



## The Peter T. Flawn Distinguished Professor

**Sos S. Agaian**

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### Education

**Ph.D., Mathematics and Physics**  
Steklov Institute of Mathematics  
Academy of Sciences of the USSR

**Doctor of Engineering Sciences**  
Computer Center  
Academy of Sciences of the USSR

### Honors and Awards

Selected as an Influential Member of the School of Engineering, Tufts University, who Contributed Significantly to Student Intellectual and Personal Development, 2005

MAESTro Educator of the Year Award (2004), Society of Mexican American Engineers and Scientists

President's Annual Special Research Award, The College of Staten Island 2001

### Professional Editorship

Associate Editor

- Real-Time Imaging
- Electronic Imaging

Editorial Board Member  
Pattern Recognition and Image Analysis, USA-Russia

### Research Interests

#### Fundamental

- Signal Processing and Intelligent Systems
- Applied Mathematics and Computation

#### Applications

- Medical and Mobile Imaging
- Genomic Signal Processing
- Bioinformatics
- Pattern Recognition and Machine Vision
- Secure Multimedia & Cellular Communications and Archiving
- Steganography and Watermarking
- Information Assurance

### Research Summary

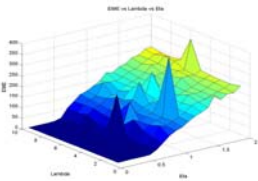
Dr. Agaian's research over the past several years has been devoted to such areas as Signal/Image Processing and Intelligent Systems. He is particularly interested in development of scientific computing applicable to the theory and practice of applied sciences. He explored the future of multi-discipline engineering applications such as object detection and recognition, bioengineering, biometrics, and medical imaging. Dr. Agaian's research is of an interdisciplinary nature that has evolved from industrial&computational mathematics to computer science, from applied signal/image processing, computer vision to object detection and recognition systems. It is this multidisciplinary experience that allows him to investigate these research areas thoroughly, and teach technical courses in an efficient manner. After September 11<sup>th</sup> he extended his research area to the fields of information assurance, secure multimedia and mobile communication, secure database system, and genomic signal processing.

Dr. Agaian's research projects, supported by the U.S. Department of Energy, DARPA, U.S. Army, Center for Infrastructure Assurance and Security and Air Force Information Warfare Center, include wavelet based target detection and recognition systems, theoretic development and application of Boolean functions and logical transforms, predictive transform-compression architecture and methodology for knowledge aided sensor signal processing and expert systems, blind detection of the localization hidden data in multimedia data, compact and fast representation multimedia signal and systems, adaptive linear and nonlinear filtering systems, and communication networks.

While teaching at Tufts University as a visiting professor, Dr. Agaian and Dr. Panetta have developed the image enhancement evaluation measure, and several elegant image enhancement, compression and de-noising algorithms based on the human visual system (including 1D and 2D biological signals). These techniques had been also employed on NASA's Earth Observing System satellite data for the purpose of anomaly detection and visualization. Earth Observing System satellite data for the purpose of anomaly detection and visualization. This collaborating work was awarded the Best Research and Presentation Diploma, NASA Annual Conference, (Fl.1998). Dr. Agaian has been working at Aware as a senior research fellow sponsored by the US Army where he with his colleague, Dr. Del-Marko, have developed the wavelet transform based automatic object detection, segmentation, and recognition system.

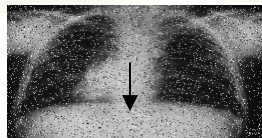
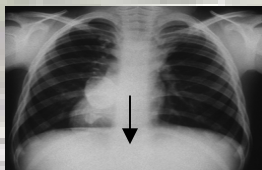
Recently, Dr. Agaian & Dr.Wang et al., have discovered novel network components from temporal expressional profiles of malaria parasite. Dr. Agaian with his student develop a new conceptual framework of a secure multilayer database system for archiving digital medical images by using data hiding techniques.

Significant work is being done in multimedia and medical signal representation areas. Agaian and his students have been developed very efficient, fast orthogonal, linear, non-linear, parametric, custom need signal representation systems such as generalized Fourier, slant, cosine, Hartely, Haar, Hadamard, KLT, SVD, fuzzy/wavelets and Fibonacci. These works involve creative theory, resourceful practical implementations, and several biological, military, and industrial applications. Major work is also being done in construction of combinatorial configurations: he constructed class of Hadamard matrices, built an example which confirms that Plotkin's conjectures are not correct and he solved the Slichta problem.



