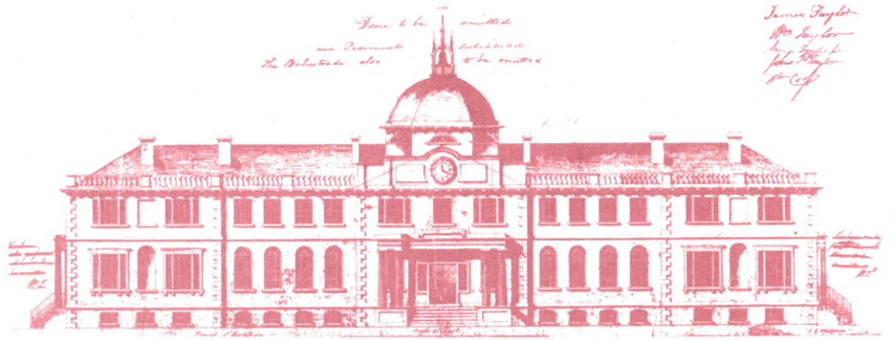
APPLICATION OF FOOTSTEP SOUND AND LAB COLOR SPACE IN MOVING OBJECT DETECTION AND IMAGE QUALITY MEASUREMENT USING OPPOSITE COLOUR PAIRS

Abstract

This PhD dissertation is focused on two major tasks of an Atlantic Innovation Fund (AIF) sponsored "Triple-sensitive Camera Project". The first task focuses on the improvement of moving object detection techniques, and second on the evaluation of camera image quality. Cameras are widely used in security, surveillance, site monitoring, traffic, military, robotics, and other applications, where detection of moving objects is critical and important. Information about image quality is essential in moving object detection. Therefore, detection of moving objects and quality evaluation of camera images are two of the critical and challenging tasks of the AIF Triple-sensitive Camera Project.

In moving object detection, frame-based and background-based are two major techniques that use a video as a data source. Frame-based techniques use two or more consecutive image frames to detect moving objects, but they only detect the boundaries of moving objects. Background-based techniques use a static background that needs to be updated in order to compensate for light change in a camera scene. Many background modelling techniques involving complex models are available which make the entire procedure very sophisticated and time consuming. In addition, moving object detection techniques need to find a threshold to extract a moving object. Different thresholding methodologies generate varying threshold values which also affect the results of moving object detection. When it comes to quality evaluation of colour images, existing Full-Reference methods need a perfect colour image as reference and No-Reference methods use a gray image generated from the colour image to compute image quality. However, it is very challenging to find a perfect reference colour image. When a colour image is converted to a grey image for image quality evaluation, neither colour information nor human colour perception is available for evaluation. As a result, different methods give varying quality outputs of an image and it becomes very challenging to evaluate the quality of colour images based on human vision.

In this research, moving object detection using frame differencing and background subtraction techniques is improved by incorporating the sound of a moving person's footsteps in the camera scene and opposite colour pairs of *Lab* colour space respectively. Novel thresholding methodologies are also developed which consider spatial distribution of pixels in addition to the statistical distribution used by existing methods. A specified frame differencing technique shows an improvement of 52% in object detection rate when footstep sound is considered. Other frame-based techniques are also improved by incorporating footstep sound. The background subtraction technique produces better outputs in terms of completeness of a moving object when opposite colour pairs are used with thresholding using spatial autocorrelation techniques. The developed technique outperformed background subtraction techniques with most commonly used thresholding methodologies. For image quality evaluation, a new "No-Reference" image quality measurement technique is developed which evaluates quantitative image quality score as it is evaluated by human eyes. The SCORPIQ technique developed in this research is independent of a reference image, image statistics, and image distortions. Colour segments of an image are spatially analysed using the colour information available in *Lab* colour space. Quality scores from SCORPIQ technique using LIVE image database yield distinct results as compared to quality scores from existing methods which give similar results for visually different images. Compared to visual quality scores available with LIVE databse, the quality scores from SCORPIQ technique are 3 times more unique. SCORPIQ give 4 to 20 times distinguishable results compared to statistics based results which do not follow the quality scores as evaluated by human eyes.



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UNIVERSITY OF NEW BRUNSWICK

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ORAL EXAMINATION

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IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Ph.D. Candidate

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Geodesy & Geomatics Engineering

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Publications:

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