



## PERSONAL

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### Robert Amelard, PhD

Research Scientist  
Schlegel-UW Research Institute for Aging  
250 Laurelwood Dr, Waterloo, Ontario, Canada, N2J 0E2  
<https://the-ria.ca/researcher/robert-amelard-phd/>

Adjunct Research Professor  
Western University, Department of Medical Biophysics  
Schulich School of Medicine and Dentistry  
1151 Richmond St, London, Ontario, Canada, N6A 3K7

## EDUCATION AND RESEARCH POSITIONS

**Scientific Advisor** Mar 2020–Present

JVP LABS

**Keywords:** congestive heart failure, remote monitoring, biophotonics, image processing, artificial intelligence

**Research Scientist** Sep 2019–Present

SCHLEGEL-UW RESEARCH INSTITUTE FOR AGING Waterloo, ON

**Keywords:** central venous pressure, biophotonics, cardiorespiratory health, wearables, intracranial pressure

**Adjunct Research Professor** Sep 2018–Present

WESTERN UNIVERSITY London, ON

**Keywords:** biophotonics, brain health, critical care, sepsis, clinical translation

**NSERC Postdoctoral Fellow** Sep 2017–Aug 2019

SCHLEGEL-UW RESEARCH INSTITUTE FOR AGING Waterloo, ON

**Keywords:** cardiovascular biosensors, computer vision, machine learning, physiological modeling, cerebral perfusion

**Visiting Researcher** Aug 2016, Feb 2017, Jul 2018

UNIVERSITY OF CALIFORNIA IRVINE Irvine, CA

**Keywords:** computational biophotonics, computer vision, image processing, breast cancer, clinical translation

**Visiting Researcher** Sep 2017

UNIVERSITY OF ALBERTA Edmonton, AB

**Keywords:** biophotonics, ischemic stroke prescreening, biomarkers, vascular collaterals, clinical translation

**Doctor of Philosophy (Ph.D.) Alumni Gold Medal** 2013–2017

UNIVERSITY OF WATERLOO (SYSTEMS DESIGN ENGINEERING) Waterloo, ON

**Thesis:** Widefield computational biophotonic imaging for spatiotemporal cardiovascular hemodynamic monitoring

**Keywords:** computational biophotonics, statistical modeling, biomedical image/signal processing, medical device design, machine learning

**Nominated for Millennium Technology Prize, Technology Academy Finland**

**Master of Applied Science (M.A.Sc.)** 2011–2013

UNIVERSITY OF WATERLOO (SYSTEMS DESIGN ENGINEERING) Waterloo, ON

**Thesis:** High-level intuitive features (HLIFs) for melanoma detection

**Keywords:** machine learning, statistical classification, feature extraction, biomedical image processing

## Bachelor of Software Engineering (B.S.E.) with distinction

2006–2011

UNIVERSITY OF WATERLOO (SOFTWARE ENGINEERING) Waterloo, ON

**Keywords:** multi-tiered software systems, client/server systems, distributed systems, human-computer interaction, augmented reality

## RESEARCH AND SCHOLARSHIP

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### PRIMARY RESEARCH INTERESTS

- Physiological monitoring | Computational biophotonics | Cardiovascular biosensors
- Computer vision | Image and signal processing | Machine learning
- Cerebrovascular and cardiovascular physiology | Neuromuscular biomechanics

### AWARDS/HONOURS

<b>Alumni Gold Medal</b>	University of Waterloo	<b>most outstanding doctoral academic achievement</b>	2017
<b>NSERC Postdoctoral Fellowship</b>	NSERC	<b>ranked 6/94</b>	2017-2019
<b>Best Imaging Paper Award</b>	Conference on Computer Vision and Imaging Systems		2017
<b>Newport Research Excellence Award</b>	SPIE/Newport		2017
<b>Carl Pollock Postgraduate Fellowship</b>	University of Waterloo		2017
<b>Computational Biophotonics Research Fellowship</b>	University of California Irvine		2016
<b>Innovator's Den Runner-Up</b>	RIA		2016
<b>3 Minute Thesis Department Heat Runner-Up</b>	University of Waterloo		2016
<b>Graduate Award in Technology and Aging</b>	AGE-WELL Network of Centres of Excellence		2015–2017
<b>Accelerate Graduate Research Award</b>	Mitacs		2014
<b>Alexander Graham Bell Canadian Graduate Scholarship–Doctoral</b>	NSERC		2013–2016
<b>President's Graduate Scholarship</b>	University of Waterloo		2013–2016
<b>Faculty of Engineering Graduate Scholarship</b>	University of Waterloo		2013
<b>Special Graduate Scholarship</b>	University of Waterloo		2013
<b>Best Presentation–Graduate Research Symposium</b>	University of Waterloo		2013
<b>Sandford Fleming Foundation Teaching Assistantship Excellence</b>	University of Waterloo		2012
<b>Alexander Graham Bell Canadian Graduate Scholarship–Master's</b>	NSERC		2011–2012
<b>President's Graduate Scholarship</b>	University of Waterloo		2011–2012
<b>Best Demonstration–Capstone Design Symposium</b>	QUALCOMM		2011

\*RIA–Schlegel-UW Research Institute for Aging | SPIE–International Society for Optics and Photonics | NSERC–Natural Sciences and Engineering Research Council of Canada

Where applicable, these honours have been highlighted with the associated entry below.

