technique for image enhancement. The proposed algorithm was tested using the traffic surveillance images. The proposed method produced good results and better quality picture for varied levels of poor quality video frames.

1. INTRODUCTION

Today, more video cameras are widely being deployed in many domains like traffic analysis, production plants, domestic and organization surveillance systems. Digital images and videos are found in many scientific, consumer, surveillance, industrial and artistic applications. It uses wide range of electromagnetic spectrum like visible light, infrared and gamma rays. Hence processing these video captured images or video signal is a challenging task. Some important tasks of video processing are removal of image degradations due to high speed image capture, video compression and transmission for efficient storage and transmission. These videos are acquired, processed and analysed for obtaining various information from the video sequence images. Despite the advancement in digital cameras, limitation exists in capturing dynamic range images. The major problem is the poor or high contrast in the im-

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ages. Contrast is the visual property of an object that separates it from other objects in a video image. The contrast of image objects against the background of a video image is important for two functions for object identification and tracking of objects. In order to perform object identification, segmentation and tracking, the contrast levels need to be adjusted properly in order to distinguish image object from one another. Hence the images captured using the video camera needs to be enhanced before further processing. The basic image processing activities involved in any of the video sequence images are detecting image objects, segmentation (Roy et. al., 2014), noise removal, filtering, recognition and moving object detection. Video enhancement is one of the most important and difficult component of video security surveillance system. This paper describes an automatic contrast enhancement technique for digital video applications. Existing contrast enhancement techniques based on spatial domain method are Histogram Equalization (HE), Contrast Stretching method and Adaptive Histogram Equalization (AHE) and various other techniques exist based on frequency domain method (Andrew, 2004). In recent years bio inspired algorithms gained more importance and was used in variety of applications. Many popular swarm intelligence based algorithm like Particle Swarm Optimization (PSO) algorithm (Kennedy & Eberhart, 1995), Ant colony algorithm, Immune system based algorithm (Castro & Zuben, 1999) and Honey Bee algorithm (Karaboga & Basturk, 2007) were used in image processing techniques. The proposed hybrid approach uses the existing Contrast Stretching method (Spatial domain) combined with ABC algorithm. Section 2 discusses with the existing video image enhancement techniques. Section 3 explains proposed Contrast adjustment technique based on the spatial domain method. Section 4, details about the ABC algorithm. Section 5, discusses the optimization functions used in the proposed work. Section 6 explains the proposed hybrid algorithm for automatic contrast adjustment in video sequence images. Experiment results and the evaluation measures used are discussed in Section 7. Conclusion and future work is briefed in Section 8.

2. LITERATURE REVIEW

Digital images captured using video cameras for a variety of purposes, including entertainment, medical, business, documents, industrial, military, civil, traffic, security and scientific. The goal of an observer, either human or machine is to extract useful information (Byeong-Ho, 2007). Video sensors are used widely in many applications due to their fast response, easy installation, operation and maintenance and their ability to monitor wide areas. The analysis of the static environment (automatic lane finding) and the detection of static or moving obstacles (object detection) on traffic video images were proposed by (Kastrinaki et. al., 2003). (Srinivasan & Balaram, 2006) describes a real time contrast enhancement technique for digital video applications on a modified histogram equalization procedure. (Lin & Kao, 2003) used the properties of Human visual system (HVS) for an adaptive local contrast enhancement (ALCE) method to enhance the medical image. (Viswanath & Gunasundari, 2015) and (Anter, 2014) performed contrast adjustment in medical images. The foraging behaviour of swarm of bees was applied in various applications in the literature. (Tereshko & Loengarov, 2005) established a robot idea based on foraging behaviour of bees. (Drias et al., 2005) introduced a new meta-heuristic approach called Bees Swarm Optimization (BSO). Similarly, (Benatchba et al., 2005) introduced a metaheuristic based on the process of bees' reproduction to solve a 3-sat problem. (Wedde et al., 2004) presented a novel routing algorithm, called Bee Hive. (Yang, 2005) developed a Virtual Bee Algorithm (VBA) to optimize two-dimensional numeric functions. (Pham et al., 2005) introduced the Bees Algorithm for optimizing multi-variable

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