
LINA J. KARAM

Professor and Fellow of the IEEE, Computer Engineering Program Director

School of Electrical, Computer & Energy Engineering

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Research Topics and Publications Highlights

Signal, Image, and Video Processing, Compression, and Transmission; Computer Vision; Machine Learning; Perceptual-based Processing; Automated Quality Assessment and Monitoring; Multidimensional Signal Processing; Digital Filter Design.

220+ Journal and Conference Publications; 3 books; 7 book chapters; 7 issued patents; Graduated 40+ MS and PhD students as Thesis Advisor.

Google Scholar: <https://scholar.google.com/citations?user=VPaETnoAAAAJ>

Industry Collaborations and Technology Transfer

R&D collaborations on computer vision, image/video processing, image/video compression, image/video transmission, and digital filtering projects with industries including Intel, Google, NTT, Qualcomm, Microsoft, Motorola/Freescale, General Dynamics, and NASA.

Inventor on 7 issued patents

Consulting in Patent Litigation, Image/Video Compression, Image/Video Processing, Computer Vision

President, PICARIS, LLC

Director, Image, Video & Usability (IVU) Laboratory

Director, Real-time Embedded Signal Processing (RESP) Laboratory

Short Bio

Lina Karam is currently a full professor, Computer Engineering Director, and the Director of the R&D Image, Video, and Usability (IVU) Lab at ASU. She is also the President of PICARIS, LLC, a consulting company on media processing, compression, understanding, and analytics. Dr. Karam is an IEEE Fellow, the highest grade level in IEEE which is conferred each year to no more than one-tenth of 1% of all IEEE voting members, for her contributions in the image and video processing, visual media compression and transmission, and digital filtering areas. Dr. Karam is a recipient of the National Science Foundation CAREER Award, NASA Technical Innovation Award, the Intel Outstanding Researcher Award, the IEEE SPS Best Journal Paper Award. Her industrial experience includes image and video processing and compression development at AT&T Bell Labs (Murray Hill), multi-dimensional data processing and visualization at Schlumberger, and collaborations on computer vision, machine learning, image/video processing, compression, and transmission projects with various industries including Intel, Qualcomm, Google, NTT, Motorola, Freescale, General Dynamics, and NASA. She is a founding member of the International Workshop on Video Processing and Quality Metrics for Consumer Electronics (VPQM) and of the International Workshop on Quality of Multimedia Experience (QoMEX). She is an elected member of the IEEE SPS Board of Governors and a member of the IEEE Publications Board.

Education

Georgia Institute of Technology

Ph.D., Electrical Engineering, 1995

M.S., Electrical Engineering, 1992

American University of Beirut

B. E., Computer and Communications Engineering, 1989.

Employment

Computer Engineering Program Director (January 2018-Present)

Computer Engineering Graduate Program Chair (Oct. 2016-December 2017)

Professor (May 2010 – Present), School of Electrical, Computer and Energy Engineering,

Arizona State University, Tempe, AZ.

Associate Professor (August 2001 – May 2010), School of Electrical, Computer, and Energy Engineering (formerly known as Department of Electrical Engineering), Arizona State University, Tempe, AZ.

Visiting Associate Professor (August 2005 – December 2005), Department of Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX.

Assistant Professor (August 1995 – August 2001), Department of Electrical Engineering, Arizona State University, Tempe, AZ.

Intern (1994), AT&T Bell Laboratories, Murray Hill, NJ.

Research Assistant (September 1992 – June 1995), School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA.

Research Assistant (June 1991 – September 1992), Graphics, Visualization, and Usability (GVU) Center, Georgia Institute of Technology, Atlanta, GA.

Intern (1992), Schlumberger, Austin, TX

Research Assistant (February 1990 - June 1991), Scientific Visualization Group, Georgia Institute of Technology, Atlanta, GA.

Intern (1988), Computing Department, Imperial College, London, UK.

Awards and Recognition

- IEEE Fellow
- Certificate of Recognition, IEEE Signal Processing Society, September 2016
- IEEE Signal Processing Society's Best Paper Award (IEEE Transactions Journal Paper)
- IEEE Signal Processing Society's Board of Governors.
- QoMEX 2012 Best Paper Award, July 2012
- Intel Outstanding Researcher Award, March 2012
- Outstanding Faculty Award, IEEE Phoenix Section, February 2012
- American University of Beirut Distinguished Alumnus Award, 2011
- Certificate of Merit, IEEE Signal Processing Society, 2009
- NASA Technical Innovation Award for work on visual compression, 2006
- Outstanding Technical Contributions Award, Digital Signal Processing, IEEE Phoenix Section, Jan. 2005.
- Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), January 2003.
- Professional Leadership & Service Recognition from the IEEE Signal Processing and the IEEE Communications societies
- U.S. National Science Foundation CAREER Award

- Society of Women Engineers Outstanding Graduate Student Award at Georgia Tech

Editorship

- Chief Guest Editor for the Proceedings of the IEEE, Special Issue on Perceptual-Based Media Processing (2011-2013)
- Senior Editorial Board of the IEEE Signal Processing Magazine (2014-present).
- Editorial Board of the IEEE Journal on Selected Topics in Signal Processing (2014-2017).
- Editorial Board, Foundation and Trends in Signal Processing (2006-present).
- Guest Editor for EURASIP Journal on Video Quality Metrics (2012-2013).
- Guest Editor for the IEEE Signal Processing Magazine, Special Issue on Multimedia Quality Assessment (2010-2011).
- Guest Editor for the EURASIP Journal on Image and Video Processing, Special Issue on Quality of Multimedia Experience (2009-2011).
- Lead Editor for the IEEE Journal on Selected Topics in Signal Processing, Special Issue on Visual Quality Assessment (2007-2009)
- Editor for the IEEE Transactions on Image Processing (1999-2003 & 2006-2010)
- Editorial Board of the IEEE Signal Processing Letters (2004-2006)

