COMPLEX NEURAL NETWORKS

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ABSTRACT

THIS THESIS FOCUSES ON HOW TO USE NEURAL NETWORKS DEALING WITH COMPLEX-VALUED PROBLEM. THE FAMOUSLY NEURAL STRUCTURE DUE TO ITS UNIQUELY NONLINEAR IN/OUT MAPPING CHARACTERISTIC, REPRESENTS WELL-SUITED ABILITY IN MANY NONLINEAR AND COMPLEX SYSTEMS. GENERALIZE TO THE RAPIDLY GROWTH FIELD OF SIGNAL PROCESSING, COMPLEX-VALUED NEURAL NETWORKS CAN BE TREATED AS ADAPTIVE ALGORITHM FOR TARGET DETECTION AND INTERFERENCE CANCELING. HOWEVER TRADITIONAL BACK-PROPAGATION METHOD NEED TO DECIDE OPTIMAL LEARNING RATE THROUGH EXPERIMENT REPEATEDLY, IT IS NOT SUITABLE TO DESIGN A HIGH RELIABILITY INTELLIGENT SYSTEM. IN THIS THESIS, WE PROPOSE AN EFFECTIVE SCHEME TO OVERCOME CHANNEL DISTORTION EMERGED FORM THE DIGITAL COMMUNICATION ENVIRONMENT. A REAL-TIME LEARNING ALGORITHM TO COPE WITH COMPLEX-VALUED SIGNAL IS DERIVED FROM THE EXTENDED KALMAN FILTER(EKF). FURTHERMORE, IN ORDER TO REDUCE COMPUTATIONAL COMPLEXITY WE ADOPT A DECOMPOSED METHOD KNOWN AS NODE DECOUPLED EKF (NDEKF). COMPARED WITH BACK-PROPAGATION METHOD, EKF HAS SEVERAL ADVANTAGES AT LEAST. (1) THE KALMAN GAIN WITH DYNAMIC UPDATE IS USED TO REPLACE THE LEARNING RATE. (2) IT ISN'T SENSITIVE TO THE INITIAL VALUE OF PARAMETER FOR TRAINING PROBLEM. (3) THE RAPIDLY LEARNING ABILITY. (4) THE PARALLEL COMPUTING CAN BE SPEEDED UP VIA VLSI TECHNOLOGY. FURTHERMORE, WE COMBINE COMPLEX-VALUED NEURAL NETWORKS WITH DECISION FEEDBACK EQUALIZER AND SIMULATE THE BASEBAND SIGNAL THROUGH QAM OR PSK MODULATION. FINALLY, WE COMPARES WITH OTHER METHOD VIA WIRELESS TRANSMISSION CHANNEL, WHICH HAS DIFFERENT CHARACTERISTIC. THE EXPERIMENT RESULTS SHOW THAT OUR SCHEME IS ROBUST AND ACCURATE.

Keywords : COMPLEX-VALUED NEURAL NETWORKS, COMPLEX-VALUED RADIAL BASIS FUNCTION NETWORK, BACK-PROPAGATION, ADAPTIVE EQUALIZE

Table of Contents

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