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Zachary M. C. Baum, MSc, BComp

Medical Imaging PhD Candidate

Computer-Assisted Navigation, Diagnosis and Intervention Group
Wellcome / EPSRC Centre for Interventional and Surgical Sciences | Centre for Medical Image Computing
Department of Medical Physics & Biomedical Engineering
University College London (UCL)

EDUCATION

University College London — London, United Kingdom
Doctor of Philosophy | Medical Imaging — **Sep. 2019 -**

Thesis Topic: "Machine learning for ultrasound-guided interventions"
Supervisors: Dean Barratt, Yipeng Hu

Queen's University — Kingston, Ontario, Canada
Master of Science | Computing — **Sep. 2017 – May 2019**

Thesis Title: "Augmented reality training platform for placement of neurosurgical burr holes"
Supervisor: Gabor Fichtinger
Notable Coursework: Bioinformatics, Pattern Recognition, Continuous Coordinate Transformations
Queen's School of Computing Distinguished Master's Thesis Award
Cumulative GPA: 4.30 / 4.30 (1st in class)

Queen's University — Kingston, Ontario, Canada
Bachelor of Computing (Honours) | Biomedical Computing — **Sep. 2013 – May 2017**

Honours Thesis Title: "Mobile augmented reality display system for surgical navigation"
Supervisor: Gabor Fichtinger
Notable Coursework: Computer-Assisted Surgery, Neural & Genetic Computing, Medical Informatics
Dean's Honour List with Distinction Standing: 2016 – 2017
Dean's Honour List Standing: 2013 – 2016
Cumulative GPA: 3.99 / 4.30 (4th in class)

HONOURS & AWARDS

IEEE Transactions on Medical Imaging
Bronze Distinguished Reviewer — **Aug. 2022**

For completion of over 7 high-quality reviews in the prior two calendar years.

Advances in Simplifying Medical Ultrasound (ASMUS) Workshop, MICCAI
Best Demonstration Award — **Sep. 2021**

For the Live Demonstration: *"ADAPTS (Artificial intelligence Diagnostic And Prognostic Tools for Sonography) for real-time ultrasound assessment and COVID-19 diagnosis".*

Advances in Simplifying Medical Ultrasound (ASMUS) Workshop, MICCAI
Reviewer Commendation — **Sep. 2021**

In recognition of outstanding quality of constructive reviewing for papers submitted to the ASMUS 2021 Workshop.

SPIE Medical Imaging
Certificate of Merit (Runner-Up) — **Feb. 2021**

For the Computer-Aided Diagnosis Live Demonstration: *"Easy deep medical image registration visualization: DeepReg meets 3D Slicer".*

Wellcome / EPSRC Centre for Interventional and Surgical Sciences, UCL
Directors' Special Commendation — **Dec. 2020**

Presented at the discretion of the Centre's Director to those within WEISS who have demonstrated exceptional efforts in research and contributions to the WEISS and wider communities.

Advances in Simplifying Medical Ultrasound (ASMUS) Workshop, MICCAI
Best Paper Award **Oct. 2020**

For the paper: *"Multimodality biomedical image registration using free point transformer networks"*.

School of Computing, Queen's University
Distinguished Master's Thesis Award **Apr. 2020**

This award recognizes excellence in master's-level thesis research, and is granted to the graduate student in the School of Computing who, having completed their thesis in the preceding academic year, made the most distinguished contributions to their respective field throughout their research.

School of Computing, Queen's University
Ian A. Macleod Award **Apr. 2019**

This award is granted to the graduate student who made the greatest contribution to the intellectual and social spirit of the School of Computing during the preceding academic year.

Queen's University
Agnes Benidickson Tricolour Award **Feb. 2019**

Admissions to the Tricolour Society through the Agnes Benidickson Tricolour Award is the highest honour given to a Queen's student for non-academic, non-athletic activities. The award is named after Dr. Agnes Benidickson who was Chancellor of Queen's University from 1980 until 1996. With all recipients chosen by their fellow students, this award is bestowed in recognition of the valuable and distinguished service of outstanding individuals to the University.

Hamlyn Centre for Surgical Robotics, Imperial College London
Hamlyn Winter School Best Project Award (Runner-Up) **Dec. 2018**

Queen's University Athletics and Recreation
Nixon Academic Leadership Award **Nov. 2018**

Awarded to the male and female varsity student-athletes who have exemplified achievement in academics, community service and fair play in their sport.

School of Computing, Queen's University
Award for Outstanding Contribution to School Life **May 2017**

Recognizes outstanding contributions by a student to the Queen's School of Computing with distinguished service, while maintaining excellent academic performance and research contributions throughout their undergraduate career.

Computing Students' Association (COMPSA), Queen's University
Gradum Dominus Machinarium Award **Mar. 2017**

Presented to a graduating undergraduate student who has, throughout their time at Queen's has contributed to the betterment of the University experience and demonstrated spirit and enthusiasm for everything COMPSA.

Engineering Society, Queen's University
Engineering Society Coding Competition, 1st Place **Feb. 2017**

Sunnybrook Research Institute
The Sunnybrook Research Prize, National Finalist **Jan. 2017**

Recognized as one of six national finalists for excellence in undergraduate biomedical sciences research.

