

## **Andrew E. Marble**

### **Curriculum Vitae July, 2021**

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#### **Biography**

Andrew received the B.Sc. and Ph.D. degrees in Electrical Engineering from the University of New Brunswick. His graduate work was at the UNB Magnetic Resonance Imaging (MRI) Centre, applying ideas from electrical engineering simulation to MRI system design. After graduating in 2007, Andrew taught undergraduate courses at St. Francis Xavier University, then moved to a tenure track position at Carleton University, with Tenure awarded in 2011. In 2013, Andrew went on leave to complete an MBA and he left Carleton in 2014 to take a non-academic position as a business focused management consultant at KPMG. At KPMG, he worked primarily on the evaluation and review of the operations of large departments within the Canadian Federal Government. In 2018, Andrew took a position as an applied research scientist at Element AI, a technology startup. The focus of his work was on helping customers identify applicable methods from machine learning research to their business problems. Andrew went on to lead a series of research projects focused on explaining and quantifying the reliability of machine learning predictions for manufacturing applications. Element AI was acquired in early 2021, and Andrew left to lead his own consulting firm that provides applied research services in machine learning, specializing in reliable computer vision models for manufacturing. Andrew's research interests are in the practical application of machine learning: quantifying and communicating the confidence of model predictions, identifying out-of-distribution data and data drift to bound where a model can be reliably used, understanding the basis for model predictions, and evaluating the real-world performance and suitability of machine learning models for their putative applications. In particular, Andrew is interested into how modern methods, often derived on public datasets of natural scenes like Imagenet, transfer to realistic manufacturing computer vision tasks. He is also broadly interested in image analysis, both through deep learning and classical methods, nondestructive inspection, and medical imaging.

#### **Education**

2014 – Masters in Business Administration, Queen's University, Kingston, ON, Canada

2007 – Ph.D. in Electrical Engineering (Specializing in computer simulation and modeling applied to Magnetic Resonance and Electromagnetic Fields) University of New Brunswick, Fredericton, NB, Canada

2003 – B.Sc. in Electrical Engineering University of New Brunswick, Fredericton, NB, Canada

Academic Awards:

2004: NSERC PGS-M Scholarship  
2005: NSERC CGS Doctoral Scholarship  
2007: NSERC Innovation Challenge Award  
2008: NSERC Doctoral Prize

## **Employment Experience**

Industry Work Experience:

2021-Present

Founder and partner, Willows AI, Machine Learning Consulting ([www.willows.ai](http://www.willows.ai)), Montreal, QC

Willows AI is a boutique consultancy specializing in applied computer vision research in manufacturing

- Business development and client relationship management with current and potential clients
- Project scoping and delivery management
- Research applicable techniques from recent literature, and their adaptation to manufacturing vision problems: uncertainty quantification, anomaly detection, pretraining methods
- Working with clients to define quantitative measurements of ML model performance that address business need
- Evaluating, assembling and maintaining IT infrastructure and tooling necessary for model training

2018-2021

Applied Research Scientist, Element AI, Montreal, QC

Element AI was a technology startup commercializing machine learning research. Andrew led “Research as a service” projects in the advisory group, including banking and manufacturing

- Managed the lifecycle (sales, scoping, delivery) of “Research as a Service” (RaaS) projects in advanced manufacturing (computer vision)
- RaaS projects delivered software plus research findings to apply recent developments in machine learning to client data and business problems
- Led a team of software developers, business strategists, research scientists and machine learning engineers
- Led work planning, daily stand-ups, client touchpoints and presentations
- Reviewed modern machine learning research for applicable methods to client problems; specialist areas include instance and feature based explainability, ensemble methods for uncertainty quantification, and self-supervised learning applied to manufacturing data
- Responsible for proposals, technical reports and client presentations
- Synthesized client situations into technical scopes of work, including evaluating research from recent literature. Translated findings into actionable insights and recommendations for clients
- Maintained relationships with clients, focusing on Fortune 500 businesses

2014-2018 – Management Consultant, KPMG

- Focusing on operations evaluation and transformation for public sector clients
- Wrote proposals in response to RFPs from government
- Scoped and planned consulting projects that included data collection, client interviews, workshops, desktop analysis and synthesis, recommendations and implementation planning

- Participated in all of the above stages across different projects
- Led data collection and analysis workstreams, including work planning and coordination of a team of consultants
- Presented findings to senior stakeholders (C-level equivalent)
- Participated in the growth of the Ottawa office, including responsible for hiring consultants / senior consultants

#### Academic Work Experience:

2008-2014

Assistant Professor (Biomedical and Electrical Engineering), Dept. of Systems and Computer Engineering, Carleton University. Awarded tenure, December 2011

Summer 2008

Instructor (Electrical Power Systems), Department of Information Technology, New Brunswick Community College, Moncton, NB

2007-2008

Assistant Professor (Electrical Engineering), Department of Engineering, St. Francis Xavier University, Antigonish, NS

2006

Sessional Lecturer, Department of Electrical and Computer Engineering, University of New Brunswick, Fredericton, NB

#### Teaching

Example Courses Taught (Carleton University, 2008-2013):

SYSC 5100 – Biomedical Instrumentation

SYSC 3501 – Communication Theory

SYSC 4205 – Biomedical Image Processing (Designed from scratch)

ECOR 1606 – Problem Solving and Computers

SYSC 3600 – Systems and Simulation

#### Publications

Since 2013, Andrew have worked outside of academia. At KPMG, he authored numerous confidential evaluation reports for clients. At Element AI and now Willows AI, he continues to author technical reports, notably related to uncertainty quantification, explainability, and performance evaluation of computer vision methods for manufacturing quality control. These reports are owned by clients and are confidential.

