

GEOMETRICALLY CONSTRAINED OBJECT TRACKING IN NON-OVERLAPPING CALIBRATED CAMERAS WITHIN A BAYESIAN FRAMEWORK

Dileepa Joseph Jayamanne

(128004A)



University of Moratuwa, Sri Lanka.
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Declaration

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Abstract

When establishing correspondence between objects across non-overlapping cameras, the existing methods combine separate likelihoods of appearance and kinematic features in a Bayesian framework, constructing a joint likelihood to compute the probability of re-detection. So far, no method has assumed dependence between appearance and kinematic features. In this work we introduce a novel methodology to condition the location of an object on its appearance and time, without assuming independence between appearance and kinematic features, in contrast to existing work. We characterize the linear movement of objects in the unobserved region with an additive Gaussian noise model. Assuming that the cameras are affine, we transform the noise model onto the image plane of subsequent cameras. This noise model acts as a prior to improving re-detection. We have tested our hypothesis with toy car experiments and real-world camera setups. The prior constrains the search space in a subsequent camera, greatly improving the computational efficiency. Our method also has the potential to distinguish between similar-type objects, and recover correct labels when they move across cameras.

Index terms— Multi-camera tracking, non-overlapping cameras, priors for object re-detection, affine transformation of noise model.



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List of Abbreviations

Abbreviation	Description
CCD	Charge coupled device
CCTV	Closed circuit television camera
EM	Expectation maximization
FOV	Field of view
HOG	Histogram of oriented gradients
3DHOG	3D-Histogram of oriented gradients
FPS	Frames per second
N-cut	Normalized cut
PDF	Probability density function
ROI	Region of interest
SURF	Speeded up robust features



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