Conference Activities

- General Chair of the 23rd IEEE International Conference on Image Processing (ICIP), Phoenix, AZ, September 2016.
- Co-founder of the World's First Visual Innovation Award to be presented for the first time at IEEE ICIP 2016.
- Initiator of the IEEE Xplore Open Paper Preview, which makes papers freely available open access prior to held conference and which results in higher impact for papers.
- Member of the organizing committee of the QoMEX 2016 conference (Lisbon, Portugal).
- Technical Area Chair, 2015 International Conference on Image Processing (2014-present)
- Area Chair, 2015 IEEE International Conference on Image Processing (ICIP) and 2015 IEEE International Conference on Circuits and Systems (IEEE CAS).
- General Chair (together with Jorge Caviedes) of the 2012 International Workshop on Video Processing and Quality Metrics for Consumer Electronics (VPQM), January 2012.
- General Chair (together with Ron Schafer) of the 14th IEEE Digital Signal Processing Workshop and 6th IEEE Signal Processing Education Workshop, Sedona, AZ, January 2011.
- Technical Program Chair (together with Thrassos Pappas) of the 2009 IEEE International Conference on Image Processing.
- Co-Founder (together with Touradj Ebrahimi, *EPFL*, Kahled El-Maleh and Gokce Dane, *Qualcomm*), of the International Workshop on Quality of Multimedia Experience (QoMEX). <http://www.qomex.org>

- Co-Founder (together with Jorge Caviedes, *Intel*, and Sanjit Mitra, *UCSB and USC*) of the International Workshop on Video Quality for Consumer Electronics (VPQM). <http://www.vpqm.org>
- Technical Program Chair (together with Gokce Dane) of the First International Workshop on Quality of Multimedia Experience (QoMEX 2009).
- Technical Program Chair of the First International Workshop on Video Quality for Consumer Electronics (VPQM 2005).
- Served on the Organizing Committees and on the Technical Committees of several other international conferences.

Scientific and Professional Society Memberships

- IEEE Fellow (2013-present).
- IEEE Circuits and Systems Society's Fellow Evaluation Committee (2018 – present)
- IEEE Signal Processing Society's Board of Governors (2016 - present)
- IEEE Signal Processing Society's TC Review Committee (2016 - present)
- IEEE Signal Processing Society's Image, Video, and Multidimensional Signal Processing (IVMSP) Technical Committee (2005-2011 & 2014-present)
- IEEE Circuits and Systems (CAS) Society's DSP Technical Committee (1996-present)
- Member of the IEEE Publication Services and Products Board (PSPB) Strategic Planning Committee (2014-2016).
- Member of the Award Board and Initiator of the World's First Visual Innovation Award presented for the first time at IEEE ICIP 2016.
- Member of the IEEE Signal Processing Society's Multimedia Technical Committee (2011-2014).
- Member of the IEEE Signal Processing Society's Appointments and Nominations Committee (2011-2014).
- Elected Member and Vice Chair of the IEEE Signal Processing Society's Education Technical Committee (2010-2012).
- Member of the IEEE Signal Processing Society's Technical Directions Board (2008-2009), and Chair of its Diversity Committee (2009).
- Member of the IEEE Signal Processing Conference Board (2003-2005 & 2017-present).
- Member of the IEEE Signal Processing Society, IEEE Circuits and Systems Society, and IEEE Communications Society.
- Member of the Institute of Electrical and Electronics Engineers (IEEE).

Journals / Proposals / Patents / Programs Reviewer

- Reviewer for IEEE, Elsevier, and ACM journals
- Reviewer on NSF (USA) panels
- Reviewer for NSF (USA) grant proposals including SBIR proposals
- Reviewer for NSERC (Canada) grant proposals
- Reviewed grant proposals for national and international universities
- Reviewed DoD (USA) proposals

- Reviewer and consultant on patent validation and litigation
- Leader of Assessment of Engineering and Computer Science University Programs at the international level.

ASU University-Level Service

- Member, University Promotion and Tenure Committee (2014-2016)
- Member, AME Audio Faculty Search Committee (2005)
- Member, Consortium for Embedded and Inter-Networking Technologies (CEINT) Curriculum Committee (2004-2007)
- General Studies Council (1998-2001)
- Numeracy Subcommittee of the General Studies Council (1998-2001)

ASU College-Level Service

- Computer Engineering Program Chair (2106 – present)
- Dean’s Faculty Advisory Committee (2011-2013)
- Member, ECEE/CSE Computer Engineering Steering Committee (ECEE and CSE) (2012-present)
- FSE Engineering Open House for Middle and High School Students
- FSE Summer Research Program for High-School Students
- BME Imaging Faculty Search Committee (2013)
- Faculty Recruiting Committees
 - CSE Computer Architecture subcommittee (1998-1999)
 - Biomedical Imaging subcommittee (2007)
- Dean’s Diversity Committee (1999-2003)
- Member of several Ph.D. and M.S. Thesis Committees

ASU School-Level Service

- Director of the Image, Video, and Usability (IVU) Lab (1996-present)
- Undergraduate Committee (1998)
- Director of the Real-time Embedded Signal Processing (RESP) Lab (2002-present)
- Signals and Systems Course (EEE303) Review and Planning Committee (2003-2004)
- Coordinator of the Freshman Introduction to Engineering Lab (2005-2012)
- Chair of the Computer Engineering Undergraduate Curriculum Committee (2005)
- Member of the ECE 201/EEE 302/EEE 303 Course Redesign Committee (2005-2007)
- Several faculty search committees
- Systems Area Committee (1995-present)
- MSE Exam Committee (1996-present)
- Member of several Ph.D. and M.S. Thesis Committees
- Development of new undergraduate (Freshman/Senior) and graduate courses.