### PUBLICATIONS

*My research straddles the fields of biomedical engineering and health sciences. I have published my biomedical engineering research primarily in top-tier biomedical optics and biomedical engineering journals: Biomedical Optics Express ( $IF_5=3.5$ ,  $h_5=50$ ), J. Biomedical Optics ( $IF_5=2.7$ ,  $h_5=48$ ), and IEEE Transactions on Biomedical Engineering ( $IF_5=3.4$ ,  $h_5=64$ ). I have published my cardiovascular physiology discovery papers in top-tier physiology journals or multidisciplinary journals: Journal of Applied Physiology ( $IF_5=3.5$ ,  $h_5=54$ ), Scientific Reports ( $IF_5=4.8$ ,  $h_5=131$ ).*

Journal Manuscripts Submitted/In Progress (5)

- [1] **R. Amelard**, A. D. Robertson, C. Patterson, H. Heigold, E. Saarikoski, and R. L. Hughson, “Optical hemodynamic imaging of jugular venous dynamics during altered central venous pressure,” *IEEE Transactions on*

*Biomedical Engineering* (2020). Submitted (TBME-01365-2020)

- [2] E. T. Hedge, **R. Amelard**, and R. L. Hughson, “Evaluation of random forest regression model to predict oxygen uptake kinetics during moderate and heavy exercise from wearable sensor data,” *Journal of Applied Physiology* (2020). (manuscript in progress)
- [3] J. S. Au, B. Y. Yiu, H. Nahas, **R. Amelard**, R. L. Hughson, and A. C. Yu, “Distal arterial occlusion induces complex blood flow and recirculation at the femoral bifurcation,” *Journal of Applied Physiology* (2020). (manuscript in progress)
- [4] K. J. Pfisterer, **R. Amelard**, A. G. Chung, B. Syrnyk, A. MacLean, and A. Wong, “Fully-automatic semantic segmentation for food intake tracking in long-term care homes,” *IEEE Journal of Biomedical and Health Informatics* (2019). Submitted (JBHI-01237-2019)
- [5] K. J. Pfisterer, **R. Amelard**, H. H. Keller, L. Duizer, and A. Wong, “Long-term care food consumption patterns, “healthfulness” and the 2019 Canada’s food guide,” *Applied Physiology Nutrition and Metabolism* (2019). Submitted (APNM-2019-0830)

#### Journal Publications Published/Accepted (12)

- [J1] **R. Amelard**, K. R. Murray, E. T. Hedge, T. W. Cleworth, M. Noguchi, A. C. Laing, and R. L. Hughson, “Monocular 3D sway tracking for assessing postural instability in cerebral hypoperfusion during quiet standing,” *IEEE Transactions on Neural Systems and Rehabilitation Engineering* **28**(3), 720–729 (2020). arXiv:1907.05376
- [J2] **R. Amelard**, J. H. Lam, B. Hill, A. Durkin, K. Cutler, and B. J. Tromberg, “Monocular 3D probe tracking for generating sub-surface optical property maps from diffuse optical spectroscopic imaging,” *IEEE Transactions on Biomedical Engineering* **67**(7), 1872–1881 (2020) **Feature Article**
- [J3] K. J. Pfisterer, **R. Amelard**, A. G. Chung, and A. Wong, “A new take on measuring relative nutritional density: The feasibility of using a deep neural network to assess commercially-prepared puréed food concentrations,” *Journal of Food Engineering* **223**, 220–235 (2018). arXiv:1707.07312
- [J4] T. Beltrame, **R. Amelard**, A. Wong, and R. L. Hughson, “Extracting aerobic system dynamics during unsupervised activities of daily living using wearable sensor machine learning models,” *Journal of Applied Physiology* **124**(2), 473–481 (2018) **Altmetric: 108 (97<sup>th</sup> percentile)**
- [J5] T. Beltrame, **R. Amelard**, A. Wong, and R. Hughson, “Prediction of oxygen uptake dynamics by machine learning analysis of wearable sensors during activities of daily living,” *Scientific Reports* **7**, 45738 (2017)
- [J6] **R. Amelard**, R. L. Hughson, D. K. Greaves, K. J. Pfisterer, J. Leung, D. A. Clausi, and A. Wong, “Non-contact hemodynamic imaging reveals the jugular venous pulse waveform,” *Scientific Reports* **7**, 40150 (2017). arXiv:1604.05213
- [J7] **R. Amelard**, D. A. Clausi, and A. Wong, “Spatial probabilistic pulsatility model for enhancing photoplethysmographic imaging systems,” *Journal of Biomedical Optics* **21**(11), 116010 (2016). arXiv:1606.09118
- [J8] T. Beltrame, **R. Amelard**, R. Villar, M. J. Shafiee, A. Wong, and R. L. Hughson, “Estimating oxygen uptake and energy expenditure during treadmill walking by neural network analysis of easy-to-obtain inputs,” *Journal of Applied Physiology* **121**(5), 1226–1233 (2016)
- [J9] **R. Amelard**, D. A. Clausi, and A. Wong, “Spectral-spatial fusion model for robust blood pulse waveform extraction in photoplethysmographic imaging,” *Biomedical Optics Express* **7**(12), 4874–4885 (2016)
- [J10] **R. Amelard**, C. Scharfenberger, F. Kazemzadeh, K. J. Pfisterer, B. S. Lin, D. A. Clausi, and A. Wong, “Feasibility of long-distance heart rate monitoring using transmittance photoplethysmographic imaging (PPGI),” *Scientific Reports* **5**, 14637 (2015). arXiv:1503.06775 **Altmetric: 160 (99<sup>th</sup> percentile)**
- [J11] **R. Amelard**, J. Glaister, A. Wong, and D. A. Clausi, “High-level intuitive features (HLIFs) for intuitive skin lesion description,” *IEEE Transactions on Biomedical Engineering* **62**(3), 820–831 (2015)
- [J12] J. Glaister, **R. Amelard**, A. Wong, and D. A. Clausi, “MSIM: Multistage illumination modeling of dermatological photographs for illumination-corrected skin lesion analysis,” *IEEE Transactions on Biomedical Engineering* **60**(7), 1873–1883 (2013)

