

## ON-LINE FEATURE SELECTION FOR ADAPTIVE EVOLVING CONNECTIONIST SYSTEMS

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*ABSTRACT.* A new concept for pattern classification systems is proposed in which the feature selection and the learning classifier are simultaneously carried out on-line. An advantage of this concept is that classification systems can improve their performance constantly even if insufficient training samples are given when the learning starts, often resulting in inappropriate feature selection and poor classifier performance. To implement this concept, we propose an adaptive evolving connectionist model in which Incremental Principal Component Analysis and Evolving Clustering Method are effectively combined. The proposed on-line learning scheme has two major desirable properties. First, the performance is improved as the learning proceeds and it converges to an acceptable level from any initial conditions. Second, the learning is sequentially carried out without retaining all the training data given so far; thus, the learning is conducted efficiently in term of the computation and memory costs. To evaluate the proposed model, the recognition performance is investigated using three standard datasets in the UCI machine learning repository. From the experimental results, we verify that the proposed scheme possesses the above two characteristics.

**Keywords:** One-line learning, Incremental learning, Pattern recognition, Feature selection

**1. Introduction.** In many real-world applications such as pattern recognition and time-series prediction, we often confront difficult situations where a complete set of training samples is not given in advance [1]. In face recognition tasks, for example, human faces have large variations depending on expressions, lighting conditions, make-up, hairstyles, and so forth. When a human is registered in a person identification system, it is quite difficult to consider all the variations of the face in advance.

A straightforward approach is that face images are collected as many times as possible and then a system is constructed using these collected images. However, it is obvious that such a system works well only under limited conditions; that is, acceptable recognition performance for future query inputs is not ensured. Therefore, it is desirable that the