GRANTS, FELLOWSHIPS & SCHOLARSHIPS

University College London
Global Challenges Research Fund (GCRF) - *£99,714* **Jan. 2021 – Jun. 2021**

"Pneumonia diagnostic support system using AI and lung ultrasound portable probes: COVID-19 versus other bacterial lung diseases"
The Graduate Research Scholarship and Overseas Research Scholarship Programs are awarded on the basis of academic excellence and research potential to attract high-quality students to University College London to undertake postgraduate research programs.
PI: Prof. C. Gandini Wheeler-Kingshott
Co-PI: Prof. L. Grandjean, Prof. G. Parker, Prof. Y. Hu
Co-I: ***Z. Baum***

University College London
Graduate Research Scholarship & Overseas Research Scholarship - *£175,000* **Sep. 2019 – Aug. 2023**

"Machine learning for ultrasound-guided interventions"
The Graduate Research Scholarship and Overseas Research Scholarship Programs are awarded on the basis of academic excellence and research potential to attract high-quality students to University College London to undertake postgraduate research programs.

Natural Sciences and Engineering Research Council of Canada (NSERC)
Postgraduate Scholarship-Doctoral - *$63,000 CAD* **Sep. 2019 – Aug. 2022**

"Intelligent simulated environments for augmented reality surgical training"
The Postgraduate Scholarships-Doctoral Program provides financial support to high-calibre scholars who are engaged in a doctoral program in the natural sciences or engineering.

King's College London
EPSRC Doctoral Training Partnership Studentship – *£190,000* **Awarded (Sep. 2019)**

"Intra-operative probe design and image processing optimization with deep learning for in-vivo and ex-vivo detection of cancerous tissue"
The EPSRC Doctoral Training Partnership Studentship is offered to an international applicant of King's College London's Surgical and Interventional Engineering Doctoral Program each year. The studentship is funded jointly through the EPSRC, the School of Biomedical Engineering and Imaging Sciences, as well as a project-specific industry sponsor with the intent of training and nurturing the next generation of surgical and interventional engineering scientists, researchers, innovators, and industry leaders.

Imperial College London
President's PhD Scholarship – *£215,000* **Awarded (Sep. 2019)**

"A platform for mass-spectrometry-based surgical navigation"
The President's PhD Scholarship Scheme is designed to help nurture future world-class researchers, recruiting outstanding students from around the world to Imperial College London to engage in an exciting and challenging program that complements research opportunities with professional development and networking within an elite cohort.

School of Graduate Studies, Queen's University
Arthur B. McDonald Prize for Academic Excellence - *$30,000 CAD* **Awarded (Sep. 2019)**

This prestigious award recognizes excellence and research potential of applicants who will begin their graduate degree programs in the School of Graduate Studies at Queen's in 2019-20. It is named in honour of Queen's University Professor Emeritus Arthur McDonald, co-winner of the 2015 Nobel Prize in Physics.

Queen's School of Computing
Conference Travel Award - *$300 CAD* **Mar. 2019**

To present *"Assessment of intra-operative neurosurgical planning with the Microsoft HoloLens"* at the 17th Annual Imaging Network of Ontario Symposium

Hamlyn Centre for Surgical Robotics, Imperial College London

Hamlyn Winter School Travel Scholarship - *£500* **Dec. 2018**

Government of Ontario – Ministry of Advanced Education and Skills Development
Ontario Graduate Scholarship - *$15,000 CAD* **Sep. 2018 – Aug. 2019**

"Holographic visualization for neurosurgical planning and training"
The Ontario Graduate Scholarship program provides merit-based scholarships to Ontario's best graduate students in all disciplines and encourages excellence in graduate studies at publicly assisted universities in Ontario.

SPIE Medical Imaging
Chair's Conference Travel Award - *$750 USD* **Feb. 2016, 2017, 2018**

School of Graduate Studies, Queen's University
Tri-Agency Recipient Recognition Award - *$5,000 CAD* **Sep. 2017 – Aug. 2018**

Natural Sciences and Engineering Research Council of Canada (NSERC)
Alexander Graham Bell Canada Graduate Scholarship - *$17,500 CAD* **Sep. 2017 – Aug. 2018**

"Mobile augmented reality display system for musculoskeletal injections"
The Canada Graduate Scholarship Program provides financial support to high-calibre scholars who are engaged in eligible master's programs in Canada.

School of Graduate Studies, Queen's University
Academic Excellence Award - *$15,000 CAD* **Awarded (Sep. 2017)**

Recognizes academic excellence and research potential of applicants who will begin their graduate degree programs in the School of Graduate Studies at Queen's.

Queen's School of Computing
Undergraduate Research Fellowship - *$6,500 CAD* **May 2017 – Aug. 2017**

"Image overlay surgical navigation in musculoskeletal procedures"
The Queen's School of Computing Undergraduate Research Fellowship is an undergraduate research award that supports summer undergraduate research for Computing undergraduate students who have demonstrated academic excellence.

