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The Pedestrian Tracking Based on an On-line Boosting Method

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1. Abstract

In actual surveillance conditions, there exist a lot of uncertainties in pedestrian movements. These movements may disturb most tracking algorithms and result in tracking failure. In this paper, a new pedestrian tracking system is proposed, in which an online-boosting method is embedded into the pedestrian tracking of object model. Online-boosting [1] methods have become very popular in computer vision, and achieved impressive performance in detection and recognition tasks. However, the on-line adaption has to face one key problem: an error which finally leads to tracking failure (drifting) may be accumulated in each update of the tracking. In order to avoid the drifting problem, MIL (Multiple Instance Learning) method is proposed, instead of traditional supervised learning, to lead to a more robust tracker with well performance.

2. Proposed method

2.1 Tracking Process

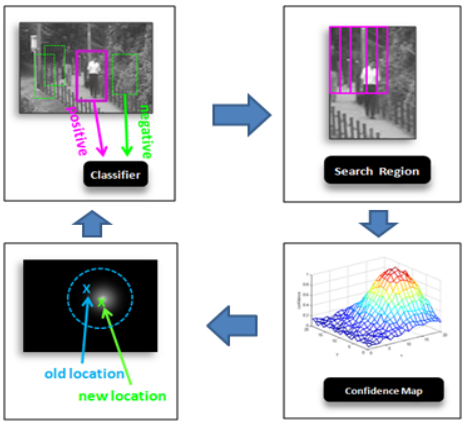

Figure 1. Process of tracking with a classifier

We build an initial classifier by using a marked region as positive samples and patches. At time t+1, we evaluate the current classifiers. Then receive a confidence value which is entered into confidence map. This confidence map is analyzed and the tracking window is shifted to the best possible position. Finally, the process is iterated by updating the classifiers.

2.2 Multiple Instance Learning (MIL)

The basic idea of Multiple Instance Learning (MIL) is that during the training, examples are provided for bags of samples rather than individual instances. If a bag is labeled positive it is assumed that at least one positive instance is contained. Otherwise the bag is negative.

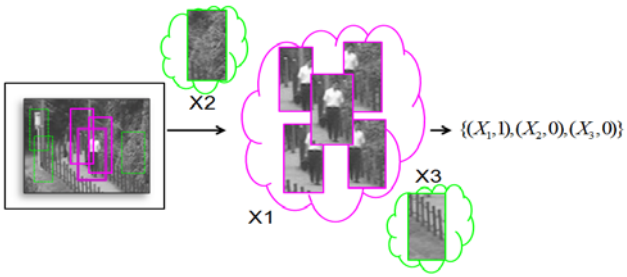

Figure 2. MIL model: the pink samples represent a positive bag; the green samples represent negative bags

2.3 Features and weak classifiers

In this paper, some orientation histograms [2] have been utilized as effective features. We calculate the gradient value and orientations using the following formula.

$$G(x,y) = \sqrt{G_x(x,y)^2 + G_y(x,y)^2}$$

$$\vartheta(x,y) = \tan^{-1}(G_y(x,y)/G_x(x,y))$$

On-line boosting for obtaining a weak classifier h_j^{weak}, for a feature j, where $f_j(x)$ evaluates this feature on the image x. We build a model by estimating the probability $p(1|f_j(x))$, via a Guass distribution, the mean μ^+ and standard deviation σ^+ for positive labeled samples and $p(-1|f_j(x))$ by $N(\mu^-,\sigma^-)$ for negative samples.

3. Experiments

We used orientation histograms with 4bins, and selected 250 features and 50 selectors and then put them into online boosting system. It also performed well in an interaction situation.

4. Future Work

Our system is not so fast to fulfill real-time requirements; we are considering using easier weak classifiers such as K-NN for each bin to speed up our system. Furthermore, we also think about variable size for detection window.

5 References

[1] H. Grabner and H. Bischof. On-line boosting and vision. In Proc. CVPR, volume 1, pages260–267, 2006.

[2] N. Dalal and B. Triggs. Histograms of Oriented Gradients for Human Detection. In Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition, San Diego, USA, June 2005. Vol. II, pp. 886-893.