INVITED PRESENTATIONS AND SHORT COURSES

1. *Plenary Talk*, “Generative Sensing,” International Conference on Computing, Networking, and Communications (ICNC), Maui, Hawaii, March 2018.

2. *Plenary Talk*, “Generative Sensing: Transforming Unreliable Sensor Data for Reliable Recognition,” Twenty-Fourth National Conference on Communications (NCC) 2018, IIT Hyderabad, India, February 2018.
3. *Distinguished Speaker*, “A Closer Look at Visual Attention Models,” College of Engineering, Penn State University, April 2017.
4. *Invited Tutorial Lecture*, “Introduction to Image and Video Compression,” Visual Signal Analysis and Processing (VSAP) Workshop, Khalifa University, Abu Dhabi, United Arab Emirates, November 2015.
5. *Plenary Distinguished Lecture*, “Attentive Visual Processing – Towards User-Centric Visual Technologies,” International Conference on Computing, Networking and Communications (ICNC), February 2014.
6. *Intel Webinar*, “Automated Defect Detection and Identification for Semiconductor Units Undergoing Assembly and Test,” Intel Corporation, November 2011.
7. *Plenary Talk*, “Efficient Perceptual-Based Image and Video Processing,” Tenth FEA Student Conference, American University of Beirut, Beirut, Lebanon, May 2011.
8. *Expert Panel Talk*, “Trends in 3D Video Processing,” IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), May 2011.
9. *Invited Talk*, “Foundations and Trends of Visual Quality Assessment,” American University of Beirut, Beirut, Lebanon, July 2010.
10. *Plenary Talk*, “Foundations and Trends of Visual Quality Assessment,” 2nd International Workshop on Visual Information Processing (EUVIP), Paris, France, July 2010.
11. *Invited Talk*, “Adaptive Rate-Distortion Based Wyner-Ziv Video Coding,” Multimedia, Mathematics and Machine Learning II, BIRS, Banff Centre, Banff, Canada, July 2009.
12. *Invited Talk*, “Wyner-Ziv Based Low-Complexity Distributed Video Encoding,” New Mexico State University, Las Cruces, NM, Nov. 2008.
13. *Invited Lecture*, “Real-World Applications for Freshman Engineering Education,” NI Week, Austin, TX, Aug. 2008.
14. *Invited Lecture*, “From Conventional to Distributed Video Coding,” IEEE Lebanon Section and American University in Beirut, Beirut, Lebanon, July 2008.
15. *Invited Lecture*, “BLAST-DVC: BitPlane Selective Distributed Video Coding,” Center for Research in Mathematics (CIMAT), Guanajuato, Mexico, May 2008.
16. *Short Course*, Lina J. Karam, “Image Compression: Foundations,” Qualcomm, San Diego, CA, May 2008. Invited One-Day Short Course.
17. *Short Course*, Lina J. Karam, “Basics of Image and Video Compression,” Qualcomm, San Diego, CA, 2007. Invited Two-Day Short Course.
18. *Guest Speaker*, “Functional MRI,” National Instruments, Austin, TX, 2007.
19. *Invited Talk*, “Selective Error Detection for Error-Resilient Image Coding and Transmission using Similarity Check Functions,” Ss Cyril and Methodius University, Skopje, Macedonia, 2006.
20. *Guest Speaker*, “Freshman Introduction to Engineering,” National Instruments, Austin, TX, 2005.
21. *Invited Speaker*, “Wavelet-Based Adaptive Image Denoising with Edge Preservation,” General Dynamics, Scottsdale, AZ, 2004.
22. *Invited Talk*, “Teaching Image Processing to High School Students,” IEEE Digital Signal Processing Workshop, Hunt, TX, 2000.

23. *Invited Talk*, "Error-Resilient Video Coding with Channel-Optimized Trellis-Coded Quantization," IEEE Wireless Communications and Networking Conference, Chicago, IL, 2000.
24. *Invited Talk*, "Channel-Optimized Source Coding for the Transmission of Digital Imagery over Noisy Channels," The American University of Beirut, Beirut, Lebanon, July 2000.
25. *Invited Talk*, "Robust Image Coding Using Perceptually-Tuned Channel-Optimized Trellis-Coded Quantization," Midwest Symposium on Circuits and Systems, Las Cruces, NM, 1999.
26. *Guest Speaker*, "Image Coding based on Perceptual Criteria," Motorola, Scottsdale, AZ, 1996.
27. *Distinguished Lecture*, "Color Video Coding at Very Low Bit Rates," IEEE Signal Processing & Communications Chapter, Phoenix, AZ, 1995.

PATENTS

Note: Student authors are shown in boldface.

1. Tinku Acharya, Lina J. Karam, and **Francescomaria Marino**, "The Compression of Color Images Based on a 2-Dimensional Discrete Wavelet Transform Yielding a Perceptually Lossless Image," US Patent 6,154,493. Filed 1998 by Intel. **Issued 2000.**
2. Tinku Acharya, Lina J. Karam, and **Francescomaria Marino**, "Real-time Algorithms and Architectures for Coding Images Compressed by DWT-Based Techniques," US Patent 6,124,811. Filed 1998 by Intel. **Issued 2000.**
3. Glen P. Abousleman, **Tuyet-Trang Lam**, and Lina J. Karam, "Communication System and Method for Multi-Rate, Channel-Optimized Trellis-Coded Quantization," US Patent 6,717,990. Filed 2000 by Motorola. **Issued 2004.**
4. **Katherine S. Tyldesley**, Glen P. Abousleman, and Lina J. Karam, "System and Method for Transmission of Video Signals using Multiple Channels," US Patent 7551671 B2. Filed 2003 by General Dynamics. **Issued June 2009.**
5. Glen P. Abousleman, **Wei-Jung Chien** and Lina J. Karam, "Method and Apparatus for Network-Adaptive Video Coding," US Patent. Provisional filed 2007 by ASU. Full patent filed 2008 by ASU.
6. Lina J. Karam and **Asaad F. Said**, "Automatic Cell Migration and Proliferation Analysis," United States Patent 9,082,164. **Issued July 14, 2015.**
7. Lina J. Karam and **Samuel Dodge**, "Systems, Methods, and Media for Identifying Object Characteristics Based on Fixation Points," United States Patent 9,501,710 B2. **Issued November 22, 2016.**
8. Lina J. Karam and **Jinjin Li**, "Stereo Vision Measurement System and Method," United States Patent 9,704,232 B2. Full Patent Filed March 18, 2015. **Issued July 11, 2017.** **Technology Licensed by Intel through Arizona Technology Enterprises (AzTE).**

BOOKS

Note: Student authors are shown in boldface.