Natural Sciences and Engineering Research Council of Canada (NSERC)
Undergraduate Student Research Award - *$6,000 CAD* **May 2016 – Aug. 2016**

"Image overlay guidance for medical interventions"

Queen's School of Computing
Workshop Travel Award - *$1,000 CAD* **May 2016**

To present the workshop *"3D Slicer: Hands on introduction to medical image visualization"* at the IEEE EMBS International Student Conference 2016

RESEARCH EXPERIENCE

Computer-Aided Navigation, Diagnosis and Intervention Group, Dept. of Medical Physics and Biomedical Engineering, UCL
Research Assistant **Sep. 2019 –**

Develops open-source medical engineering solutions for surgical navigation, disease diagnosis, and medical interventions. Currently develops artificial intelligence-based models and methodologies for real-time registration and diagnostic-support in image-guided interventions.

Laboratory for Percutaneous Surgery, School of Computing, Queen's University
Research Assistant **May 2015 – May 2019**

Developed open-source medical engineering solutions for image-guided therapy and surgical navigation. Contributed to the open-source platforms 3DSlicer and SlicerIGT through implementation and development of software for ultrasound-based scoliosis monitoring and

augmented reality display devices. Conducted clinical feasibility studies for augmented reality and holographic technologies in neurosurgical planning and emergency medicine.

ACADEMIC & TEACHING EXPERIENCE

Teaching Assistance

Dept. of Computer Science, UCL

COMP 0005 – Algorithms **Winter 2021, Winter 2022**

COMP 0066 – Introductory Programming **Fall 2020**

Dept. of Medical Physics and Biomedical Engineering, UCL

MPHY 0030 – Programming Foundations for Medical Image Analysis **Fall 2020**

MPHY 0041 – Machine Learning for Medical Imaging **Winter 2021**

MPHY 0043 – Artificial Intelligence for Surgery and Intervention (*Head TA*) **Fall 2021, 2022**

Smith School of Business, Queen's University

Master of Management in AI Program – Capstone Project Assistant **Spring 2019**

School of Computing, Queen's University

CISC P81 – Computers: Applications and Implications **Fall 2015, Winter 2017**

CISC 121 – Introduction to Computing Science I (*Head TA*) **Winter 2019**

CISC 365 – Algorithms (*Head TA*) **Fall 2016**

CISC 432 – Advanced Data Management Systems (*Head TA*) **Fall 2018**

CISC 472 – Medical Informatics (*Head TA*) **Winter 2018, 2019**

Faculty of Engineering and Applied Science, Queen's University

CMPE 365 – Algorithms (*Head TA*) **Fall 2017**

Invited Course Lectures

Dept. of Medical Physics and Biomedical Engineering, UCL

MPHY 0030 – Programming Foundations for Medical Image Analysis **Fall 2020**

Lecture: 3DSlicer: Open-Source Medical Image Computing

Lecture: SlicerJupyter: A 3DSlicer Kernel for Interactive Publications

School of Computing, Queen's University

CISC 472 – Medical Informatics **Winter 2019**

Lecture: Augmented Reality Neurosurgical Planning

CISC 432 – Advanced Data Management Systems **Fall 2018**

Lecture: Introduction to and Development with CouchDB

CISC 330 – Computer-Assisted Surgery **Fall 2018**

Lecture: Spatially Tracked Ultrasound and Ultrasound-Guided Interventions

CISC 330 – Computer-Assisted Surgery **Fall 2018**

Lecture: Augmented Reality Neurosurgical Planning

CISC 472 – Medical Informatics **Winter 2018**

Lecture: Computer-Assisted Interventions

CISC 330 – Computer-Assisted Surgery **Fall 2016, Fall 2017**

Lecture: Mobile Augmented Reality Surgical Navigation Systems

Supervision & Mentorship Experience

Students Supervised in Research Project

Fadwa Shagroun, Undergraduate Student **2022**

Development of open resources for medical imaging datasets

Dept. of Medical Physics and Biomedical Engineering, UCL

Xiang Li, Master of Science Student **2021 – 2022**

Deep learning for COVID-19 lung ultrasound image analysis

Ralia Boutaleb, Undergraduate Student **2021 – 2022**

Deep learning for COVID-19 lung ultrasound image analysis

Mihaela Croitor, Undergraduate Student **2021 – 2022**

Deep learning for COVID-19 lung ultrasound image analysis

Pierre Raillard, Undergraduate Student **2021 – 2022**

Deep learning for COVID-19 lung ultrasound image analysis

Harry Mason, Undergraduate Student **2020 – 2021**

Lung ultrasound segmentation and adaptation between COVID-19 and community acquired pneumonia

Students Mentored in Research Project

Laboratory for Percutaneous Surgery, School of Computing, Queen's University

Julia Wiercigoch, Undergraduate Student **2018**

Design of low-cost, adjustable handheld needle guide for spine interventions

Sydney Perrin, High School Student **2018**

Assessment of freehand ultrasound calibration reproducibility for ultrasound-guided navigation

Hillary Lia, Undergraduate Student **2018**

Development of electromagnetically tracked partial nephrectomy navigation training system

Eden Bibic, High School Student **2016**

Design of redundant sensor array for intraoperative electromagnetic tracking error monitoring

Aidan Baksh, High School Student **2015**

Design of optically and electromagnetically tracked navigation tools for computer-navigated surgery

