Chapter 71
Medical Video Processing:
Concept and Applications

Srijan Goswami
Institute of Genetic Engineering, India

Urmimala Dey
JIS College of Engineering, India

Payel Roy
St. Mary's Technical Campus – Kolkata, India

Amira S. Ashour
Tanta University, Egypt

Nilanjan Dey
Techno India College of Technology – Kolkata, India

ABSTRACT

In today's medical environments, imaging technology is extremely significant to provide information for accurate diagnosis. An increasing amount of graphical information from high resolution 3D scanners is being used for diagnoses. Improved medical data quality become one of the major aims of researchers. This leads to the development of various medical modalities supported by cameras that can provide videos for the human body internal for surgical purposes and more information for accurate diagnosis. The current chapter studied concept of the video processing, and its application in the medical domain. Based on the highlighted literatures, it is convinced that video processing and real time frame will have outstanding value in the clinical environments.

INTRODUCTION

Video processing is an essential part for various technologies, including video surveillance, robotics, medical applications and multimedia. In the clinical environments, medical imaging is significant as multiple imaging modalities, such as X-ray angiography, magnetic resonance imaging (MRI), or endos-

copy assemble information on the patient's medical status. Some of the medical modalities captured videos for the body internal, thus image/video processing become essential. For the medical consultant, visual information is vital to confirm the diagnosis and to control a therapy. Generally, the human visual system has bounded spatio-temporal sensitivity; however, below this capacity, several signals can be instructive. Moreover, Liu et al. (2005) revealed that motion with low spatial amplitude is impossible for humans to see, thus it can be magnified to provide remarkable mechanical behaviour. This motivates researchers to develop tools that extract invisible signals in videos. The extracted signals can be employed to redisplay the videos in an indicative manner. Aachet al. (2002) studied the coronary angiography, in the coronary arteries where the inflow and outflow of a contrast agent to provide decisive information.

Thus, image/video processing algorithms are required for image enhancement, analysis, interpretation, and displaying as well as other processing phases for an accurate diagnosis. Video processing can be defined as the analysis of video content in order to obtain an understanding of the scene that it describes. Generally, image frames are acquired from a medical video source. From the basic science perspective, the methods in video analysis are motivated by the necessity to develop machine algorithms that can mimic the capabilities of human visual systems.

Various functions in video analysis were grouped into several categories/levels, namely Low Level, Mid-Level and High Level (Beyong et al., 2007). However, there are certain uncertainties about which function belongs to which level. From the single image point of view, two fundamental basic tasks are employed for video processing:

1. The computation of gradients, which highlights sections of images that have significant change in the image intensity. Identification of edges in the image is used to detect lines and corners of the image.
2. Image Intensity analysis such as gray scale or color value.

The fundamental structures like edges, lines and corners can be implemented as the building blocks for the identification of higher level structures like shapes of the object.

Detection is also a basic low-level image analysis task as it can assist the identification of interesting objects in the scene, which can then lead to an understanding of the scene or an analysis of the actions of the objects. One of the factors that affect the performance of image/video analysis algorithms is the quality of the image, where different sources of noise, including sensor noise, environmental conditions like lighting, and occluding objects can temporarily mask the objects of interest. This requires statistical modelling of image quality, machine learning based approaches to compensate for the variation in quality, and physics-based approaches that model the environmental factors to account for their effects.

Alain et al. (2008) provided a sequence of images (i.e., a video), which are usually highly correlated, an additional task is to compute the motion of the objects over the video. Optical flow is a scheme for estimating the motion of each individual pixel. Combined with segmentation, it can provide a sense of how each part of the scene is changing over time. Additionally, tracking involves computing the location of each object over time, given the detections of the objects in each frame. Bayesian tracking approaches like the Kalman filter or the particle filter, combined with suitable data association strategies, have been adapted to the video analysis tasks. Mayank et al. (2005) examined the effect of distributions of certain object characteristics, like image intensity value; change over time to compute a track of these objects. Although motion analysis, including both flow computation and tracking, has been the mainstay of

Related Content

Medical 3D Graphics With eXtensible 3D
Felix G. Hamza-Lup, Nicholas F. Polys, Athanasios G. Malamosand Nigel W. John (2020). *Recent Advances in 3D Imaging, Modeling, and Reconstruction (pp. 270-288).*
www.irma-international.org/chapter/medical-3d-graphics-with-extensible-3d/254596

An Overview of Image and Video Segmentation in the Last 40 Years
Yu-Jin Zhang (2006). *Advances in Image and Video Segmentation (pp. 1-16).*
www.irma-international.org/chapter/overview-image-video-segmentation-last/4834

Thermal Human Face Recognition for Biometric Security System
Ayan Seal, Debotosh Bhattacharjee, Mita Nasipuriand Dipak Kumar Basu (2018). *Computer Vision: Concepts, Methodologies, Tools, and Applications (pp. 1838-1863).*
www.irma-international.org/chapter/thermal-human-face-recognition-for-biometric-security-system/197028

SAR Image Recording Strategy to Improve Characteristics
Hocine Chebi (2021). *International Journal of Computer Vision and Image Processing (pp. 58-65).*
www.irma-international.org/article/sar-image-recording-strategy-to-improve-characteristics/275818

Securing Digital Image with Authentication Code
Siva Charan Murahariraoand Manik Lal Das (2014). *Computer Vision and Image Processing in Intelligent Systems and Multimedia Technologies (pp. 203-215).*
www.irma-international.org/chapter/securing-digital-image-with-authentication-code/108417