Curriculum Vitae

Leif Simmatis, PhD
Speech Production Lab (University of Toronto) and KITE (Toronto Rehabilitation Institute)
Postdoctoral fellow

Personal information

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Education

Jan. 2016-Aug. 2020 PhD, neuroscience, Centre for Neuroscience Studies, Queen's University, Kingston, Ontario, Canada
Supervisors: Dr. Stephen H. Scott, Dr. Albert Y. Jin

Sept. 2013-Dec. 2015 MSc, neuroscience, Centre for Neuroscience Studies, Queen's University, Kingston, Ontario, Canada
Supervisor: Dr. Albert Y. Jin

Sept. 2009- Apr. 2013 BSc(H), life sciences, Neuroscience Specialization, Queen's University, Kingston, Ontario, Canada
Undergraduate thesis supervisor: Dr. Michael D. Kawaja

Awards

2021-2023 Mitacs Elevate postdoctoral fellowship, University of Toronto, Toronto, Ontario, Canada
Value: $60,000 CAD x2 years ($120,000 CAD total)

2019 Centre for Neuroscience Studies travel award, Kingston, Ontario, Canada
Value: $300 CAD

2017 Robert J. Wilson fellowship, Queen's University, Kingston, Ontario, Canada
Value: $10,000 CAD per year x2 years ($20,000 CAD total)

2009 Principal's undergraduate entrance award, Queen's University, Kingston, Ontario, Canada
Value: $5,000 CAD x2 years ($10,000 CAD total)

A. Research summary

Clinical applications of digital and behavioural biomarkers

Research has focused on the development of digital and behavioural biomarkers via novel assessment technologies. Objectives have been (1) improving understanding of neurological disease, and (2) translating clinical knowledge to automated disease detection systems.

Postdoctoral research has consisted of using machine learning/statistical techniques to extract and characterize motor speech biomarkers. This has led to an industry partnership (Winterlight Labs, via Mitacs) to validate a novel speech assessment platform for use in amyotrophic lateral sclerosis/Lou Gehrig's disease. Additionally, this has involved the development of a novel multimodal (video/audio) speech assessment tool that uses AI for automated data analysis.

Doctoral research consisted of studying upper limb motor function using the Kinarm robotic assessment system in individuals with various neurological diseases, which led to several publications in peer-reviewed journals.

Research projects (postdoctoral fellowship; 2020-current)

Automated multimodal assessment of motor speech impairment (dysarthria)

- Deep learning-based 3D facial reconstruction for facial tracking in motor speech disorders.
- Automated temporal segmentation of speech audio/video data using machine learning.
- Multimodal statistical and machine learning assessment of speech using audio/video data.
- Overcame algorithmic bias in deep learning models using finetuning.
- 8 papers and conference proceedings/presentations.

Development of multimodal speech assessment app (VirtualSLP)

- Designed AI-powered speech assessment pipeline.
- Collaborated with clinicians and software designers to optimize code and analytics.
- Led analytical validation and clinical validation using multimodal data.
- Followed Agile software development principles to enable CI/CD, including regular scrum and update meetings.
- 2 peer-reviewed papers and 3 conference abstracts, with more in progress.

Validation of Winterlight assessment app in amyotrophic lateral sclerosis (ALS)

- Led academia/industry research collaboration with Winterlight Labs.
- Trained and managed a data preprocessing team 4 research assistants).
- Created and maintained training/scheduling documents, and managed regular check-ins.
- Developed custom data analysis pipelines (Python) using machine learning and statistics expertise.
- Bayesian and frequentist statistics for pattern detection.
- Supervised and unsupervised machine learning for disease prediction.
- Prepared 4 papers/conference abstracts in <1 year in collaboration with Winterlight clinical research coordinators.

Publications

1. **Leif Simmatis**, Saeid Alavi Naeini, Deniz Jafari, Michael (Kai Yue) Xie, Chelsea Tanchip, Niyousha Taati, Scotia McKinlay, Rupinder Sran, Justin Truong, Diego L. Guarin, Babak Taati, Yana Yunusova. Analytical validation of a webcam-based assessment of speech kinematics: digital biomarker evaluation following the V3 framework. *Digital Biomarkers 7(1):7-17*. https://doi.org/10.1159/000529685

2. Deniz Jafari, **Leif E. R. Simmatis**, Diego L. Guarin, Babak Taati, Yana Yunusova. 3D video tracking technology in the assessment of orofacial impairments in neurological disease: Clinical validation. *Journal of Speech, Language and Hearing Research.* https://doi.org/10.1044/2023_JSLHR-22-00321.