## Papers published in refereed journals

Tan, C. S., Marble, A. E., Ono, Y. (2012) Magnetic resonance elastometry using a single-sided permanent magnet, *Measurement Science and Technology* 23 (4), 045703

Marble, A. E. (2012), Optimization of echo amplitudes resulting from a series of 90° pulses in an inhomogeneous static field. *Journal of Magnetic Resonance*, *Journal of Magnetic Resonance* 216: 37-42

Zhang, Z., Marble, A. E., MacGregor, R., Martin, J., Wang, H., and Balcom, B. J., (2011) Zero Mode TEM Parallel Plate Resonator for High Resolution Thin Film Magnetic Resonance Imaging. *Canadian Journal of Chemistry*, 90: 745-753.

Li, L., Chen, Q., Marble, A. E., Romero-Zeron, L., Newling, B., and Balcom, B. J. (2009) Flow imaging of fluids in porous media by magnetization prepared centric scan SPRITE. *Journal of Magnetic Resonance*, 197: 1-8.

Marble, A. E., LaPlante, G., Mastikhin, I. V., and Balcom, B. J. (2009) Magnetic resonance detection of water in composite sandwich structures. *NDT & E International*, 42: 404-409.

Cano-Barrita, P. F. J, Marble, A. E., Balcom, B. J., Garcia, J. C., Mastikhin, I. V., Thomas, M. D., and Bremner, T. W. (2009) Embedded NMR sensors to monitor evaporable water loss caused by hydration and drying in ordinary Portland cement mortar. *Cement and Concrete Research*, 39: 324-328.

Marble, A. E. (2008) Strong, stray static magnetic fields. *IEEE Transactions on Magnetics*, 44: 576-580.

Veliyulin, E., Mastikhin, I. V., Marble, A. E. and Balcom, B. J. (2008) Rapid determination of the fat content in packaged dairy products by unilateral NMR, *Journal of the Science of Food and Agriculture*, 88:2563-2567.

Zhang, Z., Marble, A. E., MacMillan, B., Promislow, K., Martin, J., Wang, H., and Balcom, B. J., (2008) Spatial and temporal mapping of water content across Nafion membranes under wetting and drying conditions, *Journal of Magnetic Resonance*, 194:245-253

Marble, A. E., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J., (2007) A compact permanent magnet array with a remote homogeneous field. *Journal of Magnetic Resonance*, 186: 100-104.

Marble, A. E., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J., (2007) Designing static fields for unilateral magnetic resonance with the scalar potential approach. *IEEE Transactions on Magnetics*, 43: 1903-1911.

Meng, J. and Marble, A. E. (2007) Effective communication strategies for noise-limited power-line channels. *IEEE Transactions on Power Delivery*, 22: 887-892.

Marble, A. E., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J. (2006) A constant gradient unilateral magnet for near-surface MRI profiling, *Journal of Magnetic Resonance*. 183: 240-246.

LaPlante, G. Marble, A. E., MacMillan, B., Lee-Sullivan, P., Colpitts, B. G., and Balcom, B. J. (2005) Detection of water ingress in composite sandwich panel structures: a magnetic resonance approach. *NDT & E International*, 38: 501-507.

Chen, Q., Marble, A. E., Colpitts, B. G., and Balcom, B. J. (2005) The internal magnetic field distribution, and single exponential magnetic resonance free induction decay, in rocks. *Journal of Magnetic Resonance*, 175: 300-308.

Marble, A. E., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J. (2005) An analytical methodology for magnetic field control in unilateral NMR. *Journal of Magnetic Resonance*, 174: 78-87.

Marble, A. E., Mastikhin, I. V., MacGregor, R. P., Akl, M., LaPlante, G. Colpitts, B. G., Lee-Sullivan, P. and Balcom, B. J. (2004) Distortion-free single point imaging of multi-layered composite sandwich panel structures. *Journal of Magnetic Resonance*, 168: 164-174.

#### Patents

P3. (2010) Marble, A. E., Young, J. J., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J., Probe, System and Method Suitable for Unilateral Nuclear Magnetic Resonance, United States Patent 7,733,091.

P2. (2008) Balcom, B. J., Marble, A. E., Mastikhin, I. V., Colpitts, B. G., Sensor for unilateral nuclear magnetic resonance and method for making same. United States Patent 7,319,326.

P1. (2013) Marble, A. E., Mastikhin, I. V., Colpitts, B. G., and Balcom, B. J., Magnet Array, United States Patent 8,593,144

#### Theses Supervised

Sept 2011	G. Seyoum – Pulse sequences for multi-frequency selective NMR excitation in inhomogeneous magnetic fields
Sept 2011	H. Caytak – Signal optimization for unilateral NMR magnet design
May 2011	C. S. Tan – Magnetic resonance elastography using a single-sided constant gradient magnet. Co-supervised with Y. Ono.

#### Other information

Licensed Professional Engineer # 100149415, Ontario