1. Lina J. Karam and **Naji Mounsef**, *Introduction to Engineering: A Starter's Guide With Hands-On Digital Multimedia Explorations and Robotics*, Morgan-Claypool, 2008.
2. Lina J. Karam and **Naji Mounsef**, *Introduction to Engineering: A Starter's Guide With Hands-On Analog Multimedia Explorations*, Morgan-Claypool, 2008.

3. Lina J. Karam, *Design of Complex Digital FIR Filters in the Chebyshev Sense*, Ph.D. Thesis, Georgia Institute of Technology, March 1995.

BOOK CHAPTERS

1. **Vicente Molieri**, Lina J. Karam, and Zoe Lacroix, "CLAST: Clustering Biological Sequences," in *Emerging Trends in Computational Biology, Bioinformatics, and Systems Biology* (Q. Nam and H. Arabnia Eds.), Chapter 10, pp. 203-220, Aug. 2015, Elsevier. ISBN: 978-0-12-802508-6. <http://www.sciencedirect.com/science/book/9780128025086>
2. **Nabil G. Sadaka** and Lina J. Karam, "Perceptually Driven Super-Resolution Techniques," in *Perceptual Digital Imaging: Methods and Applications*, Rastislav Lukac Editor, CRC Press/Taylor & Francis, 2012.
3. Lina J. Karam, "Lossless Image Compression," in *The Essential Guide to Image Processing*, Al Bovik Editor, Chapter 16, pages 385-417, Elsevier Academic Press, 2009.
4. Lina J. Karam, "Lossless Coding", in *the Handbook of Image and Video Processing*, 2nd Edition, Al Bovik Editor, Chapter 5.1, pages 643-660, Elsevier Academic Press, 2005.
5. Umesh Rajashekar, Alan C. Bovik, Daniel Sage, Michael Unser, Lina J. Karam, and Reginald Legendijk, "Image Processing Education," in *the Handbook of Image and Video Processing*, 2nd Edition, Al Bovik Editor, Chapter 2.4, pages 73-95, Elsevier Academic Press, 2005.
6. Lina J. Karam, "Lossless Image Coding," in *the Handbook of Image & Video Processing* Al Bovik, Editor, Chapter 5.1, pages 461-474, Academic Press, 2000.
7. Lina J. Karam, James H. McClellan, Ivan Selesnick, and C. Sidney Burrus, "Digital Filtering," in *the Digital Signal Processing Handbook* (V. K. Madisetti and D. B. Williams, Editors), Chapter 11, pages 11-1 to 11-86, CRC Press, 1998.

REFEREED JOURNAL PAPERS (PUBLISHED OR ACCEPTED):

Note: Student authors are shown in boldface.

1. **Milind S. Gide** and Lina J. Karam (2017), "Computational Visual Attention Models", *Foundations and Trends® in Signal Processing*: Vol. 10: No. 4, pp 347-427, 2017. <http://dx.doi.org/10.1561/20000000055> (*invited*)
2. **S. Alirezah Golestaneh** and Lina J. Karam, "Reduced-Reference Quality Assessment Based on the Entropy of DWT Coefficients of Locally Weighted Gradient Magnitudes," *IEEE Transactions on Image Processing*, vol. 25, no. 11, pp. 5293-5303 (11 pages), Nov. 2016.
3. **Bashar M. Haddad**, **Sen Yang**, Lina J. Karam, Jieping Ye, Nital Patel, and Martin Braun, "Multi-Feature, Sparse-Based Approach for Defects Detection and Classification in Semiconductor Units," *IEEE Transactions on Automation Science and Engineering*, 15 pages, Aug. 2016, doi 10.1109/TASE.2016.2594288.

