Prof. Eli Saber

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EDUCATION

Ph.D., Electrical Engineering, University of Rochester, Rochester, New York (March 1996)
Concentration: Signal/Image/Video Processing, Pattern Recognition, and Computer Vision.
Dissertation: Automatic image annotation and query-by-example using color, shape and texture information.

M.S., Electrical Engineering, University of Rochester, Rochester, New York (May 1992)
Concentration: Signal/Image/Video Processing, Pattern Recognition, Computer Vision, Communications.

B.S., Electrical and Computer Engineering, Summa Cum Laude, State University of New York at Buffalo, Buffalo, New York (May 1988).
Concentration: Computers, Microprocessors, Communications, Instrumentation.

A.S., Engineering Science, Mohawk Valley Community College, Utica, New York (May 1986)

CAREER MAJOR HIGHLIGHTS

- **Academic Experience:**
  - **Teaching:** Taught/continue to teach undergraduate and graduate courses in the signal/image/video processing, computer vision, controls and communications focus areas with excellent feedback from students from 1996 to Present. Founded new coursework in Digital Video Processing and Pattern Recognition.
  - **Research:** Conducted research on multiple acquired government and industry grants in the areas of: 1) image/video processing for multimedia, military and biomedical applications, 2) deep learning/artificial intelligence for object detection and tracking purposes, 3) three-dimensional scene reconstruction for remote sensing, and 4) color image processing for printing and multimedia applications. Graduated several PhD and MS students. Currently co-advising 2 PhD students.
  - **External Funding:** Acquired external funding as PI in excess of $3.5 Million and as PI/Co-PI in excess of $5 Million over the period of September 2004 to present from government agencies and industry partners.
  - **Publications:** 1 Book, 2 Special Issues, 38 Journal, 100 Conference and 11 Patents/Patent Publications.
  - **Service:** Served/chaired several department, college and university level committees. Chaired the Graduate Program at the EE department for a period of five years. Served on the academic senate for a period of 9 years and on the Academic Senate Executive Committee for a period of 3 years.

- **Industrial Experience:** Worked for Xerox Corporation from 1988 until 2004 in a variety of engineering, managerial and scientific positions ending as Product Development Scientist and Manager.

- **Consulting/Litigation Experience:** Served as an expert in several patent and non-patent cases representing numerous companies. Provided declarations in support of multiple Inter Partes Reviews (IPR), expert opinions and reports with regards to validity/invalidity, infringement/non-infringement and domestic industry, tutorial at Markman hearing, multiple depositions, and testimony in court proceedings.

- **Professional Activities:** Served on several IEEE and SPIE conferences in various chair positions including Finance, Tutorials, Plenaries and Technical Program. Served as general chair for two conferences.

- **Honors & Awards:** RIT Trustees Award (2012), KGCOE Scholarship Award (2012), EME Gleason Professor (2011-2013), and PI Millionaire (2011).

RESEARCH INTERESTS

- Machine Learning for Imaging, Video and Remote Sensing Applications
- Image and Video Processing for Multimedia, Military & Biomedical Applications.
- Computer Vision and Three-Dimensional Scene Reconstruction.
- Color Image Processing for Printing and Multimedia Applications.

ACADEMIC EXPERIENCE

Professor (Associate 2004 – 2010, Full 2010 – Present), Department of Electrical and Microelectronic Engineering (EME), Kate Gleason College of Engineering (KGCOE), Rochester Institute of Technology.
Extended Faculty (2004 – Present), Center for Imaging Science (CIS), Rochester Institute of Technology.
Director of the Image, Video and Computer Vision Laboratory (2004 – Present)
Graduate Program Director (2010 – 2014)