PROFESSIONAL ACTIVITIES

Conference, Workshop, and Seminar Series Organization

Machine Learning Interest Group, Center for Medical Image Computing, UCL

Co-Chair **2020 –**

Advances in Simplifying Medical Ultrasound (ASMUS) Workshop, MICCAI

Program Co-Chair **2022 –**

Demonstrations Chair **2020 –**

Computing Student Research Conference (CSearch), Queen's University

Founder & Conference Chair **2018**

Journal Article Reviews (ad hoc)

IEEE Transactions on Medical Imaging **2020 –**

Journal of Medical Robotics Research **2020 –**

SPIE Journal of Medical Imaging **2020 –**

Conference Paper / Abstract Reviews

Intl. Conf. on Information Processing in Computer Assisted Interventions **2020 –**

Intl. Conf. on Medical Image Computing and Computer Assisted Interventions **2020 –**

PROFESSIONAL EXPERIENCE

Atheneum Partners Ltd.

AI Engineer **Dec. 2021 –**

Leads the development and application of ML techniques to optimize internal operations for expert recruitment and compensation**.** Early member of AI Team, establishing end-to-end ML workflows (data ingestion, feature engineering, model development & management, deployment, monitoring, serving) to support real-time operational decision making**.**

Veterinary Surgical Innovation Ltd.

Software Engineer **Sep. 2020 –**

Develops open-source medical engineering solutions for surgical navigation, disease diagnosis, and medical interventions. Currently develops surgical navigation tools and software for real-time guidance and navigation of canine hip replacement to provide critical information, models and methodologies for decision-support in image-guided interventions.

Verdure Imaging Inc.

Sr. AI Research Scientist & Software Engineer **Jul. 2016 –**

Designs and validates state-of-the-art deep learning models for ultrasound segmentation and reconstruction. Develops well-designed and user-friendly ultrasound-based diagnostic software for monitoring and assessing scoliosis.

Office of Undergraduate Admission and Recruitment, Queen's University

Automation Developer **Jan. 2019 – May 2019**

Developed software and macros to automate the reporting and collection of various test scores and other application-specific information for Admission Coordinators to simplify daily workflows and remove the need for manual searches through internal datastores by any staff members.

PUBLICATIONS & PRESENTATIONS

Journal Articles

1. **Z Baum**, Y Hu, D Barratt. "Meta-learning initializations for interactive medical image registration," IEEE Transactions on Medical Imaging. (Submitted)
2. S Saeed, Y Fu, V Stavrinides, **Z Baum**, Q Yang, M Rusu, R Fan, G Sonn, A Noble, D Barratt, Y Hu. "Image quality assessment for machine learning tasks using meta-reinforcement learning," Medical Image Analysis, Vol. 78 (2022). [DOI]
3. S Saeed, W Yan, Y Fu, F Giganti, Q Yang, **Z Baum**, M Rusu, R Fan, G Sonn, M Emberton, D Barratt, Y Hu. "Image quality assessment by overlapping task-specific and task-agnostic measures: application to prostate multiparametric MR images for cancer segmentation," Machine Learning for Biomedical Imaging - Special Issue: Information Processing in Medical Imaging 2021, Vol. 1 (2022). [DOI]
4. **Z Baum**, Y Hu, D Barratt. "Real-time multimodal image registration with partial intraoperative point-set data," Medical Image Analysis, Vol. 74 (2021). [DOI]
5. Y Fu, N Montana Brown, S Saeed, A Casamitjana, **Z Baum**, R Delaunay, Q Yang, A Grimwood, Z Min, S Blumberg, J Iglesias, D Barratt, E Bonmati, D Alexander, M Clarkson, T Vercauteren, Y Hu. "DeepReg: a deep learning toolkit for medical image registration," The Journal of Open Source Software (2020) [DOI]

6. T Ungi, H Greer, K Sunderland, V Wu, **Z Baum**, C Schlenger, M Oetgen, K Cleary, S Aylward, G Fichtinger. "Automatic spine ultrasound segmentation for scoliosis visualization and measurement," IEEE Transactions on Biomedical Engineering, Vol. 61 (11), p. 3234-3241 (2020). [DOI]

7. **Z Baum**, A Lasso, S Ryan, T Ungi, E Rae, B Zevin, R Levy, G Fichtinger. "Augmented reality training platform for neurosurgical burr hole localization," Journal of Medical Robotics Research - Special Issue: Technology-enabled Tools for Clinical Skills Assessment, Vol. 4 (3-4), pp. 1942001-1-1942001-13 (2019). [DOI]

Conference Presentations

1. **Z Baum**, T Ungi, C Schlenger, Y Hu, D Barratt. "Learning generalized non-rigid multimodal biomedical image registration from generic point set data," 3rd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 25th International Conference on Medical Image Computing and Computer Assisted Intervention (2022). (Accepted)

2. **Z Baum**, Y Hu, D Barratt. "Meta-registration: learning test-time optimization for single-pair image registration," 3rd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 25th International Conference on Medical Image Computing and Computer Assisted Intervention (2022). (Accepted)