4. **Milind Gide** and Lina J. Karam, "A Locally Weighted Fixation Density-Based Metric for Assessing the Quality of Visual Saliency Predictions," *IEEE Transactions on Image Processing*, vol. 25, no. 8, pp. 3852-3861, Aug. 2016.
5. **Mahesh Subedar** and Lina J. Karam, "3D Blur Discrimination," *ACM Transactions on Applied Perception*, vol. 13, issue 3, article no. 12, 13 pages, May 2016, doi 10.1145/2896453.
6. **Jinjin Li**, Bonnie L. Bennett, Lina J. Karam, and Jeffrey S. Pettinato, "Stereo Vision Based Automated Solder Ball Height and Substrate Coplanarity Inspection," *IEEE Transactions on Automation Science and Engineering*, vol. 13, no. 2, pp. 757-771, April 2016.
7. **Srenivas Varadarajan** and Lina J. Karam, "A No-Reference Texture Regularity Metric Based On Visual Saliency," *IEEE Transactions on Image Processing*, vol. 24, no. 9, pp. 2784-2796, Sep. 2015.
8. **Qian Xu, Srenivas Varadarajan**, Chaitali Chakrabarti, and Lina J. Karam, "A Distributed Canny Edge Detector: Algorithm and FPGA Implementation," *IEEE Transactions on Image Processing*, pp. 2944-2960, vol. 23, no. 7, Jul. 2014.
9. **Tong Zhu** and Lina J. Karam, "A No-Reference Objective Image Quality Metric based on Perceptually Weighted Local Noise," *EURASIP Journal on Image and Video Processing*, 2014 (8 pages). Available online: <http://jivp.eurasipjournals.com/content/2014/1/5>.
10. **Berkay Kanberoglu**, Nina Z. Moore, David Frakes, Lina J. Karam, Josef P. Debbins, Mark C. Preul, "Neuronavigation using Three-Dimensional Proton Magnetic Resonance Spectroscopy Data," *Stereotactic and Functional Neurosurgery*, pp. 306-314, 92(5), 2014.
11. **Sin Lin Wu**, Jorge Caviedes, Lina Karam, and Ingrid Heynderickx, "The Effect of Applying 2D Enhancement Algorithms on 3D Video Content," *Hindawi Journal of Electrical and Computer Engineering*, 11 pages, 2014. Online at: <http://dx.doi.org/10.1155/2014/601392>.
12. **Akshay Pulipaka**, Patrick Seeling, Martin Reisslein, and Lina J. Karam, "Traffic and Statistical Multiplexing Characterization of 3-D Video Representation Formats," *IEEE Transactions on Broadcasting*, 59(2), pp. 382-389, June 2013.
13. Lina J. Karam; W. Bastiaan Kleijn; Karon MacLean, "Perception-based Media Processing," *Proceedings of the IEEE*, 101(9), pp. 1900-1904, Sept. 2013.
14. **Asaad Said**, Bonnie Bennett, Lina Karam, Alvin Siah, Kyle Goodman, and Jeffrey Pettinato, "Automated Void Detection in Solder Balls in the Presence of Vias and Other Artifacts," *IEEE Transactions on Electronics Packaging Manufacturing*, vol. 2, no. 11, pp. 1890-1901, November 2012.

15. **Rohan Gupta, Akshay Pulipaka**, Patrick Seeling, Lina J. Karam, and Martin Reisslein, "H.264 Coarse Grain Scalable (CGS) and Medium Grain Scalable (MGS) Encoded Video: A Trace Based Traffic and Quality Evaluation," *IEEE Transactions on Broadcasting*, vol. 58, no. 3, pp. 428 to 439, September 2012.
16. Gaurav Sharma, Lina Karam, and Patrick Wolfe, "Select Trends in Image, Video, and Multidimensional Signal Processing," *IEEE Signal Processing Magazine*, pp. 5-8, Jan. 2012.
17. Lina J. Karam, **Nabil G. Sadaka, Rony Ferzli and Zoran A. Ivanovski**, "An Efficient Selective Perceptual-Based Super-Resolution Estimator," *IEEE Transactions on Image Processing*, vol. 20, no. 12, pp. 3470-3482, Dec. 2011.
18. Touradj Ebrahimi, Lina Karam, Fernando Pereira, Khaled El-Maleh, and Ian Burnett, "The Quality of Multimedia: Challenges and Trends," *IEEE Signal Processing Magazine*, pp. 17 & 148, Nov. 2011.
19. **Shyamprasad Chikkerur, Vijay Sundaram**, Martin Reisslein, and Lina J. Karam, "Objective Video Quality Assessment Methods: A Classification, Review, and Performance Comparison," *IEEE Transactions on Broadcasting*, vol. 57, no. 2, pp. 165-182, June 2011.
20. **Niranjan D. Narvekar** and Lina J. Karam, "A No-Reference Image Blur Metric Based on the Cumulative Probability of Blur Detection (CPBD)," *IEEE Transactions on Image Processing*, vol. 20, no. 9, pp. 2678-2682, Sep. 2011.
21. **Asaad F. Said**, Bonnie L. Bennett, Lina J. Karam, and Jeff Pettinato, "Automated Detection and Classification of Non-Wet Solder Joints," *IEEE Transactions on Automation Science and Engineering*, vol. 8, no. 1, pp. 67-80, Jan. 2011.
22. **Asaad F. Said**, Bonnie L. Bennett, Lina J. Karam, and Jeff Pettinato, "Robust Automated Void Detection in Solder Balls and Joints," *OnBoard Technology Magazine*, Issue of the Decade on Quality, pp. 36-41, Sep. 2010.
23. **Wei-Jung Chien** and Lina J. Karam, "Transform-Domain Distributed Video Coding with Rate-Distortion Based Adaptive Quantization," *IET Image Processing Journal, Special Issue on Distributed Video Coding*, pages 340-354, vol. 3, no. 6, December 2009.
24. Lina J. Karam, **Ismail AlKamal**, Alan Gatherer, Gene Frantz, David Anderson, and Brian Evans, "Trends in Multi-Core DSP Platforms," *IEEE Signal Processing Magazine, Special Issue on Signal Processing on Platforms with Multiple Cores*, pages 38-49, November 2009.
25. **Wei-Jung Chien** and Lina J. Karam, "BLAST-DVC: BitpLANe Selective Distributed Video Coding," *Springer Multimedia Tools and Applications Journal, Special Issue on Distributed Video Coding*, 20 pages, July 2009, DOI 10.1007/s11042-009-0314-8; pp. 437-456, 2010.

