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Deep Boltzmann Machine: a study of the annealed and the replica symmetric region

Deep Boltzmann machines are considered in the simplified framework of a quenched system with Gaussian noise and independent entries. We study the annealed and replica symmetric regimes of the system. A map with a one dimensional monomer-dimer system is identified and used to rigorously control the annealed region for an arbitrary number of layers. Furthermore a replica symmetric lower bound is obtained in a suitable region of the parameters and the replica symmetric pressure is proved to have a unique stationary point.