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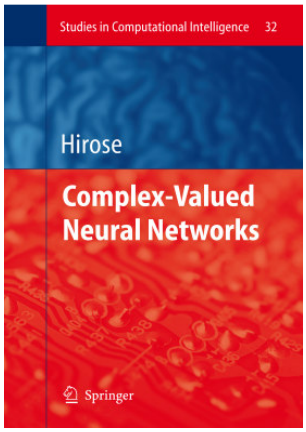

Akira Hirose, The University of Tokyo, Japan

Complex-Valued Neural Networks

This book is the first monograph ever on complex-valued neural networks, which lends itself to graduate and undergraduate courses in electrical engineering, informatics, control engineering, mechanics, robotics, bioengineering, and other relevant fields. It is useful for those beginning their studies, for instance, adaptive signal processing for highly functional sensing and imaging, control in unknown and changing environment, brainlike information processing, robotics inspired by human neural systems, and interdisciplinary studies to realize comfortable society. It is also helpful to those who carry out research and development regarding new products and services at companies. The author wrote this book hoping in particular that it provides the readers with meaningful hints to make good use of neural networks in fully practical applications. The book emphasizes basic ideas and ways of thinking. Why do we need to consider neural networks that deal with complex numbers? What advantages do the complex-valued neural networks have? What is the origin of the advantages? In what areas do they develop principal applications? This book answers these questions by describing details and examples, which will inspire the readers with new ideas.

Contents: Part I Basic Ideas and Fundamentals: Why are complex-valued neural networks inevitable?- Complex-valued neural networks fertilize electronics.- Neural networks: The characteristic viewpoints.- Complex-valued neural networks: Distinctive features.- Constructions and dynamics of neural networks.- Part II Applications: How wide are the application fields?- Land-surface classification with unevenness and reflectance taken into consideration.- Adaptive radar system to visualize antipersonnel plastic landmines.- Removal of phase singular points to create digital elevation map.- Lightwave associative memory that memorizes and recalls information depending on optical-carrier frequency.- Adaptive optical-phase equalizer.- Developmental learning with behavioral-mode tuning by carrier-frequency modulation.- Pitch-asynchronous overlap-add waveform-concatenation speech synthesis by optimizing phase spectrum in frequency domain.

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