Learning Representations by Recirculation

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Abstract:

We describe a new learning procedure for networks that contain groups of non(cid:173) linear units arranged in a closed loop.

The aim of the learning is to discover codes that allow the activity vectors in a "visible" group to be represented by activity vectors in a "hidden" group. One way to test whether a code is an accurate representation is to try to reconstruct the visible vector from the hidden vector. The difference between the original and the reconstructed visible vectors is called the reconstruction error, and the learning procedure aims to minimize this error. The learning procedure has two passes. On the fust pass, the original visible vector is passed around the loop, and on the second pass an average of the original vector and the reconstructed vector is passed around the loop. The learning procedure changes each weight by an amount proportional to the product of the "presynaptic" activity and the difference in the post-synaptic activity on the two passes. This procedure is much simpler to implement than methods like back-propagation. Simulations in simple networks show that it usually converges rapidly on a good set of codes, and analysis shows that in certain restricted cases it performs gradient descent in the squared reconstruction error.