26. Lina J. Karam, Touradj Ebrahimi, Sheila Hemami, Thrastos Pappas, Robert Safranek, Zhou Wang, and Andrew B. Watson, "Introduction to the Special Issue on Visual Media Quality Assessment," *IEEE Journal on Special Topics in Signal Processing, Special Issue on Visual Media Quality Assessment*, vol. 3, no. 2, pp. 189-192, April 2009.
27. **Rony Ferzli** and Lina J. Karam, "A No-Reference Objective Image Sharpness Metric Based on the Notion of Just Noticeable Blur (JNB)," *IEEE Transactions on Image Processing*, vol. 18, no. 4, pp. 717-728, April 2009.
28. **Brian Lenoski**, Leslie C. Baxter, Lina J. Karam, José Maisog, and Josef Debbins, "On the Performance of Autocorrelation Estimation Algorithms for fMRI Analysis," *IEEE Journal on Special Topics in Signal Processing, Special Issue on Functional Magnetic Resonance Imaging*, vol. 2, no. 6, pp. 828-838, Dec. 2008.
29. **Geert Van der Auwera, Prasanth T. David**, Martin Reisslein, and Lina J. Karam, "Traffic and Quality Characterization of the H.264/AVC Scalable Video Coding Extension," *Advances in Multimedia*, vol. 2008, Article ID 164027, 27 pages, 2008. doi:10.1155/2008/164027.
30. Andrew B. Watson, **Zhen Liu**, and Lina J. Karam, "JPEG2000 Encoding with Perceptual Distortion Control," *NASA Tech Brief*, pp. 37-38, Sep. 2008.
31. **Geert Van der Auwera**, Martin Reisslein, and Lina J. Karam, "Corrections to "Video Texture and Motion Based Modeling of Rate Variability-Distortion (VD) Curves," *IEEE Transactions on Broadcasting*, vol. 54, no. 1, pp. 166 – 166, Mar. 2008.
32. Lina J. Karam and **Tuyet-Trang Lam**, "Selective Error Detection for Error-Resilient Wavelet-Based Image Coding," *IEEE Transactions on Image Processing*, vol. 16, no. 12, pp. 2936-2942, Dec. 2007.
33. **Geert Van der Auwera**, Martin Reisslein, and Lina J. Karam, "Corrections to "Video Texture and Motion Based Modeling of Rate Variability-Distortion (VD) Curves," *IEEE Transactions on Broadcasting*, vol. 53, issue 4, pp. 811 – 811, Dec. 2007.
34. **Geert Van der Auwera**, Martin Reisslein, and Lina J. Karam, "Video Texture and Motion Based Modeling of Rate Variability-Distortion (VD) Curves," *IEEE Transactions on Broadcasting*, vol. 53, no. 3, pp. 637-648, Sept. 2007.
35. **Zhen Liu**, Lina J. Karam, and Andrew B. Watson, "JPEG2000 Encoding with Perceptual Distortion Control," *IEEE Transactions on Image Processing*, vol. 15, no. 7, pp. 1763-1778, Jul. 2006.
36. **Zhen Liu** and Lina J. Karam, "Mutual Information-Based Analysis of JPEG2000 Contexts," *IEEE Transactions on Image Processing*, vol. 14, no. 4, pp. 411-422, April 2005.

37. Glen P. Abousleman, **Tuyet-Trang Lam**, and Lina J. Karam, "Robust Hyperspectral Image Coding with Channel-Optimized Trellis-Coded Quantization," *IEEE Transactions on Geoscience and Remote Sensing*, vol 40, no. 4, pp. 820-830, April 2002.
38. **Ingo Höntsch** and Lina J. Karam, "Adaptive Image Coding with Perceptual Distortion Control," *IEEE Transactions on Image Processing*, vol. 11, no. 3, pp. 213-222, March 2002.
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108. **Rony Ferzli** and Lina J. Karam, "No-Reference Objective Wavelet-Based Noise Immune Image Sharpness Metric," *IEEE International Conference on Image Processing (ICIP)*, vol. 1, pages 405 – 408, Sep. 2005.
109. Christian Beaudry, Michael E. Berens, **Tarek El Doker**, Anna M. Joy, Lina J. Karam, Zoé Lacroix, **Jad A. Lutfi**, **Sai Motoru**, Rosemary A. Renaut, and **Ian J. Rich**, "Automated Characterization of Cellular Migration Phenomena," *IEEE International Computational Systems Bioinformatics Conference (CSB)*, pages 185-186, Aug. 2005.
110. **Zoran Ivanovski**, Lina J. Karam, and Glen P. Abousleman, "Super-Resolution Video Enhancement based on a Constrained Set of Motion Vectors," *Proceedings SPIE 5817*,

Defense and Security Symposium, Visual Information Processing XIV, Proceedings SPIE vol. 5817, pp. 124-132, Apr. 2005.

111. **Zoran Ivanovski**, Ljupcho Panovski, and Lina J. Karam, "Efficient Edge-Enhanced Super-resolution," *3rd International Conference Sciences of Electronic, Technologies of Information and Telecommunications (SETIT)*, Tunisia, Mar. 2005.
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113. **Rony A. Ferzli**, Lina J. Karam, and Jorge Caviedes, "A Robust Image Sharpness Metric Based on Kurtosis Measurement of Wavelet Coefficients", *1st International Workshop on Video Processing and Quality Metrics for Consumer Electronics (VPQM05)*, ISBN: 09774739), Scottsdale, AZ, Jan. 2005 (invited paper), electronic proceedings at http://enpub.eas.asu.edu/resp/vpqm2006/accepted_papers_vpqm05.htm.
114. **Tuyet-Trang Lam**, Lina J. Karam, Rida A. Bazzi, and Glen P. Abousleman, "Reduced-Delay Selective ARQ for Low Bit-Rate Image and Multimedia Data Transmission," *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, vol. 2, pp. 309-312, Mar. 2005.
115. **Zoran A. Ivanovski**, Lina J. Karam, and Glen P. Abousleman, "Selective Bayesian Estimation for Efficient Super-Resolution," *Proc. 4th IEEE International Symposium on Signal Processing and Information Technology (IEEE ISSPIT)*, Rome, Italy, December 2004.
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119. **Muhammad Yasin**, Lina J. Karam, and Andreas Spanias, "On-Line Laboratories for Image and Two-Dimensional Signal Processing," *IEEE Frontiers in Education Conference*, vol. 1, pages T3E_19- T3E_22, Nov. 2003.

