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Construction of Rules for Knowledge-Based Anatomical Landmark Localization (K-BALL)

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a) Background and Objective

Anatomical landmark localization is important as it provides: 1) initial information for the registration; 2) navigation and retrieval guidance through the image data; 3) initial models for segmentation using deformable models; and 4) valuable (though rough) information about morphologic or volumetric features of the organs or structures of interest. Knowledge-Based Anatomical Landmark Localization (K-BALL) is an image analysis method that we have been developing over the past few years for the localization of anatomical phenomena of the same origin with natural discrepancies distributed over a reference space, e.g., human brain anatomical structures.

b) Approach

Our approach to landmark localization consists of two stages. In the first stage, it searches the image and finds candidate points. In the second stage, a set of rules are used to evaluate the candidate points and select appropriate landmarks. Here, we focus on the second stage and present our proposed framework for generating rules based on estimated and derived models. In particular, we study the effectiveness of the estimated versus derived models for selecting correct landmarks. Each rule evaluates the candidate points by producing an intermediate confidence factor (ICNF). A total confidence factor is calculated using ICNF's to facilitate the acceptance or rejection of candidate points as landmarks of interest.

c) Results and Conclusions

The rules constructed merely based on the estimated models produced an overall success rate of 91.8% while the rules constructed based on both of the estimated and derived models increased this rate to 92.5%. This study shows that the derived statistical models improve the overall performance of the information analysis phase of the K-BALL.

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