- **Teaching:** Responsible for teaching undergraduate & graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Engineering Analysis, Advanced Engineering Mathematics, Random Signal & Noise, Pattern Recognition, Communication Systems, Digital Data Communications, Computer Vision, Modern Control Theory, Linear Systems, and Matrix Methods. Typically teaching two courses per semester. Have taught three per semester on occasion to fulfill department needs.
- **Research:** Director of the Image, Video and Computer Vision Laboratory. Currently co-advising 2 PhD and 2 MS students on deep learning/machine learning/artificial intelligence applications for object detection and tracking. Advised several PhD and MS students in image/video segmentation, hierarchical image decomposition, video mosaicking/3-dimensional scene reconstruction, image/video understanding, object tracking/recognition. All students are/were funded under various government or corporate grants.
- **Funding:** Acquired funding as PI in excess of $3.5 Million and as PI/Co-PI in excess of $5 Million over the period of September 2004 – Present from various government agencies and industrial partners.
- **Service (Department, College and University):**
  - Advised/currently advising several undergraduate and graduate students on curriculum issues.
  - Member of the Academic Senate Resource Allocation and Budget Committee, the University Compensation Committee and of the Kate Gleason College of Engineering Promotion Committee.
  - Former Member (KGCOE representative) of the Academic Senate (2007 – 2013 and 2014-2017) and of the Academic Senate Executive Committee (2009-2010, 2016-2017).
  - Served as Chair of the RIT Vision 2025 committee per request from RIT President Dr William Destler. Committee was commissioned, over the summer of 2009, to review 80+ ideas submitted from all colleges and provide a recommendation to upper administration.
  - Former Member and Chair of KCGOE graduate committee.
  - Former Member of Graduate Council.
  - Served on several committees for curriculum development, recognition, and faculty search.
- **Professional Activities:**
  - Senior member of the Institute of Electrical and Electronic Engineers (IEEE) society.
  - Former Member of the IEEE Industry Technical Committee on DSP.
  - Former Member of the IEEE Image and Multidimensional Digital Signal Processing (IMDSP) technical Committee.
  - Former Area Editor for the Journal of Electronic Imaging.
  - Former member of the Imaging Science and technology (IS&T) society.
  - International Conference on Image Processing (ICIP) 2002 Finance Chair, ICIP 2007 and ICIP 2009 Tutorial Chair, ICIP 2012 General Chair, ICASSP 2017 Technical Program Chair, ICIP 2021 Plenary Chair.
  - Co-founder and General Chair of the Video Surveillance and Transportation Imaging Conference within the Electronic Imaging Symposium.
- **Honors and Awards:**
  - Awarded the Prestigious Trustees Scholarship award – the highest award at RIT with regards to research recognition

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- Elected in 2011 as PI Millionaire.
- Awarded the EME Gleason Professor for 3 years (2011-2013).
- Elected as the Kate Gleason College of Engineering Scholarship award winner.

Adjunct Faculty Member, Dept. of Electrical & Computer Engineering, University of Rochester. (09/96-07/04)

- Taught undergraduate & graduate courses in Digital Signal Processing, Digital Image Processing, Pattern Recognition/Advanced Image Processing, Detection/Estimation Theory, and Analog & Digital Communications.
- Advised and graduated 1 Ph.D. student in the areas of "Image Understanding" and "Database Content Indexing".
- Co-advised 1 Ph.D. student in the areas of "Watermarking".
- Advised and graduated 1 MS student in the area of "Color Rendering" and "Printer Characterization".
- Served as a committee member on several doctoral dissertations.
- Served on PhD qualifying examinations for the Signal Processing and Communications Concentration.
- Sought and captured funding from the National Science Foundation for the development of an intelligent image database system. Proposal funded for 4 years under NSF Grant IIS – 9820721
- Sought and captured industrial funding from Xerox Corporation for Printer Color Characterization & Digital Front End Object Oriented Rendering.

Adjunct Faculty Member, Dept. of Electrical Engineering, Rochester Institute of Technology. (03/98-07/04)

- Taught undergraduate and graduate courses in Pattern Recognition, Digital Video Processing, Random Signal & Noise, Image and Video Compression, and Communications.
- Advised and graduated a master student in the area of "Texture Classification".

INDUSTRIAL EXPERIENCE

Product Development Scientist & Manager, Print Engine Development Unit, Xerox Corporation. (10/98-08/04)
Major responsibilities included:

- Lead the Image Science, Analysis and Evaluation area (12-15 direct reports and ~$2 Million budget).
- Lead the development of highlight color specifications for the Sorrento print engine.
- Lead the development of color characterization algorithms for the iGen3 print engine.
- Lead the image quality integration of two color front end for the iGen3 Product.
- Lead the development of ROS and LED based imaging systems and image path architectures for upcoming highlight & full color products.
- Lead the development of xerographic hardware/algorithms & imaging systems for the DP92C highlight color product. (Product launched 9/30/99 and follow-on launched 4/20/00)
- Lead the research and development of image quality metrics for various product platforms and their dissemination throughout the Print Engine Development Unit and Xerox Corporation.
- Collaborate with the Department of Electrical & Computer Engineering (Univ. of Rochester) & the Center for Electronic Imaging Systems.