3. **Leif E. R. Simmatis**, Carolina Barnett, Reeman Marzouqah, Babak Taati, Mark I. Boulos, Yana Yunusova. Reliability of Automatic Computer Vision-Based Assessment of Orofacial Kinematics for Telehealth Applications. Digit Biomark 2022;6:71-82. doi: 10.1159/000525698

4. **Leif E. R. Simmatis**, Albert Y. Jin, Stephen H. Scott. Quantifying changes over 1 year in motor and cognitive skill after transient ischemic attack (TIA) using robotics. *Sci Rep 11, 17011 (2021)*.

5. Michael D. Wood*, **Leif E. R. Simmatis***, Jill A. Jacobson, Sean P. Dukelow, J. Gordon Boyd & Stephen H. Scott. Principal Components Analysis Using Data Collected from Healthy Individuals on Two Robotic Assessment Platforms Yields Similar Behavioral Patterns. *Front. Hum. Neurosci.* 2021; 15. *contributed equally.

6. **Leif E. R. Simmatis**, Albert Y. Jin, Sean W. Taylor, Etienne J. Bisson., Stephen H. Scott, Moogeh Baharnoori. The feasibility of assessing cognitive and motor functionality in multiple sclerosis patients using robotics. *MSJ-ETC* 2020; 6(4).

7. **Leif E. R. Simmatis**, Spencer Early, Kimberly D. Moore., Simone Appaqaq, Stephen H. Scott. Statistical measures of motor, sensory and cognitive performance across repeated robot-based testing. Journal of Neuroengineering and Rehabilitation 17, 86 (2020). https://doi.org/10.1186/s12984-020-00713-2

8. **Leif E. R. Simmatis**, Albert Y. Jin, Michelle Keiski, Lysa B. Lomax, Stephen H. Scott, Gavin P. Winston. Assessing various sensorimotor and cognitive functions in people with epilepsy is feasible with robotics. Epilepsy & Behaviour. 2020; 103(A) https://doi.org/10.1016/j.yebeh.2019.106859

9. **Leif E. R. Simmatis**, Stephen H. Scott, Albert Y. Jin. 2019. The Impact of Transient Ischemic Attack on Brain and Behaviour. Front Behav Neurosci 2019; 13:44. https://doi.org/10.3389/fnbeh.2019.00044

10. **Leif E.R. Simmatis**, Ghada Atallah, Stephen H. Scott, Sean W. Taylor. The Feasibility of Robotic Technology to Quantify Sensory, Motor, and Cognitive Impairments Associated with ALS Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration. 2019 Jan 27:1-10. https://doi.org/10.1080/21678421.2018.1550515

11. Michael D. Wood, **Leif E. R. Simmatis**, J. Gordon Boyd, Stephen H. Scott and Jill A. Jacobson. Using Principal Component Analysis to Reduce Complex Datasets Produced by Robotic

Technology in Healthy Participants. Journal of Neuroengineering and Rehabilitation. 2018; 15:71.
https://doi.org/10.1186/s12984-018-0416-5

12. **Leif Simmatis**, Jonathan Krett, Stephen H. Scott, Albert Y. Jin. Robotic Assessment of Transient Ischemic Attack. PLoS One. 2017; 12(12).
https://doi.org/10.1371/journal.pone.0188786

Publications (in preparation)

1. **Leif E. R. Simmatis**, Jessica Robin, Yana Yunusova. Detection of bulbar ALS using automated acoustic analysis. *Invited paper based on poster from ICAIR 2023*.
2. Saeid Alavi Naeini, **Leif Simmatis**, Deniz Jafari, Yana Yunusova, Babak Taati. Improving Automatic Temporal Segmentation of Orofacial Assessment Data Using ASR Augmentation.
3. **Leif E. R. Simmatis**, Jessica Robin, Timothy Pommee, Justin Truong, Bharatkumar Khoyani, Yana Yunusova. Validation of automated pipeline for the assessment of a motor speech disorder in amyotrophic lateral sclerosis (ALS). Submitted.
4. **Leif E. R. Simmatis**, Emma Russo, Irene Harmsen, Joseph Geraci, Nardin Samuel. Towards the development of validated, robust, EEG-based biomarkers in major depression.

