

## JOSEPH DAGHER, Ph.D.

*Imaging Scientist*

*MAGPI LLC, Founder*

*Expert & Legal Consultant*



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### PROFESSIONAL SUMMARY

- More than 25 years of Research and Development experience in Imaging Science: Imaging Systems, Optical Systems, Camera Systems, Sensors, Image and Video Processing and, Data Analysis Algorithms.
- Formal education & decades of hands-on experience in Signal and Image Processing such as Image and Video Compression, Computer Vision, Image Enhancement, Image forensics, Image Analysis, Machine Vision, Image Reconstruction, Image Quality, Inverse Problems, etc.
- More than a decade experience in Medical Imaging Systems (Magnetic Resonance Imaging), Brain Imaging Research, functional MRI image analysis, Designing MRI Protocols to detect micro bleeds/micro-hemorrhages in the brain, MRI for Concussion Imaging, MRI protocols, MRI pulse sequences, MRI Image Enhancement and Image Processing.
- Contributed to the development of the world's first cellphone cameras at Omnivision & CDM Optics, designed multi-aperture multi-lens cellphone imaging systems for low light imaging, improved image quality, extended depth of field, image zoom, super-resolution and ranging.
- Hands on and R&D experience with diverse set of imaging systems systems including Scientific Imaging Devices (microscopes, Hyperspectral, Laser Radar, Acoustic Sensors, Neuromorphic Cameras), Warfare Technology (LIDAR, RADAR, Interferometric Telescopes)
- Holder of a DoD Secret **Clearance**
- Recipient of the prestigious **Career Award** by the National Institute of Biomedical Imaging and Bioengineering (NIH-NIBIB)
- **Broad patent expertise**, more than 10 patents (as inventor), 10 years support role for patent lawyers, experience in patent litigation support.
- More than 12 journal papers (as first & senior author), and 20+ conference presentations and proceedings. Winner of **Best Paper Awards**, best presentations, Best Instructor.
- Expert Witness experience: retained by Amazon in a class action lawsuit, retained by a "high profile" firm in patent and trade secret case, retained by small businesses in Inter Partes Review cases, testified in depositions, 30 hour training course on How to Start and Run an Expert Witness Practice, and Expert Witness in Patent Cases, from SEAK, Inc.

## EDUCATION

08/06	<b>Doctor of Philosophy,</b> College of Optical Sciences, Department of Electrical and Computer Engineering, The University of Arizona, Tucson, AZ Advisors: Prof. Mark A. Neifeld Prof. Michael W. Marcellin
05/02	<b>Master of Science,</b> Electrical Engineering The University of Arizona, Tucson, AZ Minor: Optical sciences Advisor: Prof. Michael W. Marcellin

## EMPLOYMENT HISTORY

*October 2017 - Current*

MAGPI LLC



**Founder**

**Legal Expert**

- Subject Matter Expert for legal and private sectors.

*November 2021 - Current*

*CHESS Solutions & Presage Technologies*

**Director of Imaging and Signal Processing**

**Imaging Systems**

- Analytics from Video for Security Applications
- Extracting Physiology from Video for Medical and Forensic Applications
- Deep Fake Detection in Video, Images, Audio, and Text.

August 2016 - November 2021

The MITRE Corporation

**Imaging Scientist****MRI & Imaging Systems**

- Computational Imaging Group: Novel Imaging Systems for Health, Security, Defense and Commercial Applications
- Quantitative imaging techniques: optimize imaging hardware + software for task of interest
- Medical Imaging Project Lead: managing team to explore novel MRI solutions
- Funded by MITRE to design and build an MRI Phantom, with corresponding imaging analysis tools, for quantifying iron deposits in the human brain (2017-2020). A joint NIST+MITRE+NIH project.
- Publications: see Journals (11), Patents (pending/under review)

October 2012 - July 2016

University of Arizona

**Research Assistant Professor****MRI & Optics**

- Department of Medical Imaging, School of Medicine
- Department of Electrical and Computer Engineering
- Publications: see Journals (8-10); Peer-Reviewed Proceedings (9,10); Abstracts (6-9)
- Grant Support: **NIH Career Award (NIBIB)**

July 2011 - September 2012

Harvard Medical School

**Research fellow<sup>#</sup>****MRI and PET**

- Department of Radiology, Massachusetts General Hospital
- Publications: see Journals (7); Peer-Reviewed Proceedings (8); Abstracts (4-5) and Patents (5,6)

