Recognition-by-Parts Using Boosting and Transduction

Harry Wechsler
Department of Computer Science
Volgenau School of Information Technology and Engineering
George Mason University
Fairfax, VA 22030

wechsler@gmu.edu
http://cs.gmu.edu/~wechsler

We describe a unified recognition-by-parts architecture suitable for reliable and robust open (vs. closed) set (object) recognition. Reliability vis-à-vis outliers (including intrusion detection and surveillance) and robustness vis-à-vis incomplete / missing or corrupt information, e.g., occlusion and disguise. The architecture proposed is model-free and non-parametric. The strangeness / typicality, local in nature and characteristic of discriminative methods and practical intelligence, is the thread for the architecture proposed. The conceptual framework, which draws support from discriminative methods using the likelihood ratio, links the Bayesian framework and statistical learning theory (SLT). Layered categorization starts with detection using implicit rather than explicit segmentation. It proceeds with authentication / classification that involves feature selection of local patch instances (including dimensionality reduction), exemplar-based clustering of patches into parts, and data (feature / decision) fusion for matching using boosting driven by parts that play the role of weak-learners. The implementation, driven by transduction, employs proximity and typicality (ranking) realized using strangeness and p-values, respectively. The presentation concludes with suggestions for augmenting and enhancing the scope and utility of the proposed architecture.