Advanced Development Scientist and Manager, Print Cartridge Delivery Unit, Xerox Corporation. (2/97 – 9/98)
Major responsibilities included:

- Establish the Advanced Design Laboratory (an imaging/xerographics lab) and provide technical and managerial leadership for the Electrical, Imaging and Xerographics Dept.
- Perform image processing and xerographic hardware/software design and development for low/mid volume color copiers and printers for current and future programs.
- Perform technology development, modeling, and product design for upcoming Xerox color products, specifically image on paper and image on belt products..
- Lead the development of the xerographic module for a color intermediate belt transfer product with direct technical and management responsibilities.
- Collaborate with the Department of Electrical & Computer Engineering (Univ. of Rochester) & the Center for Electronic Imaging Systems.

Research and Development Scientist, Production Systems Group, Xerox Corporation. (1/96-1/97)
Major responsibilities included:

- Lead the design and development of color characterization/management and image quality algorithms and specifications for digital front ends destined to drive high quality, high speed color print engines.
- Integrate color management & image processing algorithms into the Raster Image Processing module.
- Participate in the design and development of a high speed raster image processing architecture.
- Benchmark developed algorithms against existing products & systems both internally and externally.
- Collaborate with the Department of Electrical & Computer Engineering of the University of Rochester and the Center for Electronic Imaging Systems.

Research and Development Engineer, Corporate Research, Xerox Corporation (8/93-12/95) & Department of Electrical & Computer Engineering, University of Rochester. (1/95-12/95). Major responsibilities included:

- Design and develop query by image content and query by example image annotation algorithms utilizing color, shape, texture and motion cues. System is able to perform query by keywords, color, shape, texture, and/or a combination of the above cues.
- Design and develop intelligent image segmentation algorithms. These algorithms are currently utilized in the query by image content and query by example systems described above.
- Design and develop face detection and facial feature extraction approaches.
- Design and develop color characterization/calibration and image quality algorithms for Digital Front Ends aimed at driving high speed / high quality print engines.

(Note: Image annotation/content analysis research was done in conjunction with the Department of Electrical & Computer Engineering and Center for Electronic Imaging Systems leading to the Ph.D.)

Electronic, Computer and Instrumentation Engineer, New Toner/Developer Facility Engineering, Xerox Corporation. (6/88-7/93). Major responsibilities included:

- Provide design, development, installation, startup, and training for multiple toner production facilities.
- Provide development and implementation of control system database, software and displays for several systems.
- Evaluate vendor supplied electrical specifications and drawings.
- Manage and coordinate the efforts of technicians, electrical support, construction crew, and industrial workforce during the design, construction, startup, and implementation phases.
- Supervise and complete a number of upgrade projects for toner & photoreceptor production including software development, preparation of electrical design, procurement of necessary equipment and parts, supervision of technicians, contractors and industrial workforce, and scheduling of construction.

During this time, I gained extensive experience in the following systems: Fisher distributive control, unit operation controller, Provue console, Acrison material handling, Werner and Pfleiderer extrusion, Alpine air grinding, Majac/Micropul centrifugal classifiers, dry/wet material screening, Waeschle and others bulk powder storage and pneumatic convey, Ingersoll Rand and Joy compressed air equipment, Statistical process control.

CONSULTING EXPERIENCE

Expert on Legal Cases: Served as expert in multiple patent cases representing many companies (A separate document with details can be provided upon request). Provided: 1) declarations in support of multiple Inter Partes Reviews (IPR); 2) expert opinions and reports with regards to validity/invalidity, infringement/non-infringement and domestic industry; 3) tutorial at Markman hearing and 4) testimony in multiple court proceedings.

Summary of Experience:

- IPR/Declarations: Provided declarations in support of multiple IPR proceedings.
- Depositions: Provided 14 Depositions.
- Court Testimony: Testified in International Trade Commission Court in Sept. 2018 and Oct. 2019.
- Expert Opinions: Provided multiple expert opinions and reports in support of validity/invalidity, infringement/non-infringement, domestic industry and rebuttals.
- Claim Construction: Provided reports in support of claim construction.

- Hearings: Attended one Markman hearing and provided a brief technology tutorial.

Industrial Training: Developed and conducted industrial training at Xerox Corporation for engineering personnel over three separate summer periods in the areas of signal and image processing, color engineering, and control systems with a distinct focus on digital front ends and print engines. I have also provided pattern recognition/shape matching expertise for Leica corporation.

