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A Study on the Design of Real-Time Active Visual Surveillance System for Wireless Network

用於無線網絡的實時影像
自動監察系統設計之研究

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ABSTRACT

In this thesis, we study the important issues in the design of an efficient real-time Wireless vIsual Surveillance systEm (WISE). Due to the limitation of the wireless network and the processing capacity of mobile devices, two important factors are considered (1) to minimize the video workload on the wireless network, and (2) to minimize the processing workload at the front-end video capturing unit.

For a single static camera setting, the first factor is addressed by the proposed *cooperative framework* for *semantic filtering* of video frames. Instead of forwarding every frame to the backend server for analysis and query evaluation, only those visual objects which are relevant to the monitoring queries are forwarded. The processing workload at the front-end video capturing unit is controlled and reduced by the evaluation frequency of visual objects in such a way that a visual object under monitoring will not be lost tracked and, at the same time, no extra processing workload is consumed.

In addition, an efficient visual object detection and segmentation algorithm – Integer Hybrid Algorithm – is proposed for the front-end video capturing unit which does not have a floating point processing unit (FPU). It combines the advantages as well as compensates the disadvantages from each other from two base algorithms, namely, background subtraction and temporal differencing. The result is a robust algorithm for visual object extraction for processing power limited device.

We further study the job scheduling issues in which a continuously moving panning camera is installed. Due to movement of panning camera, visual object may be out of the camera range at the pre-determined evaluation frequency. In addition, processor overloading may occur due to the dynamic properties of visual

objects together with the movement of camera. Basing on our previous study on static camera setup, a predictive scheme is proposed to control the evaluation workload by rearranging jobs into other execution time window that has less loading and, more importantly, the object is mostly likely being visible by the camera. The loading is further reduced to within the processor capacity by adaptively adjusting the analysis resolution at the cost of scarifying the accuracy of visual object extraction.

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