## Refereed Conference Publications (38)

- [C1] H. Heigold, A. D. Robertson, C. A. Patterson, R. L. Hughson, and **R. Amelard**, “Monte Carlo photon migration modeling for assessing external jugular venous dynamics,” *IEEE International Conference on Bioinformatics and Bioengineering*, (virtual) (2020)
- [C2] C. A. Patterson, R. L. Hughson, **R. Amelard**, E. Saarikoski, and A. D. Robertson, “Infrared visualization by coded hemodynamic imaging tracks changes in central venous pressure and jugular vein cross-sectional area during head-down tilt and lower body negative pressure,” *International Society for Gravitational Physiology*, Texas, USA (2020)
- [C3] E. T. Hedge, **R. Amelard**, and R. L. Hughson, “Evaluation of pulse arrival time model to estimate systolic blood pressure during exercise,” *American Physiological Society Annual Meeting*, San Diego (2020)
- [C4] E. T. Hedge, D. K. Greaves, K. N. Wood, T. Beltrame, **R. Amelard**, and R. L. Hughson, “Bio-monitor on ISS for non-intrusive smart monitoring of crewmember cardiorespiratory fitness and health,” *NASA Human Research Program Investigator’s Workshop*, Texas, USA (2020)
- [C5] C. A. Patterson, A. D. Robertson, **R. Amelard**, E. Saarikoski, and R. L. Hughson, “Use of coded hemodynamic imaging to track changes in jugular vein cross sectional area and central venous pressure during head down tilt,” *NASA Human Research Program Investigator’s Workshop*, Texas, USA (2020) **Best Poster Award**
- [C6] J. S. Au, **R. Amelard**, B. Y. Yiu, H. Nahas, R. L. Hughson, and A. C. H. Yu, “A femoral stealing effect: Presence of collateral retrograde blood flow redistribution in the femoral bifurcation during reactive hyperemia,” *ARTERY19 Scientific Meeting*, Hungary, Budapest (2019)
- [C7] K. J. Pfisterer, **R. Amelard**, B. Szyrnyk, and A. Wong, “Towards computer vision powered color-nutrient assessment of pureed food,” in *Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Women in Computer Vision Workshop*, Long Beach, USA (2019). arXiv:1905.00310
- [C8] **R. Amelard**, B. Hill, J. H. Lam, A. Durkin, and B. J. Tromberg, “Generating dense 2D tissue maps from non-gridded diffuse optical spectroscopic imaging measurements using image-based probe tracking,” in *Optical Tomography and Spectroscopy of Tissue XIII, Proc. SPIE*, San Francisco, USA (2019)
- [C9] **R. Amelard**, J. S. Au, K. Murray, D. Greaves, and R. L. Hughson, “Non-contact biophotonic assessment of changes in central venous pressure using photoplethysmographic imaging,” in *Optical Diagnostics and Sensing XIX: Toward Point-of-Care Diagnostics, Proc. SPIE*, San Francisco, USA (2019)
- [C10] C. A. Patterson, **R. Amelard**, A. D. Robertson, and R. L. Hughson, “Use of coded hemodynamic imaging to track dynamic changes in jugular venous pressure,” *NASA Human Research Program Investigator’s Workshop*, Texas, USA (2019)
- [C11] K. Pfisterer, **R. Amelard**, and A. Wong, “Intuitive data-driven visualization of food relatedness via t-distributed stochastic neighbor embedding,” in *Proc. Conference on Computational Vision and Imaging Systems*, **4**(1) (2018) **Best Poster Award**
- [C12] **R. Amelard**, K. J. Pfisterer, S. Jagani, D. A. Clausi, and A. Wong, “Non-contact assessment of obstructive sleep apnea cardiovascular biomarkers using photoplethysmography imaging,” in *Optical Diagnostics and Sensing XVIII: Toward Point-of-Care Diagnostics, Proc. SPIE*, San Francisco, USA (2018)
- [C13] K. J. Pfisterer, **R. Amelard**, and A. Wong, “Differential color space analysis for investigating nutrient content in a pureed food dilution-flavor matrix: a step toward objective malnutrition risk assessment,” in *Optical Diagnostics and Sensing XVIII: Toward Point-of-Care Diagnostics, Proc. SPIE*, San Francisco, USA (2018)
- [C14] M. Y. Tran, **R. Amelard**, and A. Wong, “Integrating multispectral hemodynamic imaging for bulk tissue oxygenation analysis,” in *Proc. Conference on Computational Vision and Imaging Systems*, **3**(1) (2017) **Best Imaging Paper Award**
- [C15] A. MacLean, K. Pfisterer, **R. Amelard**, A. G. Chung, D. Kumar, and A. Wong, “Goldilocks and the three parameters: empirically finding the “just right” for segmenting food images for the AFINI-T system,” *Proc. Conference on Computational Vision and Imaging Systems* **3**(1) (2017)

