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# Randomized Mixture Models for Probability Density Approximation and Estimation

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## Abstract

Neural networks (NNs) with random weights are an interesting alternative to conventional NNs that are used more for data modeling. The random vector functional-link (RVFL) network is an established and theoretically well-grounded randomized learner. A key theoretical result for RVFL networks is that they provide universal approximation for continuous maps, in expectation, with respect to the square-integral norm. We specialize and modify this result, and show that RVFL networks can provide functional approximations that converge in Kullback-Leibler divergence, when the target function is a probability density function. Expanding on the approximation results, we demonstrate the RVFL networks lead to a simple randomized mixture model (MM) construction for density estimation from sample data. An expectation-maximization (EM) algorithm is derived for the maximum likelihood estimation of our randomized MM. The EM algorithm is proved to be globally convergent

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