053 - Computational Methods in Image Analysis

053 - 053 - Session 1: Computational Methods in Image Analysis

No: 1574

Title: TRACKING FEATURES WITH KALMAN FILTERING, MAHALANOBIS DISTANCE AND A MANAGEMENT MODEL

Abstract: Feature tracking is a complex problem whose automatic detection and execution evolved considerably in the recent past, especially due its wide range of applications, for instance in surveillance, object deformation analysis, traffic monitoring. Many of such applications require simultaneous tracking of multiple features, and also involve problems related to their appearance and disappearance of the image scene.

A key component of a successful tracking system is its ability to search efficiently for the feature [1].

For the tracking system to perform properly, the most likely measured potential target location should be used to update the target's state estimator. This is generally known as the data association problem. The probability of the given measurement being correct can be a distance function between the predicted state of the target and the measured state. This becomes especially important for targets that may come close to each other or even overlap, such as people.

An approach uses assignment algorithms, which were recently shown to be effective in data association for target tracking in the presence of noise. In this case, data association is formulated as a constrained optimization problem, where the cost function to be minimized is, usually, a combined likelihood function evaluated using the results from the state estimator. The state is usually constrained by position and/or velocity and the assignment by physical constraints, for example, only one measurement for a track and vice-versa [2].

On the other hand, to track the captured movement the Kalman filter is a widespread technique for feature tracking, but it has recently been substituted by particle filters [3]. The Kalman filter rests on the assumption that the disturbances and initial state vector are normally distributed, and it is shown that the obtained mean of the conditional distribution of a state is an optimal estimator in the sense that it minimizes the mean square error. If the normality assumption is dropped there is no guarantee that the Kalman filter will give the conditional mean of the state vector. So, other filters have been proposed, but they reveal some problems too as well as high computational cost [3].

Comments: References

[1] T. Liu and H. Chen. Real-time tracking using trust-region methods. IEEE Transactions on attern Analysis and Machine Intelligence, 26:397/402, 2004.

[2] T. Kirubarajan, Y. Bar-Shalom, and K. Pattipati. Multiassignment for tracking a large number of overlapping objects. IEEE Transactions on Aerospace and Electronic Systems, 37(1):2/21, 2001.

[3] M. Arulampalam, S. Maskell, N. Gordon, and T. Clapp. A tutorial on particle filters for online nonlinear/non-gaussian Bayesian tracking. IEEE Transactions on Signal Processing, 50(2):174/188, 2002.

[4] Pinho, R., Tavares, J., Correia, M., An Improved Management Model for Tracking Missing Features in Long Image Sequences, CompIMAGE - Computational Modelling of Objects Represented in Images: Fundamentals, Methods and Applications, Coimbra, Portugal, 2006.

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