120. **Charles Q. Zhan** and Lina J. Karam, "Wavelet-based Adaptive Image Denoising with Edge Preservation," *IEEE International Conference on Image Processing*, vol. 1, pages 97-100, Sep. 2003.
121. **Zhen Liu**, Lina J. Karam, and Andrew B. Watson, "JPEG2000 Encoding with Perceptual Distortion Control," *IEEE International Conference on Image Processing*, vol. 1, pages 637-640, Sep. 2003.
122. **Tuyet-Trang Lam**, Lina J. Karam, **Katherine Tyldesley**, and Glen P. Abousleman, "An Efficient Long-Term Memory Motion-Compensated Prediction Scheme and Application to Error-Resilient Video Transmission," *IEEE International Symposium on Signal Processing and its Applications*, vol. 1, pages 101-104, July 2003.
123. **Muhammad Yasin**, Lina J. Karam, and Andreas Spanias, "On-Line Laboratories for Image and Two-Dimensional Signal Processing Using 2D J-DSP," *IEEE International Conference on Acoustics, Speech, and Signal Processing*, vol. 3, pages 785-788, 2003.
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154. **Francescomaria Marino**, Tinku Acharya, and Lina J. Karam, "A DWT-Based Perceptually Lossless Color Image Compression Architecture," *Thirty-Second Asilomar Conference on Signals, Systems, and Computers*, vol. 1, pages 149-153, Nov. 1998.
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OPEN ACCESS ARXIV PAPERS

Note: Student authors are shown in boldface.

1. **Samuel Dodge** and Lina Karam, "Can the early human visual system compete with Deep Neural Networks?," arXiv:1710.04744, Oct. 2017. Available Online at: <https://arxiv.org/abs/1710.04744>
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5. **Samuel Dodge** and Lina J. Karam, "Visual Saliency Prediction Using a Mixture of Deep Neural Networks," arXiv:1702.00372, Feb. 2017. Available Online at: <https://arxiv.org/abs/1702.00372>
6. **Milind S. Gide, Samuel F. Dodge,** and Lina J. Karam, "The Effect of Distortions on the Prediction of Visual Attention," arXiv:1604.03882, April 2016. Available Online at: <http://arxiv.org/abs/1604.03882>
7. **Samuel Dodge** and Lina Karam, "Understanding How Image Quality Affects Deep Neural Networks," arXiv:1604.04004, April 2016. Available Online at: <https://arxiv.org/abs/1604.04004>
8. **Samuel F. Dodge** and Lina J. Karam. "Is Bottom-Up Attention Useful for Scene Recognition?" arXiv:1307.5702, July 2013. Available Online at: <https://arxiv.org/abs/1307.5702>
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STUDENTS' THESES AND DISSERTATIONS SUPERVISED TO COMPLETION

Ph.D. Graduates

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Thesis Title: Perceptual-Based Locally Adaptive Noise and Blur Detection

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Thesis Title: Visual Quality with a Focus on 3D Blur Discrimination and Texture Granularity

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Thesis Title: Spatial and Multi-Temporal Visual Change Detection with Application to SAR Image Analysis

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Thesis Title: Traffic Characterization and Modeling of H.264 Scalable & Multi-View Encoded Video

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Thesis Title: Efficient Perceptual Super Resolution

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Thesis Title: Noise Resilient Image Segmentation and Classification Methods with Applications in Biomedical and Semiconductor Images

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Thesis Title: Nonlinear Shape-Based Image Analysis and Coding

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Thesis Title: Synthetic Aperture Radar Image Formation via Sparse Decomposition

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Thesis Title: Fast Algorithms and Architectures for High Throughput Encoding in H.264/AVC

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Thesis Title: Matlab Based Framework for Image and Video Quality Evaluation

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Vicente Moleri

Date: April 2010

Thesis Title: Genomic Sequence Clustering

Steven Chris Burns

Date: July 2009

Thesis Title: Real-Time Fixed-Point Wavelet-Based Image Compression

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Thesis Title: Improving Side Information Generation in a Distributed Video Coding System

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Thesis Title: Novel Tools and Techniques in Neurosurgical Planning

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Brian Lenoski

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Thesis Title: Estimating the Autocorrelation of Functional Magnetic Resonance Imaging: Presurgical Mapping of Finger Movement and Reading Comprehension

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Thesis Title: Analysis and Suppression of Mosquito Noise in Compressed Video using Optimized Epsilon-Filters

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Thesis Title: Scalable Embedded Region-Of-Interest based Image Coding

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Samuel Dodge

Joshua Feinglass (co-advised with Daniel Bliss)

S. Alirezah Golestaneh

Bashar Haddad

Shanshi Huang

Ruolei Ji

Jinane Mounsef

Charan Prakash

Aditee Shrotre

INSTRUCTION

New Courses Developed

1. EEE 598 Deep Learning for Media Processing and Understanding

This is a four-credit graduate-level course that covers the fundamentals of deep learning with applications to media classification, processing, restoration, compression, and generation. Examples of media include image, video, text, speech, and audio. This course also includes hands-on assignments and projects in Python.

