Abstract

Visual information is inherently 2-D. Complex light signals can be used to capture the 2-D information such as at a hologram. Heijmans and his [1] pioneered that the phase of a complex Fourier transform can recreate the original scene much better than the amplitude of the Fourier transform alone. It is further shown that in information processing can be done in the complex domain. For example, complex valued threshold elements can be implemented in an interconnected fashion. Furthermore, complex valued signals can be transmitted through such a network. It has been shown that using a weighted complex valued adder and magnitude thresholding, the decision surfaces are naturally curved [2]. Due to its nonlinear decision boundaries, it was shown in 1999 that a single complex valued threshold element is capable of solving the non-linear XOR problem compared to two binary perceptron trained with the Back Propagation algorithm without adjusting its weights or two binary perceptron trained [4] computationally. One can employ a phase and/or complex thresholding [12].

Mathematics of a Complex Valued Neuron

The XOR Problem

Input mapping

Training and more results

References


Future: Extend to deep learning