BOOKS

1. S. Dianat and E. Saber, "Advanced Linear Algebra for Engineers with MATLAB", CRC press, February 2009.

SPECIAL ISSUES

1. H. J. Trussell, E. Saber and M. Vrhel, "Color Image Processing", IEEE SP magazine, January 2005.
2. R. Loce and E. Saber, "Video Surveillance and Transportation Imaging", Journal of Electronic Imaging, 22(4), Dec. 2013

PEER-REVIEWED JOURNAL PUBLICATIONS

1. M. Sharma, J. Heard, E. Saber and P. Markopoulos, "Convolutional Neural Network Compression via Dynamic Parameter Rank Pruning", to be submitted to the IEEE Transactions on Artificial Intelligence.
2. M. Sharma, M. Dhararaj, S. Karnam, D. Chachlakis, R. Ptucha, P. Markopoulos and E. Saber, "YOLOrs: Object Detection in Multimodal Remote Sensing Imagery", IEEE Journal of Selected Topics in Applied Observations and Remote Sensing, Vol. 14, 2021.
3. S. Piramanayagam, E. Saber, and N. Cahill, "Gradient Driven Unsupervised Video Segmentation using Deep Learning Techniques", Journal of Electronic Imaging, 29 (1), 013019, 2020
4. U. Gewali, S. Monteiro and E. Saber, "Spectral Super-Resolution with Optimized Bands", Remote Sensing, 11(14), 2019
5. U. Gewali, S. Monteiro and E. Saber, "Gaussian Processes for Vegetation Parameter Estimation from Hyperspectral Data with Limited Ground Truth", Journal of Remote Sensing, 11(13), 2019.
6. Y. Liang, P. Markopoulos and E. Saber, "Spatial-Spectral Segmentation of Hyperspectral Images for Subpixel Target Detection", Journal of Applied Remote Sensing, 13(3), 2019.
7. Y. Liu, S. Piramanayagam, S. Monteiro, and E. Saber. "Semantic segmentation of multisensor remote sensing imagery with deep ConvNets and higher-order conditional random fields." Journal of Applied Remote Sensing 13, no. 1 (2019): 016501
8. U. Gewali, S. Monteiro and E. Saber, "Hyperspectral Image Analysis using Machine Learning: A Survey", arXiv preprint, 2018.
9. S. Piramanayagam, E. Saber, W. Schwartzkopf, F.W. Koehler, "Supervised Classification of Multisensor Remotely Sensed Images using a Deep Learning Framework", Remote Sensing Journal, 10 (9), 2018.
10. S. R. Vantaram, Y. Hu, E. Saber and S. Dianat, "Synthesis of Intensity Gradient and Texture Information for Efficient Three-Dimensional Segmentation of Medical Volumes", Journal of Medical Imaging 2, no. 2 (2015): 024003-024003.
11. S. R. Vantaram, S. Piramanayagam, E. Saber and D. Messinger, "Automatic Spatial Segmentation of Multi/Hyperspectral Imagery by Fusion of Spectral-Gradient-Textural Attributes", Journal of Applied and Remote Sensing, Vol. 9, No. 1, pp. 095086 (1-37), 2015.
12. S. R. Vantaram and E. Saber, "A Survey of Contemporary Trends in Color Image Segmentation", Journal of Electronic Imaging, 21(4), 040901, Oct-Dec 2012.