3. P Railliard, L Cristoni, A Walden, R Lazzari, T Pulimood, L Grandjean, C Gandini Wheeler-Kingshott, Y Hu, **Z Baum.** "Rapid lung ultrasound COVID-19 severity scoring with resource-efficient deep feature extraction," 3rd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 25th International Conference on Medical Image Computing and Computer Assisted Intervention (2022). (Accepted)

4. L Chalcroft, J Qu, S Martin, I Gayo, G Minore, I Singh, S Saeed, Q Yang, **Z Baum**, A Altmann, Y Hu. "Development and evaluation of intraoperative ultrasound segmentation with negative image frames and multiple observer labels," 2nd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 24th International Conference on Medical Image Computing and Computer Assisted Intervention (2021). [DOI]

5. A Grimwood, J Ramalhinho, **Z Baum**, N Montana Brown, G Johnson, Y Hu, M Clarkson, S Pereria, D Barratt, E Bonmati. "Endoscopic ultrasound image synthesis using a cycle-consistent adversarial network," 2nd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 24th International Conference on Medical Image Computing and Computer Assisted Intervention (2021). [DOI]

6. H Mason, L Cristoni, R Lazzari, T Pulimood, L Grandjean, C Gandini Wheeler-Kingshott, Y Hu, **Z Baum**. "Lung ultrasound segmentation and adaptation between COVID-19 and community acquired pneumonia," 2nd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 24th International Conference on Medical Image Computing and Computer Assisted Intervention (2021). [DOI]

7. S Saeed, Y Fu, **Z Baum**, Q Yang, M Rusu, R Fan, G Sonn, A Noble, D Barratt, Y Hu. "Adaptable image quality assessment using meta-reinforcement learning of task amenability," 2nd Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 24th International Conference on Medical Image Computing and Computer Assisted Intervention (2021). (**Best Paper Award**) [DOI]

8. S Saeed, Y Fu, **Z Baum**, Q Yang, M Rusu, R Fan, G Sonn, D Barratt, Y Hu. "Learning image quality assessment by reinforcing task amenable data selection," 27th International Conference on Information Processing in Medical Imaging, p. 755-766 (2021). [DOI]

9. **Z Baum**, E Bonmati, L Cristoni, A Walden, F Prados, B Kanber, D Barratt, D Hawkes, G Parker, C Wheeler-Kingshott, Y Hu. "Image quality assessment for closed-loop computer-assisted lung ultrasound," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 11598, p. 115980R (2021). [DOI]

10. **Z Baum**, Y Hu, D Barratt. "Multimodality biomedical image registration using free point transformer networks," Advances in Simplifying Medical UltraSound (ASMUS) Workshop - 23rd International Conference on Medical Image Computing and Computer Assisted Intervention (2020). (**Best Paper Award**) [DOI]

11. **Z Baum**, S Ryan, E Rae, A Lasso, T Ungi, R Levy, G Fichtinger. "Assessment of intraoperative neurosurgical planning with the Microsoft HoloLens," 17th Annual Imaging Network of Ontario Symposium (2019).

12. H Lia, **Z Baum**, T Vaughan, T Ungi, T McGregor, G Fichtinger. "Usability and accuracy of an electromagnetically tracked partial nephrectomy navigation system," 17th Annual Imaging Network of Ontario Symposium (2019).

13. **Z Baum**, B Church, A Lasso, T Ungi, C Schlenger, D Borschneck, P Mousavi, G Fichtinger. "Step-wise identification of ultrasound-visible anatomical landmarks for 3D visualization of scoliotic spine," SPIE Medical Imaging - Image-Guided

Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10951, p. 1095129 (2019). [DOI]

