

A5 Problem Solving Formulations for Object Detection, Discriminant Analysis, and Integrative Hypothesis Testing

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Abstract

We show that the A5 problem solving formulation provides a unified perspective for implementing not only object detection on images but also discriminant analysis and hypothesis testing on sample populations as widely encountered in bioinformatics and medical informatics. Under this formulation, two effective methods for object detection, namely randomized Hough transform (RHT) and multisets mixture learning (MML), are systematically elaborated and further extended by combining strengths of each.

Moreover, this formulation is also proposed as a general formulation of integrative hypothesis test (IHT) that not only improves hypothesis test with RHT mechanisms to enhance testing reliability but also integrates two types of hypothesis test (namely A-test versus I-test). Furthermore, this A5 formulation is generalized for three levels of integrative discriminant analysis that performs classification of samples into populations, learning parametric structures for modeling the populations, and hypothesis testing on whether the populations are significantly different, as well as identifying significant features that contribute to this distinction.