13. M. S. Erkilinc, M. Jaber, E. Saber, "Text, Photo and Line Extraction in Scanned Documents", Journal of Electronic Imaging, Vol. 21, 033006, July 2012.
14. T. Keane, E. Saber, H. Rhody, A. Savakis and J. Raj, "Practical Image Registration Concerns Overcome by the Weighted and Filtered Mutual Information Metric", Journal of Electronic Imaging, Vol. 21(2), 023029, June 2012.
15. P. Gurram, E. Saber and H. Rhody, "Semi-automated System for three-dimensional Modeling of Buildings from Aerial Video", Journal of Electronic Imaging, Vol. 21(1), 013007, Jan-Mar 2012.
16. M. Jaber and E. Saber, "Probabilistic Approach for Extracting Regions of Interest in Digital Images", Journal of Electronic Imaging, Vol. 19, No. 2, April - June 2010.
17. X. Fan, H. Rhody and E. Saber, "A Spatial Feature Enhanced MMI Algorithm for Multimodal Airborne Image Registration", IEEE Transaction on Geoscience and Remote Sensing, Vol. 48, Issue 6, pp. 2580 – 2589, 2010.
18. P. Gurram, E. Saber and H. Rhody, "A Segment-Based Mesh design for Building Parallel-Perspective Stereo Mosaic", IEEE Transactions on Geoscience and Remote Sensing, Vol. 48, No. 3, March 2010.
19. S. Vantaram, E. Saber, S. Dianat, M. Shaw and R. Bashkar, "Multiresolution Adaptive and Progressive Gradient-based color image Segmentation", Journal of Electronic Imaging, Volume 19, Number 1, pp. 1-21, January-March 2010.
20. L. Garcia, E. Saber, S. Vantaram, V. Amuso, M. Shaw and R. Bhaskar, "Automatic Image Segmentation by Dynamic Region Growth and Multi-resolution Merging", IEEE Transactions on Image Processing, Vol. 18, No. 10, Oct. 2009.
21. H. Santos, E. Saber, and W. Wu, "Streak Detection in Mottled and Noisy Images", Journal of Electronic Imaging, Vol. 16, No. 4, 2007.
22. O. Ugbeme, E. Saber and W. Wu, "An Automated Algorithm for the Identification of Artifacts in Mottled and Noisy Images", Journal of Electronic Imaging, Vol. 16, No. 3, 2007.
23. V. Misic, V. Sampath, Y. Yu and E. Saber, "Prostate Boundary Detection and Volume Estimation Using TRUS Images for Brachytherapy Applications", International Journal of Computer Assisted Radiology and Surgery, Vol. 2, No. 2, pp. 87-98, August 2007.
24. A. Ononye, A. Vodacek and E. Saber, "Towards Automatic Extraction of Fire Line Parameters from Multispectral Infrared Images", Journal of Remote Sensing of Environment, Vol. 108, pp. 179 – 188, 2007.
25. E. Saber, S. Dianat and L. Mestha, "DSP utilization in Digital Color Printing", IEEE SP Magazine, July 2005.
26. E. Saber, Y. Xu, and A. M. Tekalp, "Partial Shape Recognition by sub-matrix matching for partial matching guided image labeling", Pattern Recognition, Vol. 38, pp. 1560 – 1573, 2005.
27. M. Celik, G. Sharma, A. M. Tekalp, E. Saber, "Lossless Generalized-LSB Data Embedding", IEEE Trans. on Image Processing, Vol. 14, No. 2, pp. 253 – 266, February 2005.
28. M. Vrhel, E. Saber, and H. J. Trussell, "Color Image Generation and Display Technologies: An overview of methods, devices, and research", IEEE Signal Processing Magazine, January 2005.
29. H. J. Trussell, E. Saber and M. Vrhel, "Color Image Processing: Basics and Special Issue Overview", IEEE Signal Processing Magazine, January 2005.
30. Y. Xu, E. Saber, and A. M. Tekalp, "Dynamic Learning from Multiple Examples for Semantic Object Segmentation and Search", Computer Vision and Image Understanding, Vol. 95, No. 3, pp. 334-353, Sept 2004.
31. Y. Xu, P. Duygulu, E. Saber, A. M. Tekalp, and F. T. Yarman-Vural, "Object-Based Image Labeling through Learning by Example and Multi-Level Segmentation", Pattern Recognition, Vol. 36 (6), pp. 1407-1423, June 2003.
32. Y. Xu, E. Saber, and A. M. Tekalp, "Object Segmentation and Labeling by Learning from Examples", IEEE Transactions on Image Processing, Vol. 12, No. 6, June 2003.
33. M. Celik, G. Sharma, E. Saber, and A. M. Tekalp, "Hierarchical watermarking for secure image authentication with localization", IEEE Trans. on Image Processing, vol. 11, no. 6, June 2002.
34. M. Xia, E. Saber, G. Sharma, and A. M. Tekalp, "End-to-End Color Calibration by Total Least Squares Regression", IEEE Transactions on Image Processing, Vol. 8, No. 5, May 1999.
35. E. Saber and A. M. Tekalp, "Facial Pattern Detection and Eye Localization using Color, Shape and Symmetry-Based Cost Functions", Pattern Recognition letters, Vol. 19, 1998.
36. E. Saber and A. M. Tekalp, "Integration of Color, Shape and Texture for Automatic Image Classification, Annotation and Retrieval", Journal of Electronic Imaging, Vol. 7, No. 3, July 1998.