14. H Lia, **Z Baum**, T Vaughan, T Ungi, T McGregor, G Fichtinger. "Electromagnetically tracked partial nephrectomy navigation: demonstration of concept," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10951, p. 109512W (2019). [DOI]
15. S Perrin, **Z Baum**, M Asselin, G Underwood, S Choueib, H Lia, T Ungi, A Lasso, G Fichtinger. "Reproducibility of freehand calibrations for ultrasound-guided needle navigation," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10951, p. 109512B (2019). [DOI]
16. J Wiercigoch, **Z Baum**, T Ungi, J Fritz, G Fichtinger. "Validation of a low-cost adjustable handheld needle guide for spine interventions," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10951, p. 109510L (2019). [DOI]
17. **Z Baum**, T Ungi, A Lasso, B Church, C Schlenger, G Fichtinger. "Ultrasound-based vertebral landmark localization using deformable spine models," 16th Annual Imaging Network of Ontario Symposium (2018).
18. R Hisey, T Ungi, M Holden, **Z Baum**, Z Keri, C McCallum, D Howes, G Fichtinger. "Assessment of the use of webcam-based workflow detection for providing real-time feedback in central venous catheterization training," 16th Annual Imaging Network of Ontario Symposium (2018).
19. C Pinter, B Travers, **Z Baum**, T Ungi, A Lasso, B Church, G Fichtinger. "Real-time transverse process delineation in tracked ultrasound for scoliosis measurement," 16th Annual Imaging Network of Ontario Symposium (2018).
20. **Z Baum**, T Ungi, A Lasso, B Church, C Schlenger, G Fichtinger. "Visual aid for identifying vertebral landmarks in ultrasound," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10576, p. 105760Z (2018). [DOI]
21. R Hisey, T Ungi, M Holden, **Z Baum**, Z Keri, G Fichtinger. "Real-time workflow detection using webcam video for providing real-time feedback in central venous catheterization training," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10576, p. 1057620 (2018). (**Poster – Honourable Mention Award**) [DOI]
22. C Pinter, B Travers, **Z Baum**, S Kamali, T Ungi, A Lasso, B Church, G Fichtinger. "Real-time transverse process detection in ultrasound" SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10576, p. 105760Y (2018). [DOI]
23. **Z Baum**, T Ungi, A Lasso, G Fichtinger. "Real-time, tracked, mobile augmented reality display for surgical navigation: usability study on simulated patients," 9th National Image-Guided Therapy Workshop (2017).
24. **Z Baum**, T Ungi, A Lasso, G Fichtinger. "Evaluation of a mobile, real-time, tracked augmented reality display for surgical navigation," 15th Annual Imaging Network of Ontario Symposium (2017).
25. A Ilina, A Lasso, M Jolley, B Wohler, A Nguyen, A Scanlan, **Z Baum**, F McGowan, G Fichtinger. "Creating patient-specific anatomical models from highly elastic materials using 3D-printed molds," 15th Annual Imaging Network of Ontario Symposium (2017).
26. E Bibic, **Z Baum**, V Harish, T Ungi, A Lasso, G Fichtinger. "PLUS Model Catalog: A library of 3D-printed medical tools," 15th Annual Imaging Network of Ontario Symposium (2017).
27. G Underwood, T Ungi, **Z Baum**, A Lasso, G Kronreif, G Fichtinger. "Registration of preoperative images for navigated brain surgery using ultrasound-accessible skull regions," 15th Annual Imaging Network of Ontario Symposium (2017).
28. V Harish, E Bibic, A Lasso, M Holden, T Vaughan, **Z Baum**, T Ungi, G Fichtinger. "An application of redundant sensors for intraoperative electromagnetic tracking error monitoring," 15th Annual Imaging Network of Ontario Symposium (2017).
29. **Z Baum**, T Ungi, A Lasso, G Fichtinger. "Usability of a real-time tracked augmented reality display system in musculoskeletal injections," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10135, p. 101352T (2017). [DOI]
30. A Ilina, A Lasso, M Jolley, B Wohler, A Nguyen, A Scanlan, **Z Baum**, F McGowan, G Fichtinger. "Patient-specific pediatric silicone heart valve models based on ultrasound," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10135, p. 1013516 (2017). [DOI]

31. G Underwood, T Ungi, **Z Baum**, A Lasso, G Kronreif, G Fichtinger. "Skull registration for prone patient position using tracked ultrasound," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10135, p. 1013522 (2017). [DOI]

32. R House, V Harish, A Lasso, **Z Baum**, G Fichtinger. "Evaluation of the Intel RealSense SR300 camera for image-guided interventions and application in vertebral level localization," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10135, p. 101352Z (2017). [DOI]

33. V Harish, E Bibic, A Lasso, M S Holden, T Vaughan, **Z Baum**, T Ungi, G Fichtinger. "Monitoring electromagnetic tracking error using redundant sensors," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 10135, p. 101352R (2017). [DOI]

34. **Z Baum**, A Lasso, T Ungi, G Fichtinger. "Usability of augmented reality displays for musculoskeletal surgical navigation," Canadian Undergraduate Conference on Healthcare (2016).

35. **Z Baum**, A Lasso, T Ungi, G Fichtinger. "Real-time self-calibration of a handheld augmented reality overlay system," 14th Annual Imaging Network Ontario Symposium (2016).

36. V Harish, A Baksh, T Ungi, A Lasso, **Z Baum**, G Gauvin, CJ Engel, J Rudan, G Fichtinger. "Monitoring electromagnetic tracking error in computer-navigated breast cancer surgery," 14th Annual Imaging Network Ontario Symposium (2016).

37. **Z Baum**, A Lasso, T Ungi, G Fichtinger. "Augmented reality overlay system for computer-guided needle insertion procedures," 10th Annual Inquiry @ Queen's Undergraduate Research Conference. Queen's University (2016).

38. **Z Baum**, A Lasso, T Ungi, G Fichtinger. "Real-time self-calibration of a tracked augmented reality display," SPIE Medical Imaging - Image-Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 9786, p. 97860F (2016). [DOI]

39. V Harish, A Baksh, T Ungi, A Lasso, **Z Baum**, G Gauvin, CJ Engel, J Rudan, G Fichtinger. "Measurement of electromagnetic tracking error in a navigated breast surgery setup," SPIE Medical Imaging - Image Guided Procedures, Robotic Interventions, and Modeling. International Society for Optics and Photonics, Vol. 9786, p. 97862K (2016). [DOI]

Educational Challenges

1. N Montana Brown, Y Fu, S Saeed, A Casamitjana, **Z Baum**, R Delaunay, Q Yang, A Grimwood, Z Min, E Bonmati, T Vercauteren, M Clarkson, Y Hu. "Introduction to medical image registration with DeepReg, between old and new," MICCAI Educational Challenge (2020). (**First Place Overall Winner**) [Text-Only] [Notebook]

Theses

1. **Z Baum**. "Augmented reality training platform for placement of neurosurgical burr holes," Master's thesis, Queen's University (2019). [URI]

Academic Workshops

1. **Z Baum***, V Harish*. "3D Slicer: Hands on Introduction to Medical Image Visualization," IEEE EMBS International Student Conference (2016).