<sup>#</sup> Funded by a T32 from NIH's NIBIB

June 2009 - June 2011

University of Colorado

**Post-Doctoral fellow\*****MRI and fMRI**

- Brain Imaging Center, Department of Psychiatry, School of Medicine. Directors: Dr. *Yiping Du* and Prof. *Robert Freedman*
- Institute of Cognitive Science, Director: *Marie Banich*
- Publications: see Journals (6) and Peer-Reviewed Proceedings (7)

\* Funded by a T32 from NIH's NIMH

September 2006 – February 2009

OmniVision, CDM Optics

**Senior Research Scientist****Optics and Image Reconstruction**

- Publications: see Patents (1-4)

January 2001 – August 2006

University of Arizona

**Graduate Research Associate****Distributed Imaging**

- Signal Processing and Coding Laboratory and the Optical Computing and Processing Laboratory
- Advisors: Prof. M. W. Marcellin and Prof. M. A. Neifeld
- Publications: see Journals (1-5); Peer-Reviewed Proceedings (1-6) and Abstracts (1-3)

**PUBLICATIONS****Journal Papers**

1. **J. C. Dagher**, A. Bilgin, M. W. Marcellin, "Resource-Constrained Rate Control for Motion JPEG2000," *IEEE Transactions on Image Processing*, Vol. 12, No. 12, pp. 1522-29, December 2003.
2. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Efficient Storage/Transmission of LADAR Imagery," *Applied Optics: Information Processing*, Vol. 42, No. 35, pp. 7023-35, December 2003.
3. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "A Method for Coordinating the Distributed Transmission of Imagery," *IEEE Transactions on Image Processing*, Vol. 15, No. 7, pp. 1705-17, 2006.
4. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Collaborative transmission of distributed sensor imagery," *Applied Optics, Optical Society of America*, Vol. 45, No. 28, pp. 7353-7364, 2006.
5. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "A theory for maximizing the lifetime of sensor networks," *IEEE Transactions on Communications*, vol. 55, pp. 323-332, February 2007.
6. **J. Dagher** and Y.P. Du, "Efficient and robust estimation of blood oxygenation levels in single cerebral veins," *Medical & Biological Engineering and Computing*, Springer, 50 (5), 473-82, May 2012.
7. **J. Dagher**, T. Reese and A. Bilgin, "High resolution, large dynamic range MR field map estimation," *Magnetic Resonance in Medicine*, Vol. 71, No. 1, pp. 105-17, January 2014. **{Cover Image}**
8. K. Nael, B. Mossadeghi, T. Boutelier, W. Kubal, E.A. Krupinski, **J. Dagher**, and J.P. Villablanca, "Bayesian Estimation of Cerebral Perfusion Using Reduced- Contrast-Dose Dynamic Susceptibility Contrast Perfusion at 3T," *American Journal of NeuroRadiology*, Published online before print November 27, 2014, doi: 10.3174/ajnr.A4184.
9. **J. Dagher** and K. Nael, "MAGPI: A Framework for Maximum Likelihood MR Phase Imaging Using Multiple Receive Coils," *Magnetic Resonance in Medicine*, 2016 Mar;75(3):1218-31. doi: 10.1002/mrm.25756.
10. **J. Dagher** and K. Nael, "MR Phase Imaging with Bipolar Acquisition," *NMR Biomedicine, Special Issue on MRI Phase Contrast and Quantitative Susceptibility Mapping*, doi: 10.1002/nbm.3523.
11. Nael K, **Dagher JC**, Downs ME, Fine MS, Brokaw E, Millward D. "Maximum Ambiguity Distance for Phase Imaging in Detection of Traumatic Cerebral Microbleeds: An Improvement over Current Imaging Practice." *AJNR Am J Neuroradiol*. 2020 Nov;41(11):2027-2033. doi: 10.3174/ajnr.A6774
12. Walonoski J, Hall D, Bates KM, Farris MH, **Dagher J**, Downs ME, Sivek RT, Wellner B, Gregorowicz A, Hadley M, Champion FX, Levine L, Wacome K, Emmer G, Kemmer A, Malik M, Hughes J, Granger

- E, Russell S. "The 'Coherent Data Set': Combining Patient Data and Imaging in a Comprehensive, Synthetic Health Record." *Electronics*. 2022; 11(8):1199. <https://doi.org/10.3390/electronics11081199>
13. Keenan KE, Berman BP, Rýger S, Russek SE, Wang WT, Butman JA, Pham DL, **Dagher J**. "Comparison of Phase Estimation Methods for Quantitative Susceptibility Mapping Using a Rotating-Tube Phantom." *Radiol Res Pract*. 2021 Nov 24;2021:1898461. doi: 10.1155/2021/1898461. PMID: 34868681; PMCID: PMC8635951.

