Parallelization of an algorithm for non rigid objects detection with stochastic global optimization

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In many real applications objects suffer different deformations due to several factors like sampling errors or the flexibility of the material. Many algorithms have been developed to recover such objects. Some of them are based in the use of free-form deformable models like "snakes". Others are based in parametric models, where an object matching algorithm, combined with this deformation model, is used as a Bayesian objective function that is minimized by a gradient descent method.

In this talk, a parallel algorithm for detecting rigid and non-rigid objects in an image will be presented. This algorithm uses a Bayesian inference scheme to register the parameters that describe the object of interest included in the image. This kind of techniques requires knowledge about the shape of the object. This prior information of the object shape is composed of a prototype template, a set of deformation transformations of the template, and a probability density on the set of deformation transformations.

The likelihood measures the similarity between the deformed template and the objects present in the image. A Generalized Hough Transform (GHT [1, 2]) is used to detect the deformed template in the image and to measure the similarity using a defined energy function. The prior information is combined with the likelihood to obtain the *a posteriori* probability. Finally, by obtaining the maximum of this probability (Maximum A Posteriori), the deformed template is identified in the image. This MAP estimate is computed using the evolutionary global optimization algorithm UEGO (stands for Universal Evolutionary Global Optimizer, [3, 4]).

Our proposed algorithm is very robust and it is able to detect non-rigid objects even in the presence of noise or occlusions. Unfortunately, it is computationally very expensive. To solve this disadvantage a possible parallelization of the algorithm is proposed. The parallel strategy consists on a master-slave configuration. The tasks are distributed among the processors to balance the computational load. It has been implemented using the message-passing paradigm with PVM. The parallel program has been tested in a Cray T3E using up to 32 processors.

References

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