Some of the topics covered include:

- Basic Concepts in Machine Learning
- Probability Basics
- Motivation for Deep Learning
- Deep Feedforward Networks
- Regularization for Deep Learning
- Optimization for Training Deep Models
- Recurrent and Recursive Nets

- Autoencoders, Generative Models, Generative Adversarial Networks
- Applications: Computer Vision, Image Generation, Image Compression, Video Processing, Natural Language Processing

2. EEE 508 Digital Image and Video Processing and Compression

This is a four-credit graduate-level course that covers the fundamentals of digital image perception, representation, processing, and compression and include hands-on assignments and projects in OpenCV/C/C++, Matlab, and Android Studio. Some of the topics covered include:

- Two-Dimensional Digital Signal Processing Basics
- Vision and Perception
- Light and Color Models
- Image Segmentation
- Image Enhancement
- Image Restoration
- Basic Concepts in Information Theory
- Scalar and Vector Quantization
- Rate Distortion Theory
- Image Transforms
- Predictive, Transform, and Subband Coding
- Motion Estimation
- Entropy Coding: Huffman and Arithmetic Coding
- Run-Length Coding
- JPEG and JPEG2000 Image Compression Standards
- Motion Estimation and Compensation
- ISO MPEG and ITU-T VCEG Video Compression Standards

More information can be found at <http://lina.faculty.asu.edu/eee508/>

3. EEE 507 Multidimensional Signal Processing

This is a three-credit graduate-level course that is concerned with understanding signals of more than one variable and with systems for processing them. The specific topics covered are:

- Multi-D Discrete-Time(Space) Signals and Systems
- Multi-D Sampling
- Multi-D Discrete Fourier Transform (DFT)
- Multi-D Finite Impulse Response (FIR) Digital Filters
- Multi-D Z-Transform
- Multi-D Infinite Impulse Response (IIR) Digital Filters
- Processing of Propagating Space-Time Signals
- Multi-D Signal Restoration and Reconstruction
- Medical Imaging

More information can be found at <http://lina.faculty.asu.edu/eee507/>

4. EEE 404/EEE 591 Real-Time Digital Signal Processing

This is a four-credit senior-level course that provides the students with knowledge and hands-on experience in translating DSP concepts into real-time software for embedded systems using fixed-point DSP boards (Freescale DSP56858 and TI TMS320C5510). In addition to two 75-minute lecture sessions per week, on-campus students meet weekly for a three-hour laboratory session under the guidance of a TA. On-line students can access and control the lab equipment, boards, and software remotely, and can develop and run real-time applications from their remote location using the lab equipment, hardware, and software through a user-friendly “virtual bench” interface. I secured funding for the development of this course from the Consortium for Embedded and Inter-Networking Technologies (CEINT), Motorola, Freescale, Texas Instruments, and Tektronix.

The lecture topics covered include:

- Real-Time Systems: Introduction and Basics
- Basic Concepts in Signals and Systems: signals, Analog-to-Digital/Digital-to-Analog conversion, sampling and aliasing, quantization, discrete-time representation, filtering
- Digital Signal Processor Architectures: Harvard architecture, special addressing modes, parallel instructions, pipelining, real-time programming, modern digital signal processor architectures, hardware interfacing
- Computer Arithmetic: fixed-point and floating-point numbers, integer arithmetic
- Finite-wordlength effects: quantization, overflow, saturation, scaling, rounding and truncation
- Fixed-point Digital Signal Processors
- Fast Fourier Transforms and Applications: DTFT, DFT, FFT, implementation complexity, linear convolution, circular convolution, fast convolution, Short-Time Fourier Transform and Spectrogram
- Real-Time Multimedia and Communication Applications: speech processing, and/or audio processing, and/or image processing, and/or adaptive filtering, and/or modulation/demodulation, and/or matched filtering, and/or equalization.

The labs include:

- Lab 1: Overview of Hardware and Software Tools.
- Lab 2: Introduction to CodeWarrior.
- Lab 3: Introduction to the DSP56800E Assembly.
- Lab 4: Introduction to On-Chip Peripherals.
- Lab 5: Introduction to Processor Expert.
- Lab 6: Applications Using the DSP56858EVM CODEC.
- Lab 7: Real-Time Image Processing.
- Lab 8: Introduction to Code Composer Studio and TMS320C55x Assembly.
- Lab 9: Musical Notes Synthesis
- Lab 10: Introduction to On-Chip Peripherals and Music Equalizer
- Lab 11: Fast Fourier Transform
- Lab 12: Applications of Fast Fourier Transform (Spectrum Analysis and Speech Processing)
- Lab 13: Modem (optional)

More information can be found at <http://lina.faculty.asu.edu/realdsp>

5. EEE/CSE/FSE 101 Introduction to Engineering Design

This is a Freshman level course which was developed to include two 50-minute lectures per week and a 2-hour hands-on lab session per week under the supervision of a TA. In addition, the students work in teams on two 4-week projects (one of which is a Robotics project) that build on the lab experiments. I secured funding for the development of this course from National Instruments (cash and equipment in the amount of \$120,000). The lecture component of this course was adapted from the previously taught ECE100 (Intro to Engineering Design) course. The lab component was fully developed from scratch as it was non-existent in the previous ECE100 course. The laboratory component of this course was designed to include hands-on lab experiments that expose entering freshman students to a wide range of areas in electrical and computer engineering including circuits, electronics, communications, analog and digital signal processing, digital image processing, computing hardware and software, embedded systems, robotics and control.

The developed labs include:

- Lab 1: Introduction to Circuits: NI ELVIS, Breadboard, Circuit elements
- Lab 2: Analog Audio Level Meter (using comparators)
- Lab 3: Noise Removal Using Analog Filters
- Lab 3: Analog Music Equalizer (using op-amps)
- Lab 4: Analog Music Composer (using 555 timers)
- Lab 5: Introduction to LabVIEW and SPEEDY-33 (programming, computer architecture, embedded systems, real-time DSP)
- Lab 6: Digital Audio Level Meter
- Lab 7: Noise Removal using Digital Filters
- Lab 8: Digital Music Equalizer
- Lab 9: Digital Music Composer
- Lab 10: Digital Sound Effects
- Lab 11: Introduction to Robotics
- Lab 12: Digital Image Processing Basics
- Lab 13: Webcam Applications
- Lab 14: Telephone
- Lab 15: Amplitude Modulation
- Lab 16: Modem