### Conference Proceedings & Presentations

1. **J.C. Dagher**, A. Bilgin, and M. W. Marcellin, "Efficient rate control for video streaming," in Applications of Digital Image Processing XXIII, Proceedings. of SPIE, Vol. 4472, pp. 258-66, July 2001.
  2. **J.C. Dagher**, A. Bilgin, and M. W. Marcellin, "Rate Control for Multisequence Video Streaming," in Applications of Digital Image Processing XXIII, Proceedings. of SPIE, Vol. 4671, pp. 209-20, January 2002.
  3. H. Wang, **J.C. Dagher**, A. Tabesh, M.W. Marcellin, and M.A. Neifeld, "Volumetric compression/restoration for LADAR imagery," Proceedings of Optical Society of America, Annual Meeting, Orlando, Florida, October 2002.
  4. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Compression of LADAR imagery," in Proceedings of SPIE, Visual Communications and Image Processing, Vol. 5150, pp. 1193-1203, June 2003. **{Best Paper Award}**
  5. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Power-constrained distributed transmission of sensor-network measurements," Optical Society of America, 87<sup>th</sup> Annual Meeting, Tucson, October 2003.
  6. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Compression for transmission and storage of Laser Radar measurements," Proceedings of the International Telemetry Conference, IFT, October 2003. **{Best Paper, Second Place Award}**
  7. K. M. Siddiqui, E. L. Siegel, B. I. Reiner, O. Crave, J. P. Johnson, Z. Wu, **J. C. Dagher**, A. Bilgin, M. W. Marcellin, M. Nadar, "Improved Compressibility of Multi-Slice CT Datasets using 3D JPEG2000 Compression," in Computer Assisted Radiology and Surgery, June 2004, Chicago, IL.
  8. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Collaborative multi-hop transmission of sensor-network imagery," Optical Society of America, Annual Meeting, Rochester, October 2004.
  9. P. Kulkarni, A. Bilgin, M.W. Marcellin, **J.C. Dagher**, T. Flohr and J. Rountree, "Reduced memory multi-layer multi-component rate allocation for JPEG2000," Proceedings of SPIE, Image & Video Communications and Processing (IVCP'05), San Jose, January 2005.
  10. **J. C. Dagher** and F. G. Meyer, "A joint acquisition--reconstruction paradigm for correcting inhomogeneity artifacts in MR echo planar imaging," Proceedings of IEEE Engineering in Medicine and Biology Society (EMBS 2011):3744-3750.
  11. **J. Dagher** and A. Bilgin, "A field map estimation strategy without the noise-bandwidth trade-off", Proceedings of SPIE, Medical Imaging, Vol. 8314, February 2012.
  12. **J. Dagher**, A. Bilgin and T. Reese "A method for efficient and robust estimation of low noise, high dynamic range B0 maps," in Proceedings of the International Society for Magnetic Resonance in
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Medicine, Melbourne, Australia, May 2012.

13. **J. Dagher**, et.al., "Minimum variance unbiased estimation performance of Time of Flight PET: Impact of timing resolution," in Proceedings of the Society of Nuclear Medicine, June 2012.
14. **J. Dagher** and A. Bilgin, "Robust High Resolution MR Phase Measurement," in 2nd International Workshop on MRI Phase Contrast & Quantitative Susceptibility Mapping (QSM), Ithaca, NY, July 2013. **{Young Investigator award}**
15. **J. Dagher**, K. Nael, A. Gmitro, A. Bilgin, "MR phase reconstruction from multiple receive coils," in Proceedings of the International Society for Magnetic Resonance in Medicine, Rome, Italy, 2014.
16. **J. Dagher**, K. Nael, A. Bilgin "Maximum likelihood MR phase measurement from multiple receive coils," in 3rd International Workshop on MRI Phase Contrast & Quantitative Susceptibility Mapping, Durham, NC, October 2014.
17. **J. Dagher**, S. Hess, A. Bilgin "The effect of GRAPPA on reconstructed phase images," in 3rd International Workshop on MRI Phase Contrast & Quantitative Susceptibility Mapping, Durham, NC, October 2014.
18. **J. Dagher**, "Multi-Echo Multi-Receiver MR Phase Reconstruction with Bipolar Acquisitions," in Proceeding of International Society for Magnetic Resonance in Medicine, vol. 23, p 3310, 2015.
19. **J. Dagher**, "A Joint Acquisition-Estimation Framework for MR Phase Imaging," International Conference on Information Processing in Medical Imaging (IPMI), Isle of Skye, Scotland, Lecture Notes on Computer Science, Vol 9123, pp. 45-56, June 2015. **{François Erbsmann Award, Best Paper}**

