Generative learning with emergent self-organizing neuronal networks

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The goal of standard classification learning is to find a conditional distribution *p (c|x)*, i.e., to identify the class c of a particular case given a data set x. By contrast, the goal of generative learning is to find the joint distribution *p(x, c)* and to subsequently use this joint distribution to produce so far unseen values of x, which is followed by making class predictions c for these x [1]. This is typically achieved using a two-step approach comprising (A) a discrimination step aimed at construction of a model, typically by using multivariate density estimation, and (B) a data generation step that uses the model from step A to generate new data including their labels. A key issue in generative learning is an optimal estimation of probability density in multivariate data [2]. Major current implementations of generative learning comprise restricted Boltzmann machines [3] and deep generative models [4]. In the present work, a novel method is proposed that performs generative learning based on emergent self-organizing maps (ESOM), i.e., Kohonen SOMs [5] enhanced with the U-matrix and P-matrix [6].

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