Invited Presentations

1. **Z Baum.** "Deep learning for medical image segmentation and registration," 6th Annual UCL Medical Image Computing Summer School (MedICSS), University College London (2020).

2. **Z Baum**. "Multimodality biomedical image registration using free point transformer networks," {U|I|K}CL Bio-Imaging Symposia, University College London (2020) [LINK].

3. **Z Baum**. "Mobile image overlay system for surgical navigation," 5th Annual Bruce Visiting Scholar in Surgical Innovation Lectureship – Trainee Seminar, Queen's University (2017).

4. **Z Baum**. "Design, development, and evaluation of a real-time tracked augmented reality display system for surgical navigation," Sunnybrook Research Prize, Sunnybrook Research Institute (2016).

MEMBERSHIPS

MICCAI – The Medical Image Computing and Computer Assisted Intervention Society
Student Member **2019 –**

IEEE EMBS – The IEEE Engineering in Medicine and Biology Society
Student Member **2016 –**

IEEE – The Institute of Electrical and Electronics Engineers
Student Member **2016 –**

SPIE – The International Society for Optics and Photonics
Student Member **2015 –**

COMMUNITY INVOLVEMENT

Sail Canada / Voile Canada
Member, Board of Directors **Oct 2018 –**

Provides the governance and strategic direction for the Association. Brings an array of skills, expertise, and sailing experience to fulfill my responsibilities and duties on the board with respect to setting the vision and mission of the Association. Provides input and monitors performance the Association by overseeing core financial information and updating policies to reflect international best practices in sailing. Additionally, serves as a member of the Inclusivity, Diversity & Equity, Governance, and Finance Committees, and as Chair of the Annual General Meeting Planning Sub-Committee.

Students' Union UCL, University College London
Board of Trustees Finance Sub-Committee Student Representative **Sep. 2019 – Aug. 2020**

One of four students appointed by the Student Union executive to aid in and be responsible for considering the strategy and general management of the Student Union's finances. This includes setting annual budgets, key performance objectives, and monitoring the financial performance of the organization.

Faculty of Arts and Science, Queen's University
Graduate Studies Mentor & Recruitment Advisor **Aug. 2018 – May 2019**

Took part in discussions with current undergraduate students through online and in-person events to address concerns and questions of prospective students on programs, supervisors, funding applications and graduate student life.

Graduate Computing Society (GCS), Queen's University
MSc SGPS Liaison Officer **May 2018 – May 2019**

Attended meetings of the Society of Graduate and Professional Students (SGPS) and their Council to act as a liaison for the concerns of School of Computing graduate students with the SGPS.

Graduate Computing Society (GCS), Queen's University
President **May 2018 – May 2019**

Was responsible for the day-to-day operations of the society. Planned monthly social events for students and sits on various committees as the voice and representative for computing graduate students. Revamped the Society's orientation activities to better engage with students and provide them with a grasp of the resources and supports available in the department and at Queen's. Created a 'Computing Graduate Student Handbook' for students to provide information on the department, resources, courses, and life in Kingston.

Office of Undergraduate Admission and Recruitment, Queen's University
Senior Campus Tour Guide **Mar. 2018 – May 2019**

Led prospective students and families throughout campus, giving a first impression and information on Queen's University. Provides day-to-day oversight of the program and additional logistical support during large recruitment events.

Graduate Computing Society (GCS), Queen's University
COMPSA Liaison Officer **Sep. 2017 – May 2019**

Attended meetings of the Computing Students' Association (COMPSA) and their Council to act as a liaison for the School of Computing's graduate students with COMPSA. Provided assistance with interpretation of policy and external perspectives as an ex-officio member of the association.

Graduate Computing Society (GCS), Queen's University
MSc Graduate Committee Officer **Sep. 2017 – May 2019**

Attended the School of Computing Graduate Committee's meetings to represent the opinions and interests of master's students in the School of Computing, and to actively strive to improve the MSc program for students.

School of Computing, Queen's University
School of Computing Council Graduate Representative **Sep. 2017 – May 2019**

Voiced graduate student concerns and discusses changes to programs, courses and other aspects of the School of Computing with members of Administration, Faculty and Staff.

Graduate Computing Society (GCS), Queen's University
Vice President Operations **Sep. 2017 – May 2018**

Primarily responsible for the day-to-day operations of the Society. Was responsible for the Society's finances, event budgeting and acted as a coordinator for all officers of the Society.

Student Experience Office, Queen's University
Summer Orientation to Academic Resources Peer Ambassador **Jul. 2017**

Created a welcoming environment for incoming students, their families and guests by assisting with program implementation and event coordination. Coordinated registration and check-in for over 2000 attendees and acted as a Master of Ceremonies throughout the event. Participated in panel discussions to share personal experiences on resources, campus life, and academics.

