Advances in Similarity-Based Pattern Analysis and Recognition

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Abstract

Traditional pattern recognition techniques are centered around the notion of "feature." According to this view, the objects to be classified are represented in terms of properties that are intrinsic to the object itself. Hence, a typical pattern recognition system makes its decisions by simply looking at one or more feature vectors provided as input. The strength of this approach is that it can leverage a wide range of mathematical tools ranging from statistics, to geometry, to optimization. However, in many real-world applications a feasible feature-based description of objects might be difficult to obtain or inefficient for learning purposes. In these cases, it is often possible to obtain a measure of the (dis)similarity of the objects to be classified, and in some applications the use of dissimilarities (rather than features) makes the problem more viable. In the last few years, researchers in pattern recognition and machine learning are becoming increasingly aware of the importance of similarity information per se. Indeed, by abandoning the realm of vectorial representations one is confronted with the challenging problem of dealing with (dis)similarities that do not necessarily obey the requirements of a metric. This undermines the very foundations of traditional pattern recognition theories and algorithms, and poses totally new theoretical and computational questions. With this lecture we aim to offer a discussion of the latest developments in the area of similarity-based pattern recognition and to provide a critical overview of their main applications. We will cover a wide range of problems and perspectives, from supervised to unsupervised learning, from generative to discriminative models, and from theoretical issues to real-world practical applications.

References

M. Pelillo (Ed.) *Similarity-Based Pattern Analysis and Recognition*. Springer, London (2013).