- [C16] **R. Amelard**, R. L. Hughson, D. A. Clausi, and A. Wong, “Non-contact arrhythmia assessment in natural settings: a step toward preventive cardiac care,” in *Diagnostic and Therapeutic Applications of Light in Cardiology, Proc. SPIE 10042*, 1004205, San Francisco, USA (2017)
- [C17] **R. Amelard**, R. L. Hughson, D. K. Greaves, D. A. Clausi, and A. Wong, “Assessing photoplethysmographic imaging performance beyond facial perfusion analysis,” in *Optical Diagnostics and Sensing XVII, Proc. SPIE, 100720Q*, San Francisco, USA (2017) **Student Paper Award**
- [C18] M. Wilson, **R. Amelard**, D. Clausi, and A. Wong, “Co-integrating thermal and hemodynamic imaging for physiological monitoring,” *Proc. Conference on Computational Vision and Imaging Systems 2*(1), Waterloo, Canada (2016)
- [C19] B. Chwyl, **R. Amelard**, D. Clausi, and A. Wong, “A Bayesian multi-scale framework for photoplethysmogram imaging waveform processing,” in *Proc. Conference on Computational Vision and Imaging Systems, 2*(1), Waterloo, Canada (2016)
- [C20] B. Chwyl, A. G. Chung, **R. Amelard**, J. Deglint, D. A. Clausi, and A. Wong, “SAPPHIRE: Stochastically acquired photoplethysmogram for heart rate inference in realistic environments,” in *Proc. IEEE International Conference on Image Processing*, 1230–1234 (2016)
- [C21] B. Chwyl, A. G. Chung, **R. Amelard**, J. Deglint, D. A. Clausi, and A. Wong, “Time-frequency domain analysis via pulselets for non-contact heart rate estimation from remotely acquired photoplethysmograms,” in *Proc. Conference on Computer and Robot Vision*, 201–207, Victoria, Canada (2016)
- [C22] **R. Amelard**, D. A. Clausi, and A. Wong, “Coded hemodynamic imaging for non-contact detection of abnormal blood pulse waveforms,” in *Proc. Imaging Network Ontario*, Toronto, Canada (2016)
- [C23] **R. Amelard**, D. A. Clausi, and A. Wong, “Spectral photoplethysmographic imaging sensor fusion for enhanced heart rate detection,” in *Proc. SPIE, 9701*, 970113, San Francisco, USA (2016)
- [C24] **R. Amelard**, K. J. Pfisterer, D. A. Clausi, and A. Wong, “Non-contact hematoma damage and healing assessment using reflectance photoplethysmographic imaging,” in *Multimodal Biomedical Imaging XI, Proc. SPIE 9701*, 970112, San Francisco, USA (2016)
- [C25] J. Deglint, A. G. Chung, B. Chwyl, **R. Amelard**, F. Kazemzadeh, X. Y. Wang, D. A. Clausi, and A. Wong, “Photoplethysmographic imaging via spectrally demultiplexed erythema fluctuation analysis for remote heart rate monitoring,” in *Multimodal Biomedical Imaging XI, Proc. SPIE 9701*, 970111, San Francisco, USA (2016)
- [C26] **R. Amelard**, J. Leung, D. A. Clausi, and A. Wong, “A portable plug-and-play imaging system for physiological monitoring,” in *Proc. Conference on Computational Vision and Imaging Systems, 1*, Waterloo, Canada (2015)
- [C27] F. Kazemzadeh, C. Jin, M. Yu, **R. Amelard**, S. Haider, S. Saini, M. Emelko, D. A. Clausi, and A. Wong, “Multispectral digital holographic microscopy with applications in water quality assessment,” in *Novel Optical Systems Design and Optimization XVIII, Proc. SPIE 9579*, 957906, San Diego, USA (2015)
- [C28] D. S. Cho, S. Haider, **R. Amelard**, A. Wong, and D. A. Clausi, “Quantitative features for computer-aided melanoma classification using spatial heterogeneity of eumelanin and pheomelanin concentrations,” in *Proc. IEEE International Symposium on Biomedical Imaging*, 59–62, New York, USA (2015)
- [C29] **R. Amelard**, C. Scharfenberger, A. Wong, and D. A. Clausi, “Illumination-compensated non-contact imaging photoplethysmography via dual-mode temporally-coded illumination,” in *Multimodal Biomedical Imaging X, Proc. SPIE 9316*, 931607, San Francisco, USA (2015)
- [C30] **R. Amelard**, C. Scharfenberger, A. Wong, and D. A. Clausi, “Non-contact assessment of melanin distribution via multispectral temporal illumination coding,” in *Multimodal Biomedical Imaging X, Proc. SPIE 9316*, 93160N, San Francisco, USA (2015)
- [C31] A. Chung, X. Y. Wang, **R. Amelard**, C. Scharfenberger, J. Leong, J. Kulinski, A. Wong, and D. A. Clausi, “High-resolution motion-compensated photoplethysmographic imaging for remote heart rate monitoring,” in *Multimodal Biomedical Imaging X, Proc. SPIE 9316*, 93160A, San Francisco, USA (2015)

- [C32] D. S. Cho, S. Haider, **R. Amelard**, A. Wong, and D. Clausi, “Physiological characterization of skin lesion using non-linear random forest regression model,” in *Proc. Conference of the IEEE Engineering in Medicine and Biology Society*, 3349–3352, Chicago, USA (2014)
- [C33] S. Haider, D. Cho, **R. Amelard**, A. Wong, and D. A. Clausi, “Enhanced classification of malignant melanoma lesions via the integration of physiological features from dermatological photographs,” in *Proc. Conference of the IEEE Engineering in Medicine and Biology Society*, 6455–6458, Chicago, USA (2014)
- [C34] A. Wong, K. A. Scott, E. Li, and **R. Amelard**, “Continuous sea ice thickness estimation using a joint modis and amsr-e guided variational model,” in *Proc. IEEE International Geoscience and Remote Sensing Symposium*, 4106–4109, Melbourne, Australia (2013)
- [C35] **R. Amelard**, A. Wong, F. Li, and D. A. Clausi, “Unsupervised classification of sea-ice and water using synthetic aperture radar via an adaptive texture sparsification transform,” in *Proc. IEEE International Geoscience and Remote Sensing Symposium*, 3958–3961, Melbourne, Australia (2013)
- [C36] **R. Amelard**, A. Wong, and D. A. Clausi, “Unsupervised classification of agricultural land cover using polarimetric synthetic aperture radar via a sparse texture dictionary model,” in *Proc. IEEE International Geoscience and Remote Sensing Symposium*, 4383–4386, Melbourne, Australia (2013)
- [C37] **R. Amelard**, A. Wong, and D. A. Clausi, “Extracting morphological high-level intuitive features (HLIF) for enhancing skin lesion classification,” in *Proc. Conference of IEEE Engineering in Medicine and Biology Society*, 4458–4461, San Diego, USA (2012)
- [C38] **R. Amelard**, A. Wong, and D. A. Clausi, “Extracting high-level intuitive features (HLIF) for classifying skin lesions using standard camera images,” in *Proc. Conference on Computer and Robot Vision*, 396–403, Toronto, Canada (2012)

#### Patents (2)

- [P1] **R. A. Amelard** and A. S. L. Wong, “System and method for spatial cardiovascular monitoring,” *U.S. Patent 62/270409 Patent Pending* (Dec 21 2016)  
*Also filed as:* Canada Patent 2,952,485
- [P2] G. Valsan, S. Z. Mahmoodabadi, R. B. Wagner, D. Priest, and **R. Amelard**, “Multispectral medical imaging devices and methods thereof,” *US Patent 14/341103 Issued* (Jul 25 2014)  
*Also issued as:* Europe Patent EP2977003, Japan Patent JP2016030214, China Patent CN105286785, Hong Kong Patent HK1215142

