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Recognition of patterns in pattern recognition

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ABSTRACT

Classification, aka 'pattern recognition', takes an essential part in scientific research, including, a fortiori, the forensic applications. Classification method should be selected with respect to the underlying features of the solved problem. In practice, each sample that has to be attributed to a predefined class, or classes, or left unclassified. In case the sample is unlabeled, this is either identification, or discrimination problem. Otherwise, this is an authentication task. Another characteristic refers to the classes, which list can be exhaustive (complete), or open (incomplete). Our message is that a risk-based decision should only be made out after a thoughtful examination and recognition of the classification pattern (prototype: identification, discrimination, or authentication), which goes better with the research objectives. This time we focus on the assessment of the authentication (labeled, incomplete) versus the discrimination (unlabeled, complete) classification problems [1].

Authentication is the process of determining whether an object is, in fact, what it is declared to be. Discrimination is the process of allocation of an object to one of the predefined classes. In practice, authentication is often solved using discrimination. We explain that such techniques do a poor authentication job. The main drawback of these methods is inability of proper classification of new samples, which do not belong to any of the predefined classes. We illustrate this by real-world examples and a comparison of the two methods: Partial Least Squares- Discriminant Analysis, PLS-DA, and Data Driven Soft Independent Modeling of Class Analogy, DD-SIMCA [2, 3].

Pattern recognition encloses a big variety of different methods and techniques. Each type of problem requires an application of relevant methods. A well constructed discrimination method will perfectly classify a new sample only if this sample is a member of one of the predefined classes. However, in case the new sample does not belong to any of such classes, the discriminant analysis is unable to properly define the membership of the sample. Thus, discrimination methods are inappropriate for solving authentication problems. Class-modeling methods [4] develop the acceptance area around the target class, and, thus, delimit the target objects from any other objects and classes. This is the reason why only one-class classifiers should be used for authentication.

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