Queen's Varsity Sailing Team, Queen's University
President & Captain **Jan. 2017 – Dec. 2019**

Acted as chairperson of the executive committee and as the team's spokesperson and representative to Queen's University and other external stakeholders. Managed finances and operations for the team of over 60 athletes and its coaching staff. Created the 'Try Varsity Sailing' program to bring high school sailors to Queen's to experience life as a student-athlete. Established partnerships with Able Sail Kingston to aid with their fundraising and promotional efforts.

Canadian Intercollegiate Sailing Association (CICSA)
Team Development Officer **Jan. 2017 – Dec. 2017**

Created and promoted opportunities for new post-secondary institutions to develop competitive sailing programs through outreach and mentorship. Organized sailing clinics and implemented a team ranking system across the league to reinforce existing best practices in college sailing. Represented the Association to external sports associations such as Sail Canada.

Queen's Native Student Association (QNSA)
Director of Web Development **Sep. 2016 – Aug. 2017**

Oversaw the design, development, and maintenance of the QNSA webpage, and worked to rebrand the organization's national online presence.

Arts and Sciences Undergraduate Society (ASUS), Queen's University
Founder & Editor-in-Chief of The Data Journal **May 2016 – Apr. 2017**

Coordinated with the Editorial Board and Panel of Referees, tracks submissions to the Journal, hires management, and provides general supervision and oversight of the Journal's inaugural volume.

Office of Undergraduate Admission and Recruitment, Queen's University
Campus Tour Guide **Mar. 2016 – Mar. 2018**

Led prospective students and families throughout campus, giving a first impression and information on Queen's University.

Information Technology Services (ITS), Queen's University

Information Services and Technology Student Advisory Committee Member **May 2015 – Apr. 2016**

Provided concerns and commented on student priorities about information technology at Queen's University. Discussed current and future information technology initiatives while developing reports for ITS management.

School of Computing, Queen's University

School of Computing Council Undergraduate Representative **May 2015 – Apr. 2016**

Voiced undergraduate student concerns and discussed changes to programs, courses and other aspects of the School of Computing with members of Administration, Faculty and Staff.

Arts and Sciences Undergraduate Society (ASUS), Queen's University

Computing Representative **May 2015 – Apr. 2016**

Represented Computing students at ASUS Assembly. Presented the views, perspectives and needs of Computing Students to the ASUS Executive and other Assembly members.

Computing Students' Association (COMPSA), Queen's University

Vice President Operations **May 2015 – Apr. 2016**

Oversaw day-to-day operations and finances of the Association, worked with commissioners to assist with execution of their events and initiatives throughout the year. Renewed relations with the Arts and Science Undergraduate Society and worked collaboratively with them to found new programs such as The Data Journal - Queen's first undergraduate computer science research journal.

School of Computing, Queen's University

Orientation Chair **Oct. 2014 – Sep. 2015**

Planned, coordinated and successfully delivered the 2015 Computing Orientation Week. Recruited and trained Orientation Leaders and Executives. Reinforced positive relations with external bodies and stakeholders, including students, staff, faculty and administrators ranging from the School of Computing, to the Office of the Principal. Developed new events with other faculties to promote interfaculty relations and restructured several core events of the week. As a result, saw higher turn-out and retention rates than any previous computing orientation weeks.

School of Computing, Queen's University

Open House Volunteer **Oct. 2013 – May 2019**

Engages with students at various recruitment events, such as Fall Preview, March Break Open House, Majors Night, the Ontario University Fair and Summer Orientation to Academic Resources (SOAR). Helps to promote the Queen's School of Computing, the Faculty of Arts and Science, and the School of Graduate Studies to prospective students and parents through discussion of the programs offered at Queen's, and by demoing various graduate and undergraduate research projects at these events.

SELECT ATHLETIC HONOURS & AWARDS

Sail Canada / Voile Canada
Helly Hansen Sailor of the Month **Nov. 2017, Mar. 2018**

Queen's University Athletics and Recreation
Jack Jarvis Trophy **Mar. 2018**

Awarded annually to a Varsity Club male student-athlete in his 4th or 5th year who best displays qualities of scholastic achievement, competitiveness, leadership, sportsmanship, dedication and exceptional contributions to his team.

Queen's University Athletics and Recreation
Queen's Sailing Team Most Valuable Player **Mar. 2018**

Canadian Intercollegiate Sailing Association (CICSA)
Landon Gardner Volunteer of the Year Award **Nov. 2017**

Canadian Intercollegiate Sailing Association (CICSA)
Male Skipper of the Year Award **Nov. 2017**

Queen's Sailing Team
Nathan Cohen Memorial Trophy **Nov. 2017**

Canadian Intercollegiate Sailing Association (CICSA)
1st Place - Team Racing National Championship **2013, 2014, 2016, 2017**

North American Intercollegiate Sailing Association (ICSA)
1st Place – Canadian American Cup **2014, 2015, 2016, 2017**

Queen's University Athletics and Recreation
Varsity Clubs Male Athlete of the Week **24/10/2016, 11/9/2017**

CORK / Sail Kingston
1st Place - Olsen 30 North American Championship **Jul. 2017**