#### Books (1)

- [B1] A. Wong, J. R. Wallace, E. A. Lee, X. Wang, V. Cheung, A. Kumar, **R. Amelard**, and I. Ivkovic, *Data Structures and Algorithms in a Nutshell*, University of Waterloo (2015)

#### Book Chapters (2)

- [BC1] **R. Amelard** and A. Wong, “Hemodynamic imaging,” in *Encyclopedia of Biomedical Engineering*, R. Narayan, Ed., 545–550, Elsevier, 1st ed. (2018)
- [BC2] **R. Amelard**, J. Glaister, A. Wong, and D. A. Clausi, “Melanoma decision support using lighting-corrected intuitive feature models,” in *Computer Vision Techniques for the Diagnosis of Skin Cancer*, J. Scharcanski and M. E. Celebi, Eds., *Series in BioEngineering*, 192–219, Springer, Heidelberg (2013)

#### Theses (2)

- [T1] **R. Amelard**, “Widefield Computational Biophotonic Imaging for Spatiotemporal Cardiovascular Hemodynamic Monitoring,” *PhD Thesis, University of Waterloo* (2017). <http://hdl.handle.net/10012/12066>
- [T2] **R. Amelard**, “High-Level Intuitive Features (HLIFs) for Melanoma Detection,” *Master’s Thesis, University of Waterloo* (2013). <http://hdl.handle.net/10012/7761>



## Industry R&amp;D Publications (3)

- [I1] **R. Amelard**, “Feasibility assessment of non-invasive heart rate monitoring system for clinical use.” for Hill-Rom Inc. (2016)
- [I2] **R. Amelard**, “A real-time multispectral melanin compensation algorithm for tissue oxygen imaging.” for Christie Medical Holdings (2013)
- [I3] **R. Amelard**, C. Scharfenberger, A. Wong, and D. A. Clausi, “An image processing system for determining parcel dimensions.” for Rogue Specialty Transportation (2013)

## PRESENTATIONS

*I have delivered 35 presentations in 3 countries (Canada, USA, Australia), including 4 invited seminar talks, and have received 3 honours.*

## Invited Seminar Talks

- [P1] “Detecting atrial fibrillation in blood pulse signals using generated datasets.” Machine Learning Research Group Seminar (University of Guelph, Guelph, Aug 2018)
- [P2] “Co-integrating biophotonics, wearable sensors, signal processing and artificial intelligence for assessing age-related biomarkers.” Laser Microbeam and Medical Program Seminar (University of California Irvine, Irvine, Jul 2018)
- [P3] “Assessing widefield hemodynamic pulsatility using computational biophotonic imaging: a co-integration of biomedical optics, electronic control, image processing and machine learning.” Alberta Machine Intelligence Institute Seminar (University of Alberta, Edmonton, Sep 2017)
- [P4] “Non-contact hemodynamic monitoring.” Laser Microbeam and Medical Program Seminar (University of California Irvine, Irvine, Aug 2016)

## Academic Presentations

- [P5] “Developments in cardiovascular & cerebrovascular health monitoring.” RIA Research Seminar (Schlegel-UW Research Institute for Aging, Waterloo, Mar 2020)
- [P6] “Non-contact biophotonic assessment of changes in central venous pressure using photoplethysmographic imaging.” Optical Diagnostics and Sensing XIX (SPIE Photonics West, San Francisco, Jan 2019)
- [P7] “Coded Hemodynamic Imaging: an infrared eye into the body.” Cerebral Hypoperfusion Summit (Schlegel-UW Research Institute for Aging, Waterloo, Apr 2018)
- [P8] “Engineering meets cardiovascular physiology: Non-contact blood pulse imaging for new ways of monitoring cardiovascular health.” Research Seminar (Schlegel-UW Research Institute for Aging, Waterloo, Feb 2018)
- [P9] “Non-contact assessment of obstructive sleep apnea cardiovascular biomarkers using photoplethysmography imaging.” Optical Diagnostics and Sensing XVIII (SPIE Photonics West, San Francisco, Jan 2018)
- [P10] “Non-contact arrhythmia assessment in natural settings: a step toward preventive cardiac care.” Diagnostic and Therapeutic Applications of Light in Cardiology (SPIE Photonics West, San Francisco, Jan 2017)
- [P11] “Assessing photoplethysmographic imaging performance beyond facial perfusion analysis.” Optical Diagnostics and Sensing XVII (SPIE Photonics West, San Francisco, Jan 2017)
- [P12] “Photoplethysmographic imaging for non-contact blood pulse detection.” Systems Design Engineering Seminar (University of Waterloo, Waterloo, Sep 2015)
- [P13] “Intelligent clinical decision support system for melanoma cancer management.” Agfa Healthcare (Waterloo, Jul 2015)

- [P14] “Illumination-compensated non-contact imaging photoplethysmography via dual-mode temporally-coded illumination.” Multimodal Biomedical Imaging X (SPIE Photonics West, San Francisco, Feb 2015)
- [P15] “Skin lesion classification system: image processing summary.” Agfa Healthcare (Waterloo, Apr 2014)
- [P16] “Unsupervised classification of agricultural land cover using SAR via a sparse texture dictionary model.” IEEE International Geoscience and Remote Sensing Symposium (Melbourne, Australia, Jul 2013)
- [P17] “Unsupervised classification of sea-ice using SAR via an adaptive texture sparsifying transform.” IEEE International Geoscience and Remote Sensing Symposium (Melbourne, Australia, Jul 2013)
- [P18] “Continuous sea ice thickness estimation using a joint MODIS/AMSR-E guided variational model.” IEEE International Geoscience and Remote Sensing Symposium (Melbourne, Australia, Jul 2013)
- [P19] “Importance of intuitive features in clinical decision support systems.” University of Waterloo Research Symposium (Waterloo, Mar 2013) **Best Oral Presentation**
- [P20] “Progress on a clinical decision support system for detecting melanoma.” Agfa Healthcare (Waterloo, Sep 2012)
- [P21] “Perceptual structure distortion ratio: an image quality metric based on robust measures of complex phase order.” Conference on Computer and Robot Vision (Toronto, May 2012)
- [P22] “Extracting high-level intuitive features (hlf) for classifying skin lesions using standard camera images.” Conference on Computer and Robot Vision (Toronto, May 2012)
- [P23] “Extracting high-level intuitive features to enhance skin cancer detection.” Graduate Student Research Conference (Waterloo, Apr 2012)
- [P24] “A computational framework for recognizing handwritten matrices.” Symbolic Computation Research Seminar (Waterloo, Apr 2010)
- [P25] “A system for tracking and managing a managed assets program.” TD Asset Management (Toronto, Aug 2009)

