2009 PhD subject: Non-parametric likelyhood functions for visual estimation : application to object tracking and recognition.

1 Description:

Lasmea's Gravir Group develops methods of visual estimation in images or sequences of images. These give rise to object tracking applications like pedestrians or vehicles, as well as pattern recognition applications like pedestrians detection or gesture or pose estimation.

Most of these methods use a likelyhood function to relate the observation sequence to the searched state, which has generated that last. The likelyhood functions are often expressed under the form of densities of probabilities. They are either modelized by parametric models or by non parametric models. In the first case, the shape of the functions are often simple (for instance Gaussians or mixtures of Gaussians...) and can not explain complex densities. In the second case, densities are approximated by methods like the k nearest neighbours (kNN) or the Parzen windows.

The works of Sylvain Boltz [1][2] deal with the estimation of probabity density functions by methods like kNN. He showed that they were less sensitive to the tuning of the parameters than the classical techniques like "*Kernel Density Estimation*". The results of his works are very promising in the field of segmentation and object tracking.

The goal of this thesis is to use a similar approach to compare densities probabilities describing appearance models. We only know a set of vectors of features from these densities. We will seek to address the following three problems:

1) update the model along the time,
2) model the probability density function in a high dimensional space,
3) model the probability density function from a very high number of points.

The study of these three problems will allow to develop original methods in tracking [3] and in object recognition [4].

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References

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[2] S. Boltz, A. Herbulot, E. Debreuve, M. Barlaud, and Aubert G. motion and appearance non parametric joint entropy for video segmentation. *published on line in International Journal of Computer Vision*, 2007.

[3] F. Bardet and Chateau T. Real time multi object tracking with few particles. In *Visapp, International Conference on Vision Theory and Applications, Lisboa, Portugal*, 2009.

[4] L. Leyrit, T. Chateau, and J.T. Laprest. Visual pedestrian recognition in weak classifier space using nonlinear parametric models. *In ICIP IEEE International Conference on Image Processing, San Diego, USA*, 2008.