Echo state networks represent a special type of recurrent neural networks. Recent papers stated that the echo state networks maximize their computational performance on the transition between order and chaos, the so-called *edge of chaos*. This work confirms this statement in a comprehensive set of experiments. Afterwards, the best performing echo state network is compared to a network evolved via neuroevolution. The evolved network outperforms the best echo state network, however, the evolution consumes significant computational resources. By combining the best of both worlds, the simplicity of echo state networks and the performance of evolved networks, a new model called *locally connected echo state networks* is proposed. The results of this thesis may have an impact on future designs of echo state networks and efficiency of their implementation. Furthermore, the findings may improve the understanding of biological brain tissue.