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A survey on tracking and surveillance of multiple road users in outdoor urban traffic

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Abstract
The large variability of road user appearance in an urban setting makes it very difficult to control the traffic and the crowd. Here a real-time system that detects moving crowd in a video sequence is presented. Crowd detection differs from pedestrian detection in that no individual pedestrian can be properly segmented in the image is assumed. A scheme that looks at the motion patterns of crowd in the spatio-temporal domain and give an efficient implementation that can detect crowd in real-time is proposed. Pedestrain detection from a moving platform (i.e, vehicles) holds the promise of increased safety, both for pedestrains and passengers. For tracking users an on board computer vision is developed. Web cam is used to monitor the road side status and the number of vehicles get counted while it enters into the frame. It gives voice suggestions to the authority. Thus, the accuracy of the system is more and accidents can be avoided before it happens.

Keywords: Crowd detection, vehicle, tracking, computer vision, voice suggestions, accidents, etc

1. Introduction
An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system often with real-time computing constrains. It is embedded as part of a complete device often including hardware and software and mechanical parts.
A precise definition of embedded system is not easy. Simply stated, all computing systems other than general purpose computer (with monitor, keyboard etc.,) are embedded systems.
Embedded system finds numerous applications in various fields such as digital electronics, Telecommunications, computing network, smart cards, satellite communication, military defence equipment, research system equipment, and so on. Some of the applications are mentioned below:

- IOT Based Energy Meter Reading Through Internet.
- Fm remote encoder/decoder circuit working principal.
- Stereo noise reduction circuit working and application.
- Flexible Ac transmitter system using Thyristor switch reactance.
- Design and implementation of GSM based industrial automation.

Today, embedded systems are found in cell phones, digital cameras, camcorders, portable video games, calculators, and personal digital assistants, microwave ovens, answering machines, home security systems, washing machines, lighting systems, fax machines, copiers, printers and scanners, cash registers, alarm systems, automated teller machines, transmission control, cruise control, fuel injection, anti-lock brakes, active suspension and many other devices/gadgets.

2. Literature survey
2.1 Tracking and segmentation of highway vehicles in crowded and cluttered scenes
Goo Jun J. K. Aggarwal and Muhittin Gokmen proposed the tracking and segmentation of highway vehicles in crowded and cluttered scenes. Monitoring highway traffic is an important application of computer vision research. In this paper, we analyze congested highway situations where it is difficult to track individual vehicles in heavy traffic because vehicles either occlude each other or are connected together by shadow. Moreover, scenes from traffic monitoring videos are usually noisy due to weather conditions and/or video compression.

We present a method that can separate occluded vehicles by tracking movements of feature points and assigning over-segmented image fragments to the motion vector that best represents the fragment's movement. Experiments were conducted on traffic videos taken from highways in Turkey, and the proposed method can successfully separate vehicles in overpopulated and cluttered scenes.

2.2 Urban Tracker: Multiple Object Tracking in Urban Mixed Traffic

Jean-Philippe Jodoin, Guillaume-Alexandre Bilodeau and Nicolas Saunier proposed Multiple Object Tracking in Urban Mixed Traffic. In this paper, we study the problem of detecting and tracking multiple objects of various types in outdoor urban traffic scenes. This problem is especially challenging due to the large variation of road user appearances. To handle that variation, our system uses background subtraction to detect moving objects. In order to build the object tracks, an object model is built and updated through time inside a state machine using feature points and spatial information. When an occlusion occurs between multiple objects, the positions of feature points at previous observations are used to estimate the positions and sizes of the individual occluded objects. Our Urban Tracker algorithm is validated on four outdoor urban videos involving mixed traffic that includes pedestrians, cars, large vehicles, etc. Our method compares favorably to a current state of the art feature-based tracker for urban traffic scenes on pedestrians and mixed traffic.

2.3 Tracking Sports Players with Context-Conditioned Motion Models

Jing hen Liu, Peter Carr, Robert T. Collins and Yanxi Liu proposed Tracking sports players with Context-Conditioned Motion Models. We employ hierarchical data association to track players in team sports. Player movements are often complex and highly correlated with both nearby and distant players. A single model would require many degrees of freedom to represent the full motion diversity and could be difficult to use in practice. Instead, we introduce a set of Game Context Features extracted from noisy detections to describe the current state of the match, such as how the players are spatially distributed. Our assumption is that players react to the current situation in only a finite number of ways. As a result, we are able to select an appropriate simplified affinity model for each player and time instant using a random decision forest based on current track and game context features. Our context-conditioned motion models implicitly incorporate complex inter-object correlations while remaining tractable. We demonstrate significant performance improvements over existing multi-target tracking algorithms on basketball and field hockey sequences several minutes induration and containing 10 and 20 players respectively.