#### **Book Chapters**

1. **J. C. Dagher**, M. W. Marcellin, and M.A. Neifeld, "Power-constrained distributed transmission of sensor-network measurement," in SPIE Optics in Information Systems, special issue on Computational Imaging, Proceedings of SPIE, Vol. 14, No. 2, 2003.
2. P. Kulkarni, A. Bilgin, M.W. Marcellin, **J.C. Dagher**, J.H. Kasner, T.J. Flohr, and J.C. Rountree, "Compression of earth science data with JPEG2000 in Hyper-spectral Image Compression," G. Motta and J. Storer, Springer Inc., 2006.
3. **J.C. Dagher**, "A new paradigm for quantitation from MR phase," in Computer Vision in Medical Imaging, edited by C.H. Chen, World Scientific Publishing, 2014.

#### **Thesis**

J.C. Dagher, "Efficient Rate Control for Video Streaming," Master's thesis, Department of Electrical and Computer Engineering, The University of Arizona, May 2002.

#### **Dissertation**

J.C. Dagher, "Collaborative compression and transmission of distributed sensor imagery," Ph.D. Dissertation, College of Optical Sciences, The University of Arizona, August 2006

## RESEARCH AWARDS

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### NIH Career Award

9/30/14 – 9/30/18 NIH/NIBIB

1K25EB018355 DAGHER (PI)

#### DETECTION AND QUANTIFICATION OF MILD TBI USING BIOMARKERS DERIVED FROM MRI PHASE

*The goal of this project is to develop MRI techniques that can obtain accurate quantitative information about biomarkers of mild TBI. This advancement will enable the clinicians to (a) identify mTBI patients at an earlier stage in the disease process, and (b) accurately and quantitatively assess diagnosed mTBI patients*

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### MITRE Innovation Program

9/30/17 – ongoing

DAGHER (PI)

#### QUANTIFICATION OF IRON DEPOSITS AS BIOMARKER FOR NEUROLOGICAL DISORDERS

*The goal of this project is to develop MRI techniques that can obtain accurate estimates of iron concentration in the brain of patients suffering from disorders such as Alzheimer's, Parkinson's, Multiple Sclerosis and mTBI. We are collaborating with NIST to fabricate a novel brain test object (phantom) with known iron concentrations which will be used to validate, optimize and standardize quantitative MRI iron measurements. We are also collaborating with NIH and academic hospitals to test these techniques in the clinic.*

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## PATENTS

1. "Object-based optical character recognition algorithm," US 61/157904, March 2009.
2. "Deployable image sensors", US 11/675509, February 2007.
3. "Image data fusion systems and methods," Patent Cooperation Treaty, PCT/US09/32689, January 2009.
4. "Fusing of images captured by a multi-aperture imaging system," Taiwan 098103287, February 2009.
5. "System and method for joint degradation estimation and image reconstruction in Magnetic Resonance Imaging," PCT/US2012/053384, August 2012.
6. "System and method for field map estimation", PCT/61/588, December 2012.
7. "Magnetic Resonance Imaging System and Method," PCT/US15/29778, filed 5/7/2015.
8. (MITRE patents pending not disclosed herein)

## AWARDS

1. **François Erbsmann Award**, Information Processing in Medical Imaging, 2015
2. Magnetic Resonance in Medicine, Cover Art for January 2014 Issue.
3. Recipient of the Young Investigator Award, 2nd Workshop on MRI Phase Contrast and Quantitative Susceptibility Mapping (QSM), ISMRM, Cornell University, Ithaca, NY, July 2013.
4. **Recipient of the Developmental Psychobiology Research Fellowship**, July 2009-July 2011.
5. Recipient of the Rolyn Optics Outstanding Teaching Assistant Award at the College of Optical Sciences, University of Arizona, Fall 2005.
6. Recipient of the Best Student Paper, second place award, at IFT's International Telemetry Conference, ITC 2003, Nevada, October 2003.
7. Recipient of the Imaging Fellowship Award at The University of Arizona, August 2003 – May 2004.
8. Recipient of the Best Student Paper Award at SPIE's Visual Communication and Image Processing conference, VCIP 2003, Switzerland, July 2003.

## EXTRA-CURRICULAR ACTIVITIES

Football (*aka* soccer), Running, Cycling, Swimming

## LANGUAGE PROFICIENCY (*In order from first to last acquired*)

Arabic & French (co-acquired), English, Spanish  
Portuguese (Reading/Writing)

## REFERENCES

Available upon request