DETECTION OF LINEAR STRUCTURES IN AERIAL PHOTOGRAPHIC IMAGES BASED ON A MARKOV/GIBBS MODEL

Jorge Augusto de Castro Neves Barbosa M.Sc Thesis IST/UTL - Lisbon - Portugal December, 1994

ABSTRACT

This work addresses the problem of detecting linear structures (such as roads) in aerial photographic images. Bayesian methods based on a Markov/Gibbs model are used. The Markov/Gibbs model describes the prior knowledge as a joint representation of the intensity and line fields.

Since the quality of the solution is strongly dependent on the line field modeling, we focus our attention in this problem. The derived model integrates several constraints related to unlike geometric forms. By doing so, the likelihood that the detected structures correspond to the objects of interest is increased.

Two different implementations of the optimization algorithm are considered: (i) sequential, where the line detection and following is performed on a previously segmented image; and (ii) integrated, where the intensity and line fields are jointly optimized. The superior performance of the former approach is verified.

The bayesian approach supported on the model here proposed is compared with well known techniques based on heuristic models. This study shows that the statistical approach, provided that it relies on structured prior models in accordance with the specific problem under consideration, yields much more efficient solutions.

Based on the results obtained, it can be concluded that the line field model here developed is an adequate representation of the particular structures of interest.

Keywords: Edge Detection, Markov Random Fields, Gibbs Distribution, Intensity Field, Line Field