37. E. Saber and A. M. Tekalp "Region-Based Affine Shape Matching for Automatic Image Annotation and Query-by-Example", Journal of Visual Communication and Image Representation, March 1997.
38. E. Saber, A. M. Tekalp, and G. Bozdagi, "Fusion of Color and Edge Information for Improved Segmentation and Edge Linking,", Image and Vision Computing, Vol. 15, 1997.
39. E. Saber, A. M. Tekalp, R. Eschbach and K. Knox, "Automatic Image Annotation using Color Classification", Graphical Models and Image Processing, Volume 58, Number 2, March 1996.

CONFERENCE & WORKSHOP PUBLICATIONS

1. S. Singh, P. Markopoulos, E. Saber, J. Lew and J. Heard, "Measuring Modality Utilization in Multi-Modal Neural Networks", accepted for publication in 2023 IEEE Conference on Artificial Intelligence (CAI 2023), Santa Clara, CA.
2. S. Singh, M. Sharma, J. Heard, J. Lew, E. Saber and P. Markopoulos, "Multimodal Aerial View Object Classification with Disjoint Unimodal Feature Extraction and Fully-Connected-Layer Fusion", SPIE: Defense and Commercial Sensing 2023, Orlando, FL.
3. M. Sharma, P. P. Markopoulos, E. Saber, M. S. Asif, and A. Prater-Bennette, "Convolutional Auto-Encoder with Tensor-Train Factorization," Proc. International Conference on Computer Vision, (ICCV 2021), RLS-CV workshop.
4. M. Sharma, P. P. Markopoulos, and E. Saber, "YOLOrs-LITE: A Lightweight CNN for Real-time Object Detection in Remote Sensing," Proc. IEEE International Geoscience and Remote Sensing Symposium (IEEE IGARSS), Brussels, Belgium, July 2021.
5. M. Dhanaraj, M. Sharma, T. Sarkar, S. Karnam, D. Chachlakis, R. Ptucha, P. Markopoulos and E. Saber, "Vehicle Detection from Multi-modal Aeriel Imagery using YOLOv3 with Mid-level Fusion", Big Data II: Learning, Analytics, and Applications, SPIE, April 2020.
6. Y. Liu, S. Monteiro and E. Saber, "Dense Semantic Labeling of Very High Resolution Aerial Imagery and LIDAR with Fully Convolutional Neural Networks and Higher Order CRFs", CVPR, 2017
7. Y. Liu, S. Piramanayagan, S. Monteiro and E. Saber, "Semantic segmentation of remote sensing data using Gaussian processes and higher order CFRs", IGARSS, Fort Worth, TX, July 2017.
8. Y. Liang, S. T. Monteiro, and E. Saber, "Gaussian processes for object detection in high resolution remote sensing images", IEEE International Conference on Machine Learning and Applications (ICMLA 2016), Anaheim, CA, December 2016.
9. S. Piramanayagam, W. Schwartzkopf, F.W. Koehler, E. Saber, "Classification of remote sensed images using random forests and deep learning framework", Proc. SPIE 10004, Image and Signal Processing for Remote Sensing XXII, 100040L, October 2016;
10. Y. Liang, S. T. Monteiro, and E. Saber, "Transfer learning for high resolution aerial image classification" ,to appear in IEEE Applied Imagery Pattern Recognition Workshop (AIPR 2016), Washington, D.C., October 2016.
11. Y. Liang, P. P. Markopoulos, and E. Saber, "Subpixel target detection in hyperspectral images with local matched filtering in SLIC superpixels", IEEE Workshop on Hyperspectral Image and Signal Processing: Evolutions in Remote Sensing (WHISPERS 2016), Los Angeles, CA, August 2016.
12. Y. Hu, S. Monteiro and E. Saber, "Super Pixel Based Classification using Conditional Random Fields for Hyperspectral Images", ICIP 2016, Phoenix, AZ.
13. O. de Lima, S. Janakiraman, E. Saber, D. C. Day, M. Shaw, P. Bauer. R. S. Twede, and P. Lea, "Signature Line Detection in Scanned Documents", ICIP 2016, Phoenix, AZ.
14. Y. Liang, P.P. Markopoulos, and E. Saber", Subpixel Target Detection in Hyperspectral Images from Superpixel Background Statistics," IGARSS, Beijing, China, July 2016.
15. Y. Liu, S.T. Monteiro, and E. Saber. "Vehicle detection from aerial color imagery and airborne LiDAR data", IGARSS, Beijing, China, 2016.
16. Y. Wang, J. Mathew, E. Saber, D. Larson, P. Bauer, G. Kerby and J. Wagner. "Scanned Document Enhancement Based on Fast Text Detection," International Conference on Acoustics, Speech and Signal Processing, Shanghai, China, 2016
17. Y. Liu, S. Monteiro, and E. Saber, "An Approach for Combining Airborne LiDAR and High Resolution Aerial Color Imagery using Gaussian Processes", Proc. SPIE 9643, Image and Signal Processing for Remote Sensing XXI, Oct. 2015.