2.4 A Novel Video Dataset for Change Detection Benchmarking

Nil Goyette, Pierre-Marc Jodoin, Fatih Porikli, Janusz Konrad and Prakash Ishwar proposed A novel video Dataset for change detection benchmarking. Change detection is one of the most commonly encountered low-level tasks in computer vision and video processing. A plethora of algorithms have been developed to date, yet no widely accepted, realistic, large-scale video dataset exists for benchmarking different methods. Presented here is a unique change detection video dataset consisting of nearly 90,000 frames in 31 video sequences representing 6 categories selected to cover a wide range of challenges in 2 modalities (color and thermal IR). A distinguishing characteristic of this benchmark video dataset is that each frame is meticulously annotated by hand for ground-truth foreground, background, and shadow area boundaries – an effort that goes much beyond a simple binary label denoting the presence of change. This enables objective and precise quantitative comparison and ranking of video-based change detection algorithms. This paper discusses various aspects of the new dataset, quantitative performance metrics used, and comparative results for over two dozen change detection algorithms. It draws important conclusions on solved and remaining issues in change detection, and describes future challenges for the scientific community. The dataset, evaluation tools, and algorithm rankings are available to the public on a website1 and will be updated with feedback from academia and industry in the future.

2.5 A Real-time Computer Vision System for Measuring Traffic Parameters

David Beymer, Philip McLauchlan, Benn Coifman, and Jitendra Malik proposed A Real Time Computer Vision System. For Measuring Traffic Parameters For the problem of tracking vehicles on freeways using machine vision, existing systems work well in free-flowing traffic. Traffic engineers, however, are more interested in monitoring freeways when there is congestion, and current systems break down for congested traffic due to the problem of partial occlusion. We are developing a feature based tracking approach for the task of tracking vehicles under congestion. Instead of tracking entire vehicles, vehicle sub-features are tracked to make the system robust to partial occlusion. In order to group together sub-features that come from the same vehicle, the constraint of common motion is used. In this paper we describe the system, 0 real-time implementation using a network of DSP chips, and experiments of the system on approximately 44 lane hours of video data.

2.6 ViBe: A Universal Background Subtraction Algorithm for Video Sequences

Olivier Barnich and Marc Van Droogenbroeck proposed A Universal Background Subtraction Algorithm for video Sequnces. This paper presents a technique for motion detection that incorporates several innovative mechanisms. For example, our proposed technique stores, for each pixel, a set of values taken in the past at the same location or in the neighborhood. It then compares this set to the current pixel value in order to determine whether that pixel belongs to the background, and adapts the model by choosing randomly which values to substitute from the background model. This approach differs from those based upon the classical belief that the oldest values should be replaced first. Finally, when the pixel is found to be part of the background, its value is propagated into the background model of a neighboring pixel. We describe our method in full details (including pseudo-code and the parameter values used) and compare it to other background subtraction techniques. Efficiency figures show that our method outperforms recent and proven state-of-the-art methods in terms of both computation speed and detection rate. We also analyze the performance of a

downscaled version of our algorithm to the absolute minimum of one comparison and one byte of memory per pixel. It appears that even such a simplified version of our algorithm performs better than mainstream techniques.

2.7 Multi-target Tracking by Lagrangian Relaxation to Min-Cost network

A sad A. Butt and Robert T. Collins proposed Multi-target Tracking by Lagrangian Relaxation to Min-Cost network. We propose a method for global multi-target tracking that can incorporate higher-order track smoothness constraints such as constant velocity. Our problem formulation readily lends itself to path estimation in a trellis graph, but unlike previous methods, each node in our network represents a candidate pair of matching observations between consecutive frames. Extra constraints on binary flow variables in the graph result in a problem that can no longer be solved by min-cost network flow. We therefore propose an iterative solution method that relaxes these extra constraints using Lagrangian relaxation, resulting in a series of problems that are solvable by min-cost flow, and that progressively improve towards a high-quality solution to our original optimization problem. We present experimental results showing that our method outperforms the standard network-flow formulation as well as other recent algorithms that attempt to incorporate higher-order smoothness constraints.

2.8 Tracking All Road Users at Multimodal Urban Traffic Intersections

Jean-Philippe Jodoin, Guillaume-Alexandre Bilodeau Nicolas Saunier proposed Tracking All Road Users at Multimodal Urban Traffic Intersections. Because of the large variability of road user appearance in an urban setting, it is very challenging to track all of them with the purpose of obtaining precise and reliable trajectories. However, obtaining the trajectories of the various road users is very useful for many transportation applications. It is particularly essential for any task that requires higher level behavior interpretation, including new safety diagnosis methods that rely on the observation of road user interactions without a collision and therefore do not require waiting for collisions to happen. In this paper, we propose a tracking method that has been specifically designed to track the various road users that may be encountered in an urban environment. Since road users have very diverse shapes and appearances, our proposed method starts from background subtraction to extract the potential a prior unknown road users. Each of these road users is then tracked using a collection of key points inside the detected foreground regions, which allows the interpolation of object locations even during object merges or occlusions. A finite state machine handles fragmentation, splitting, and merging of the road users to correct and improve the resulting object trajectories. The proposed tracker was tested on several urban intersection videos and is shown to outperform an existing reference tracker used in transportation research.

3. Conclusion

In order to avoid traffic in urban areas this project is very useful. The road conditions can be monitored continuously using web cam. Web Cam monitors the crowd and Raspberry Pi gives the instructions to control the crowd to the respective authority. Thus, the manual work of monitoring gets reduced. As we are using web cam the accuracy will also be more compare to the manual work. Thus the traffic can be controlled using this method and accidents could also be avoided.

4. References

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