Adaptive Wavelet Transforms

Harold H. Szu, FELLOW SPIE
Naval Surface Warfare Center
Dahlgren Division, Code B44
10901 New Hampshire Avenue
Silver Spring, Maryland 20903-5640

Since the last special section on wavelet transforms appeared in the September 1992 issue of *Optical Engineering,* wavelet transform activity in optics has increased at least an order of magnitude. The last special section was an outcome of the Gordon Research Conference on Holography and Signal Processing. This special section is an outcome of the April 1994 SPIE Wavelet Applications Conference in Orlando, which contained more than 80 papers. From these, a number were selected to be revised and included in this special section along with a number of independent submissions. A special emphasis is on data-driven adaptivity in waveform and basis selection to best address particular applications.

Several important new theories presented in this special section center on how to widen the flexibility of wavelet transform waveform and basis selection, how to increase the robust nature of the discrete wavelet transform using filter banks, and on the relationship between the discrete adaptive wavelet transform and continuous adaptive wavelet transform. Applications of wavelet transforms are numerous and include classical signal pattern recognition, radar, sonar, speech, sound, medical imaging, and data processing.

We believe that this special section will inspire more theories and applications to explore the mathematical freedom of allowing the wavelet transform to choose its own linear transform kernels, to enhance signal-to-noise ratio, and to increase the robustness of the wavelet transform by adaptivity. The adaptivity should match naturally to iterative processors with feedback. We are anticipating another special section in the near future in which wavelet chips for data compression and feature extraction are joined with neurochips for automatic classification, thus widening the application domain significantly.

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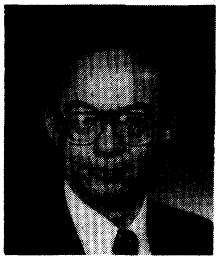

Harold H. Szu received his PhD from Rockefeller University in 1971, and worked at the Naval Research Laboratory for 15 years. He has published more than 200 technical papers and holds six patents. He is an SPIE fellow. He hosted the SPIE Institute for Advanced Optical Technologies in Leesburg, Virginia, in 1986, which led to the formation of the International Neural Network Society (INNS) the following year. He is a co-founder of INNS, has been its treasurer since its inception in 1987, and was its president in 1993. Dr. Szu is currently the information science group leader and a science advisor at the Naval Surface Warfare Center Dahlgren Division. His current research involves neural network pattern recognition, wavelet preprocessing, optical computing, photonic storage, and biomolecular implementations.