18. Y. Liang, N. Cahill, E. Saber and D. Messinger, "A Game-Theoretic Tree Matching Approach for Object Detection in High Resolution Remotely Sensed Images", Proc. SPIE 9643, Image and Signal Processing for Remote Sensing XXI, Oct. 2015.
19. Y. Hu, S. T. Monteiro and E. Saber, "Comparing Inference Methods for Conditional Random Fields for Hyperspectral Image Classification", *Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing*, Tokyo, Japan, 2015
20. Y. Hu, N. Cahill, S. Monteiro, E. Saber and D. Messinger, "Dimensionality Reduction for Hyperspectral Imagery Classification in Conditional Random Fields", Proc. SPIE 9643, Image and Signal Processing for Remote Sensing XXI, Oct. 2015.
21. S. Piramanayagam, P. J. Cutler, W. Schwartzkopf, F.W. Koehler, E. Saber, "Application of gradient based image segmentation to SAR imagery", IGARSS, Milan, Italy, July 2015.
22. S. Piramanayagam, E. Saber, N. D. Cahill, and D. Messinger, "Shot Boundary Detection and Label Propagation for Spatio-Temporal Video Segmentation", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb, 2015.
23. M. Yousefhussien, R. Easton, R. Ptucha, M. Shaw, B. Bradburn, J. Wagner, D. Larson and E. Saber, "Flatbed Scanner Simulation to Analyze the Effect of Detector's Size on Color Artifacts", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2015.
24. K. Shah, E. Saber and K. Verrier, "Improved Metrology of Implant Lines on Static Images of Textured Silicon Wafers using Line Integral Method", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2015.
25. Y. Hu, E. Saber, S. Monteiro, N. Cahill and D. Messinger, "Classification of Hyperspectral Images Based on Conditional Random Fields", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2015.
26. R. Kothari, E. Saber, M. Nelson, M. Stauffer and D. Bohan, "Image Enhancement for Low Resolution Display Panels", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2015.
27. Y. Liang, A. H. Syed, N. Cahill, E. Saber, and D. Messinger, "Application of Tree Matching Techniques to High Resolution Remotely Sensed Images toward Object Detection", GEOBIA, May 2014.
28. Y. Hu, A. H. Syed, E. Saber, N. Cahill, and D. Messinger, "Dynamic scale-space representation based on a MRF region merging model", GEOBIA, May 2014
29. Y. Liu, M. Helguerra and E. Saber, "Measurement of blood flow velocity in vivo video sequences with motion estimation methods", SPIE Medical Imaging, San Diego, 2014.
30. Y. Wang, O. F. de Lima, and E. Saber, "Improved edge directed Super resolution with hardware realization for surveillance, transportation, and multimedia applications", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2014.
31. J. Whitesell, D. Patru, E. Saber, G. Roylance and B. Larson, "Design for Implementation of Color Image Processing Algorithms", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2014
32. R. Toukatly, D. Patru, E. Saber, E. Peskin, G. Roylance and B. Larson, "Performance Analysis of a Color Space Conversion Engine Implemented using Dynamic Partial Reconfiguration", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2013.
33. O. De Lima, S. R. Vantaram, S. Piramanayagam, E. Saber and K. Bengtson, "An Edge Directed Super Resolution Technique for Surveillance and Printing Applications", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2013.
34. M. YousefHussien, K. Garvin, D. Dalecki, E. Saber and M. Helguera, "Three-Dimensional Volume Analysis of Vasculature in Engineered Tissues", SPIE/IS&T: Electronic Imaging Symposium, San Francisco, CA, Feb. 2013
35. A. Mykyta, D. Patru, E. Saber. G. Roylance and B. Larson, "Reconfigurable Framework for High-Bandwidth Stream-Oriented Data Processing", IEEE International SoC Conference (SOCC), Buffalo, NY, Sept. 2012.
36. S. R. Vantaram, and E. Saber, "Unsupervised Video Segmentation by Dynamic Volume Growing and Multivariate Volume Merging using Color-Texture-Gradient Features", *IEEE International Conference on Image Processing*, *Orlando, Florida, September 2012*.
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EXTERNAL FUNDING/FUNDED PROPOSALS