#### Non-Academic Presentations

- [P26] “New technologies for health monitoring.” Lunch With Residents Research Seminar (Schlegel-UW Research Institute for Aging, Waterloo, Oct 2018)
- [P27] “How can a computer see your blood?.” Curiosity Fair (Schlegel-UW Research Institute for Aging, Waterloo, May 2018)
- [P28] “Blood flow imaging and demystifying academic research.” Biomedical Engineering Undergraduate Seminar (Waterloo, May 2017)
- [P29] “Improving quality of care through touchless vitals monitoring.” Innovator’s Den (Schlegel Villages Innovation Summit, Toronto, Jun 2016) **Runner-Up**
- [P30] “Revolutionizing baby monitoring with cutting-edge imaging research.” Velocity Fund Finals (Waterloo, Mar 2016)
- [P31] “Touchless vitals monitoring: pushing toward preventive healthcare.” 3 Minute Thesis Competition (Waterloo, Mar 2016) **Runner-Up, Department Heat**
- [P32] “Inventing an imaging system and how to get people excited about your research.” Vision and Image Processing Research Seminar (Waterloo, Feb 2016)
- [P33] “Graduate School—What I wish I knew in 3rd year.” Software Engineering Undergraduate Symposium (Waterloo, Oct 2015)
- [P34] “The cardiovascular system: a primer for biomedical engineering applications.” Vision and Image Processing Research Seminar (Waterloo, Jan 2014)
- [P35] “Making an academic poster.” Rockway Mennonite Collegiate (Kitchener, Jan 2013)



## RESEARCH FUNDING

<b>Enhanced detection of the jugular venous pressure: A home monitoring solution for congestive heart failure</b> Co-Applicant   National Research Council of Canada Industrial Research Assistance Program (NRC IRAP) \$50,000 CAD	2020
<b>Internal jugular vein hemodynamics during rest and exercise at different gravitational stresses</b> Co-investigator   Canada Space Agency \$200,000 CAD (approved by ESA pending funding by CSA)	2019
<b>Bed rest in older adults accelerates aging-like changes</b> Co-Applicant   Canadian Institutes of Health Research \$200,000 CAD	2019
<b>Coded hemodynamic imaging to advance astronaut health</b> Co-Applicant   Canada Space Agency Flights and Fieldwork for the Advancement of Science and Technology \$400,000 CAD	2018–2020
<b>MAchine Learning and Computer Vision to Enhance the Detection of STROke (MAE-STRO): Pilot and Feasibility Study</b> Co-Applicant   Quality Improvement & Clinical Research Alberta Stroke Program \$24,900 CAD	2017–2019
<b>Smart heart rate and breath rate monitoring framework using cameras</b> Co-Applicant   Hill-Rom Inc. \$30,000 USD	2017
<b>Advanced aging ResearCH (ARCH) to transform health and well-being of older adults</b> Collaborator   Canadian Foundation for Innovation \$1,387,023 CAD	2015
<b>A mixing model for inferring oxygen status from multispectral imaging</b> Collaborator   Mitacs \$15,000 CAD	2013

PUBLIC MEDIA ATTENTION

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*My research received international public media attention following my 2015 Scientific Reports paper, including being featured on Discovery Channel's **Daily Planet**, **OmniTV**, and various newspaper, radio, and online media outlets. Consequently, my article received 160 Altmetric social impact score, top 5% of all ranked journal publications.*

<b>Could wearable technology save your life?</b>	The Globe and Mail	Aug 2019
<b>Researcher Profile: Robert Amelard</b>	Biotechnology and Bioengineering Conference	Aug 2019
<b>Canadian scientists investigate effects of space travel on human body [VIDEO]</b>	The National	Jul 2019
<b>The Americas' most innovative universities for AI and robotics</b>	Current	Jan 2019
<b>Curiosity of the Ages on Display at RIA</b>	RIA Research Highlights	Jun 2018
<b>Smart clothing aims to predict failing health</b>	Waterloo Stories	May 2018
<b>Curiosity Fair unites inquisitive minds of all ages</b>	The Record	May 2018
<b>UW unveils new artificial intelligence lab [VIDEO]</b>	CTV News	Apr 2018
<b>Waterloo Launches AI Institute [VIDEO]</b>	University of Waterloo	Apr 2018
<b>Waterloo Artificial Intelligence Institute—A Message from the Co-Directors [VIDEO]</b>	UWaterloo	Apr 2018

<a href="#">Impact of emerging technologies on healthcare</a>	Cyber Psychology	Aug 2016
<b>Cultivating and spreading innovation</b>	Research Matters	Jul 2016
<b>It takes a village: Lab Profile</b>	LAB Business Magazine	Feb 2016
<b>Preventing medical emergencies through vascular imaging</b>	University of Waterloo's Student Success Office Blog	Feb 2016
<b>Getting under your skin: A video camera that tracks blood flow</b>	Waterloo Stories	Jan 2016
<a href="#">New touchless device makes earlier detection of heart problems possible</a>	Waterloo	Jan 2016
News		
<i>Featured on:</i> Discovery Channel's <a href="#">The Daily Planet</a> and <a href="#">OmniTV News</a> .		
<i>Selected appearances:</i> Yahoo! News, The Engineer, Science Daily, Phys.org, Gizmag, Sina, Exchange Magazine, Design Engineering, United Press International, International Business Times, Big News Network, NDTV, Seattle Bulletin, 570 news, Imprint Newspaper		
<i>Translated to:</i> French, German, Russian, Chinese, Spanish, Arabic, Indonesian		
<b>Building collaborative internships with a win-win mentality</b>	AGE-WELL Blog	Nov 2015