### Areas of Expertise and Keywords

- Intelligent Systems
- Multimedia & Medical Signal Processing (Enhancement, Analysis, Representation, Modeling, Filtering and Compression)
- Measures (Image Enhancement, Image Similarity)
- Fast and Parallel Computation
- Data Hiding and Detection
- Monitoring, Diagnosis, and Forecasting



Dr. Agaian also introduces a visual morphology concept, which is remarkably capable of being a substitute (for many real-life problems) to the commonly used morphological methods. The results of Dr. Agaian's research in DSP with applications are described in one of his several books on multidimensional discrete unitary and logical transforms, Hadamard matrices, logical transform with applications and articles. Many of his results are internationally known (Agaian's Theorems, Agaian's Bound, and Agaian's Family (see for examples, "Contemporary Design Theory", edited by J.H. Dinitz and D.R. Stinson, John Wiley & Sons, Inc. 1992, or visit the website at <http://www.cs.uow.edu.au/people/jennie/lifework.html>).

**Selected Publications:** He has written over 300 scientific papers (more than 100 refereed journal papers), four books, six book chapters, and has 12 patents)

- H. Cai, S. Agaian, M. Sanchez, Y. Wang "Discovery of Novel Network Components from Temporal Expression Profiles", WSEAS Transactions on Biology and Biomedicine, Issue 2, Volume 3, February 2006, pp 104-112
- (Invited Paper) S. Agaian et al. "Image Enhancement", Advances in Imaging and Electron Physic, 2004, pp.165-243
- S. Agaian O. Caglayan, "Conceptual Framework of a New Secure Storage System for Medical Data Archiving" IS&T Archiving Conference, 2006, Canada.
- Hon Cai, Sos Agaian, M. Sanchez, J. Gu, Y. Wang "Analysis of transcriptomic profiles of malaria parasite using wavelet decomposition", Ninth Annual International Conference on Research in Computational Molecular Biology (RECOMB 2005), May 14-18, 2005, Cambridge, MA, USA, pp 57 -59
- Hong Cai, Sos Agaian, J. Gu, and Y. Wang, "Wavelet Analysis on Temporal Expression Profiles of Malaria Parasite", 8<sup>th</sup> Joint Conference on Information Sciences (JCIS), July 21-26, 2005, Salt Lake City, USA 1191-1194
- Blair Silver, Sos S. Agaian and Karen A. Panetta, "Contrast Entropy Based Image Enhancement and Logarithmic Transform Coefficient Histogram Shifting", Proceedings, IEEE ICASSP 2005. March 2005.
- E. Danahy, S. Agaian, K. Panetta, "Non-linear algorithms for noise removal from medical signals using the logical transform", SPIE Optics & Photonics advance technical program, San Diego, USA, 31 July-4 August 2005
- C.B Smith, S.S., Agaian, "Class of Fibonacci-Daubechies-4-Haar wavelets with application to ECG de-noising," Image Processing Algorithms and Systems III, Proceedings of SPIE-IS&T Electronic Imaging, SPIE vol. 5298, pp. 25-36, 2004
- S. Agaian et al., "Transform Based Image Enhancement Algorithms with Performance Measure", IEEE Transaction on Image Processing, Volume 10, No.3, March, 2001, pp. 367-380.
- US Patent, E. Feria and S.Agaian, "Accelerated Predictive-Transform," Nov. 2003
- A.M. Grigoryan, and S.S.Agaian, "Multidimensional Discrete Unitary Transformations: Representation, Partitioning, and Algorithms", Marcel Dekker INC, New York, 2003, 521 pages.
- S.Agaian, J. Astola and K.Egiazarian, "Binary Polynomial Transforms and Nonlinear Digital Filters," Marcel Dekker INC, New York, 1995, 308 pages.
- S.Agaian, "Hadamard Matrices and Their Applications", Lecture Notes of Mathematics. No 1168, Springer-Verlag, 1985, 227 pages