Proposals Funded while at RIT

- Acquired/continue to acquire funding with multiple grants from government agencies and corporate partners (Hewlett-Packard, Dataphysics, Lenel, Xerox) in excess of $3.5 Million as PI and in excess of $5 Million as PI/Co-PI (total Portfolio) since joining RIT. A complete statement listing the details of each grant can be provided upon request.

Proposals Funded prior to Joining RIT as an employee of Xerox Corporation and University of Rochester:

- A. M. Tekalp and E. Saber (co-PI), "An intelligent visual database system: Hierarchical content description and matching using integrated similarity metrics", funded for $243K for four years at the University of Rochester by the National Science Foundation under NSF Grant IIS – 9820721.

HONORS AND AWARDS

- Awarded the Prestigious Trustees Scholarship award – the highest award at RIT with regards to research recognition (2012)
- Elected as the Kate Gleason College of Engineering Scholarship award winner (2012).
- Elected as Electrical and Microelectronic Engineering Gleason Professor for 3 years Fall 2011 – Summer 2014.
- Elected as PI Millionaire by RIT Sponsored research organization.
- Winner of an M.S./Ph.D. scholarship for graduate study from Xerox Corporation.
- Winner of the quality recognition award from Xerox Corporation for outstanding performance.
- Core member of a toner/developer facility engineering project team recognized as ``The 1991 and 1993 team of the year" by the Delaware Valley Chapter of the Project Management Institute.
- Elected to the Electrical Engineering Honor Society, Eta Kappa Nu.
- Winner of Gibran Khalil Gibran Scholarship for outstanding academic achievements.
- Valedictorian of the Electrical and Computer Engineering Department at the University of Buffalo.
- Recipient of several prizes and awards from the University of Buffalo and the Mohawk Valley Comm. College for excellent academic achievements; and from Xerox Corporation for outstanding performance.

PROFESSIONAL ACTIVITIES

- Senior Member of the Institute of Electrical & Electronic Engineers.
- Member of the IEEE Signal Processing Society.
- Plenary Chair for ICIP 2021.
- Technical Program Chair for ICASSP 2017 in New Orleans.
- General Chair for ICIP 2012.
- Member of the IEEE Signal Processing society conference board for 3 year team starting January 2013.
- Tutorial chair for the International Conferences on Image Processing, ICIP 2007 and ICIP 2009.
- Special session chair on Color Image Processing for the European Signal Processing Conference, Sept. 2006.
- Finance Chair for the International Conference on Image Processing 2002 held in Rochester, NY.
- Former Area Editor for the Journal of Electronic Imaging.

- Guest Editor for the "Color Image Processing" issue of the Signal Processing Magazine.
- Associate Editor for the IEEE Transactions on Image Processing for five years. Term ended: April 2009.
- Former Associate Editor for the IEEE Signal Processing Magazine for DSP Applications Forum.
- Former Member of the IEEE Image & Multidimensional Digital Signal Processing Technical Committee.
- Former Member of IEEE Tech. Comm. on Industry DSP Technology in 2003 & 2004 & Chair for 2005, 2006.
- Technical program committee member for ICIP 2009 and prior ICIPs.
- Technical program committee member for ICASSP 2010 and prior ICASSPs.
- Session chair for several ICIP & ICASSP Conferences and Workshops.
- Chairman, vice-chairman, treasurer, and secretary of the IEEE Rochester Chapter of the signal processing society in 1998, 1997, 1996 and 1995 respectively.
- Reviewer for the IEEE Trans. on Image Processing, IEEE Trans. on Pattern Analysis and Machine Intelligence, Graphical Models and Image Processing, IEEE Trans. on Signal Processing, IEEE Signal Processing Letters, Color Research and Applications, Graphical Modeling and Image Understanding, Image and Vision Computing, Optical Engineering, Journal of Imaging Science and Technology, and the Journal of Electronic Imaging.
- Technical committee for Western New York Imaging Workshop in 1997 and 1999 and general chair in 1998.
- Co-Chair of the Xerox Electronic Image and Video Processing Technology Council.

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