# TEACHING

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## COURSE INSTRUCTOR

*Teaching evaluation summary:*



<b>MTE 140 Data Structures and Algorithms</b> University of Waterloo (117 students)	Jan–Apr 2019
<b>MTE 140 Data Structures and Algorithms</b> University of Waterloo (117 students)	Jan–Apr 2018

## TEACHING ASSISTANTSHIPS

*TA evaluation (mean,std)=(9.75,0.38) (out of 10, n=4 submitted)*

<b>BME 122 Data Structures and Algorithms</b> 54 students (no evaluation submitted)	Jan–Apr 2017
<b>BME 122 Data Structures and Algorithms</b> 54 students (no evaluation submitted)	Jan–Apr 2016
<b>BME 122 Data Structures and Algorithms</b> 41 students, 10/10 evaluation	Jan–Apr 2015
<b>SYDE 575 Image Processing</b> 50 students, 9.2 evaluation	Sep–Dec 2014
<b>MTE 140 Data Structures and Algorithms</b> 142 students, 9.8/10 evaluation	May–Aug 2014
<b>MTE 140 Data Structures and Algorithms</b> 121 students (no evaluation submitted)	May–Aug 2012
<b>SYDE 121 Digital Computation</b> 97 students, 10/10 evaluation	Sep–Dec 2011

**Sandford Fleming Foundation Teaching Assistantship Excellence Award**

## COURSE DEVELOPMENT

**Data Structures and Algorithms in a Nutshell: MTE140/BME122 Course Textbook**, A Wong, JR Wallace, EA Lee, X Wang, V Cheung, A Kumar, **R Amelard**, I Ivkovic, University of Waterloo, 2016.

## GUEST LECTURES

<b>Trees and Heaps</b> MTE 140 Data Structures and Algorithms	Mar 2015
<b>C++ Memory and Classes</b> BME 122 Data Structures and Algorithms	Feb 2015
<b>Colour Image Processing</b> SYDE 575 Image Processing	Nov 2014
<b>Scaling Software Systems using Data Structures and Algorithms</b> MTE 140 Data Structures and Algorithms	Jul 2014
<b>Pattern Recognition in Biomedical Applications</b> SYDE 372 Pattern Recognition	Apr 2014
<b>Insertions/Deletions in Linked and Array Lists</b> MTE 140 Data Structures and Algorithms	Mar 2013

## TEACHING CERTIFICATIONS

**Certificate in Fundamentals of University Teaching** Centre of Teaching Excellence May 2014  
*Course for developing teaching strategies, knowledge and skills. Consisted of 6 workshops, 3 microteaching session evaluations, and 2 full guest lectures evaluation.*

## SUPERVISORY ACTIVITIES

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**Haarini Suntharalingam** Markham District High School Sep 2019–Jun 2020  
 “Autofluorescence imaging of lipofuscin as a biomarker for melanoma and neurodegenerative disease”  
**Youth Science Canada Regional, National, and Disease & Illness Challenge Ribbons**  
 Make: Projects Virtual Science Fair Presentation

**Shaelynn Hsu** Kinesiology Sep 2019–Apr 2020  
 “Transfer function analysis of sway and arterial blood pressure.”

**Hannah Heigold** Biomedical Engineering (NSERC USRA) May–Dec 2019, May–Aug 2020  
 “Biophotonic imaging for assessing intracranial pressure effects on brain blood flow.”

**Hetal Dawda** Mechatronics Engineering May–Dec 2019  
 “3D stereoscopic imaging for jugular venous pulse assessment.”

**Braeden Syrnyk** Mechatronics Engineering (NSERC USRA) May 2018–Apr 2019  
 “(1) Recurrent neural networks and dataset generation for arrhythmia detection.”  
 “(2) Deep semantic segmentation for food segmentation and nutrient estimation.”

**Monica Hanna** Biomedical Sciences Sep–Dec 2018  
 “Design and development of tunable optical tissue phantom models for biophotonic calibration”

**Lucille Huang** Mechatronics Engineering Sep–Dec 2018  
 “Integrating physiological data repositories for cardiovascular artificial intelligence modeling”

**Alex Tobias** Mechatronics Engineering Jan–Apr 2018  
 “Arrhythmia dataset generation and cleaning”

**Francois Barnard** Mechatronics Engineering Jan–Apr 2018  
 “Biomedical imaging calibration and tracking for cerebrovascular monitoring”

**Milind Paliath** Systems Design Engineering Jan–Apr 2018  
 “Medical device data extraction and integration with clinical patient monitors”

**Yanyan Tran** Biomedical Engineering May–Dec 2017  
 “Multispectral biophotonic imaging system design and development”

**Alexander Maclean** Biomedical Engineering May–Aug 2017  
 “RGB-D imaging analysis for widefield nutrient quantification at the plate level”

**Mujtaba Tirmizi** Mechatronics Engineering Jan–Apr 2017  
 “Multimodal physiological monitoring system development”

**Jordan Guerten** Biomedical Engineering Jan–Apr 2017  
 “Multispectral optical system development”

<b>Shubh Jagani</b> Systems Design Engineering “Non-intrusive sleep apnea detection using wavelet-based machine learning”	Sep 2016–Apr 2017
<b>Mikaela MacMahon</b> Biomedical Engineering “Embedded thermal imaging calibration and integration”	Sep–Dec 2016
<b>Mackenzie Wilson</b> Biomedical Engineering “Opto-electronic biomedical imaging system development”	Apr–Dec 2016
<b>Jason Leung</b> Biomedical Engineering “Development and manufacturing (3D print, machining) hardware for portable biomedical imaging”	May–Aug 2015, Sep–Dec 2017
<b>Bill S. Lin</b> Mechatronics Engineering (NSERC USRA) “Biomedical hemodynamic image analysis”	Sep 2014–Apr 2017
<b>Audrey Chung</b> Systems Design Engineering “Extracting heart rate from ambient smartphone cameras”	Jan–Apr 2014
<b>Eura Cho, Sara Greenberg, Sharon Leung, Michelle Pugne, Emily Sim</b> Systems Design Eng. “Real-time parking lot computer vision analytics platform”	Jan–Apr 2013

## PROFESSIONAL ACTIVITIES

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### PROFESSIONAL AFFILIATIONS

<b>Member, SPIE</b>	Jan 2015–Present
<b>Member, IEEE</b>	Mar 2012–Present
<b>Member, IEEE Engineering Medicine and Biology Society</b>	Jan 2012–Present

### EDITORIAL ACTIVITIES

<b>Guest Editor</b> Sensors (Special Issue on Biomedical Imaging and Sensing)	2019
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### CONFERENCE COMMITTEE ACTIVITIES

<b>Program Committee Member</b> 3rd International Workshop on Computer Vision for Physiological Measurement (part of IEEE Conference on Computer Vision and Pattern Recognition)	2020
<b>Program Committee Member</b> 2nd International Workshop on Computer Vision for Physiological Measurement (part of IEEE International Conference on Computer Vision)	2019
<b>Conference Organization Committee</b> Cerebral Hypoperfusion Summit	2018
<b>Program Committee Member</b> 1st International Workshop on Computer Vision for Physiological Measurement (part of IEEE Conference on Computer Vision and Pattern Recognition)	2018
<b>Conference Organization Committee</b> 3rd Annual Conference on Vision and Imaging Systems	2017
<b>Conference Coordinator</b> 2nd Annual Conference on Vision and Imaging Systems	2016
<b>Conference Coordinator</b> 1st Annual Conference on Vision and Imaging Systems	2015
<b>Conference Organization Committee</b> International Society for Gravitational Physiology Aging in Space Symposium	2014

### SERVICE ACTIVITIES

<b>Regional Science Fair Judge</b> Waterloo-Wellington Science and Engineering Fair	2018, 2019, 2020
<b>Event Volunteer</b> <a href="#">Soapbox Science – Promoting Women in STEM Research</a>	Jun 2019
<b>Volunteer</b> Ontario Blind Sports Association	2017, 2018

<b>Science Fair Judge</b>	Centennial Public School	Mar 2018
<b>Engineering Design Project Judge</b>	UWaterloo Software Engineering Capstone Design Symposium	Mar 2017
<b>Computer Vision Elementary School Outreach Coordinator</b>	KW Bilingual School	Dec 2015
<b>Engineering Design Project Judge</b>	UWaterloo Engineering Design Project Symposium	Nov 2014
<b>Sectional Lead</b>	Engineering Jazz Band	Jan–Apr 2010

## PROFESSIONAL DEVELOPMENT

<b>Innovators of Tomorrow Certificate</b>	AGE-WELL Network of Centres of Excellence	Nov 2016
<b>Teaching and Learning Conference</b>	University of Waterloo	May 2014
<b>Mitacs Team Building Excellence Workshop</b>	Mitacs	Aug 2013

## EMPLOYMENT HISTORY

**Medical Device Research Intern** Jan–Apr 2014  
CHRISTIE MEDICAL HOLDINGS Kitchener, ON  
*Developed novel biophotonic models for a real-time multispectral biophotonic tissue assessment for use in a commercial medical device. Patent published.*

**Software Engineer Intern** May–Aug 2011  
GOOGLE INC Kitchener, ON  
*Developed massively distributed ads software server serving millions of hits per hour globally. Improved load efficiency by over 10%.*

**NSERC Undergraduate Research Assistant–Symbolic Computation** Sep–Dec, Jan–Apr 2010  
SCHOOL OF COMPUTER SCIENCE, UNIVERSITY OF WATERLOO Waterloo, ON  
*Developed computational method for interpreting and parsing hand-written mathematics for engineering applications.*

**Quantitative Finance Developer** May–Aug 2009  
TD ASSET MANAGEMENT Toronto, ON  
*Developed data mining techniques to deliver rich financial model analysis for fund managers.*

**Medical Imaging Software Developer** Sep–Dec 2008  
AGFA HEALTHCARE Waterloo, ON  
*Developed software framework for handling mammography medical images in radiology hospital imaging systems (PACS).*

**R&D Software Developer** Jan–Apr 2008, May–Aug 2007  
UNCHARTERED SOFTWARE Toronto, ON  
*Integrated real-time online geographical map retrieval and rendering from open-source map servers.*

## REFeree ACTIVITIES

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### JOURNAL REFEREEING

IEEE Transactions on Biomedical Engineering  
IEEE Transactions on Medical Imaging  
IEEE Transactions on Emerging Topics in Computational Intelligence  
IEEE Journal of Biomedical and Health Informatics  
IEEE Transactions on Systems, Man and Cybernetics  
IEEE Access  
Journal of Biomedical Optics  
OSA Biomedical Optics Express



OSA Optics Express  
OSA Continuum  
OSA Applied Optics  
OSA Photonics Research  
Artificial Intelligence in Medicine  
npj Digital Medicine  
Computer Methods and Programs in Biomedicine  
Medical & Biological Engineering & Computing  
Biomedical Signal Processing and Control  
Current Medical Imaging Reviews  
Applied Sciences (**Member of Review Board**)  
Sensors  
Electronics  
Journal of Ambient Intelligence and Smart Environments  
International Journal of Environmental Research and Public Health  
American Journal of Physiology – Heart and Circulatory Physiology  
Journal of Sports Engineering and Technology  
Scientific Reports (Nature Publishing Group)

## CONFERENCE REFEREEING

International Conference on Computer Vision	2019
International Conference on Artificial Intelligence, Information Processing and Cloud Computing	2019
Conference on Computer Vision and Pattern Recognition (CVPR)	2018
Conference on Biological Information and Biomedical Engineering (BIBE)	2018
IEEE International Symposium on Biomedical Engineering (ISBI)	2015–2017

## GRANT REVIEW

Centre for Bioengineering and Biotechnology Seed Funding	2018
Ontario Research Fund, Ministry of Research Innovation and Science	2017

## ADDITIONAL INTERESTS

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Hockey goaltending  
Road cycling [[Strava profile](#)]  
Alto saxophone, electric guitar  
Reading (leadership psychology and professional growth)