Conference proceedings (accepted)

1. **Leif E. R. Simmatis**, Timothy Pommeé, Yana Yunusova. Multimodal assessment of bulbar amyotrophic lateral sclerosis (ALS) using a novel remote speech assessment app. *Interspeech 2023, to be presented 20-24 August 2023*.
2. **Leif E. R. Simmatis**, Jessica Robin, Timothy Pommeé, Bharatkumar Koyani, Yana Yunusova. Exploring the analytical validity of the Winterlight assessment app – a novel, home-based speech assessment tool – in ALS. 2022 International symposium on ALS/MND. https://www.tandfonline.com/doi/epdf/10.1080/21678421.2022.2120686?needAccess=true&role=button
3. Saeid Alavi Naeni, **Leif Simmatis**, Yana Yunusova, Babak Taati. Concurrent validity of automatic speech and pause measures during passage reading in ALS. Proceedings of *2022 IEEE International Conference on Biomedical & Health Informatics (BHI)*.
https://doi.org/10.48550/arXiv.2208.10597
4. Saeid Alavi Naeni, **Leif Simmatis**, Deniz Jafari, Diego Guarin, Yana Yunusova, Babak Taati. Automated temporal segmentation of orofacial assessment videos. Proceedings of *2022 IEEE International Conference on Biomedical & Health Informatics (BHI)*.
https://doi.org/10.48550/arXiv.2208.10591
5. **Leif E. R. Simmatis**, Diego L. Guarin, Yana Yunusova, Babak Taati. Comparing True and Reconstructed 3D Landmarks for Detection of Orofacial Impairments Associated with ALS. IEEE International conference on Biomedical and Health Informatics (BHI) 2022.
6. **Leif E. R. Simmatis**, Yana Yunusova. Facial Landmark Tracking in Videos of Individuals with Neurological Impairments: Is There a Trade-off Between Smoothness and Accuracy? 43rd

Annual International Conference of the IEEE Engineering in Medicine and Biology Society. P 2234-2237.

7. **Leif E. R. Simmatis**, Saeid Alavi Naeni, Chelsea Tanchip, Deniz Jafari, Justin Truong, Diego Guarin Lopez, Babak Taati, Yana Yunusova. A novel multimodal speech assessment platform: Technical validation study. Madonna Rehabilitation Hospital Conference on Motor Speech 2022.

Other conference abstracts (in preparation/submitted)

1. **Leif E. R. Simmatis**, Jessica Robin, Yana Yunusova. Longitudinal analysis of bulbar amyotrophic lateral sclerosis (ALS) using automated acoustic analysis.

2. **Leif E. R. Simmatis**, Timothy Pommeé, Yana Yunusova. Detection of longitudinal speech change in ALS using a novel acoustic assessment web app. Submitted to American Speech and Hearing Association (ASHA) 2023.

Oral presentations

2023 **Detecting bulbar amyotrophic lateral sclerosis using automatic acoustic analysis (08 May)**
Invited 3-minute talk
Toronto, ON, Canada

2022 **UHN Trainees *Seeds of Science* podcast (episode 4)**
Interviewee
Toronto, ON, Canada

2022 **Greening healthcare AI (29 April)**
UHN-ORT Increasing Sustainability in Research Seminar
Toronto, ON, Canada

2022 **Developing digital sensorimotor biomarkers**
Rehabilitation Sciences Institute (RSI) Leadership Rehab Rounds talk
Toronto, ON, Canada

2020 **AI in healthcare: From digits to diagnosis**
Brain Storm public lecture series
Kingston, Ontario, Canada

2019 **Decoding behaviour: Machine learning, pattern recognition, and robotic assessment**
Invited lecture for Queen's University Department of Radiology
Kingston, Ontario, Canada

2019 **Robotic assessment of transient ischemic attack**
NeuGeneration conference
Kingston, Ontario, Canada

2017 **Persistent cognitive and motor impairment after transient ischemic attack**
Canadian Stroke Congress Annual Meeting
Calgary, Alberta, Canada

Posters

2023 **Detection of bulbar ALS using automated acoustic analysis (poster)**.
International Conference of Aging, Innovation, and Rehabilitation (ICAIR) 2023.
Toronto, ON, Canada

2023 **Clinical validation of a novel home-based speech assessment app.**
International Society for CNS Clinical Trials and Methodology (ISCTM) 2023 annual meeting.
Washington, DC, USA

2022 **Exploring the analytical validity of the Winterlight assessment app – a novel, home-based speech assessment tool – in ALS**
ALS/MND annual meeting
San Diego, CA, USA (virtual)

2022 **A novel multimodal assessment platform – VirtualSLP: Technical validation study**
Madonna Rehabilitation Hospital Motor Speech Conference
Charleston, South Carolina, USA (virtual)

2021 **Investigating the reliability of computer vision based orofacial motor assessment**
Boston Speech Motor Control Symposium
Boston, Massachusetts, USA (virtual)

2020 **Assessing sensorimotor and cognitive function in people with multiple sclerosis is feasible using robotics**
American Academy of Neurology annual meeting
Toronto, Ontario, Canada

2020 **Using robotics and machine learning to classify post-stroke motor impairments**
NeuGeneration conference
Kingston, Ontario, Canada

2019 **Detecting neurological deficits using robotics and one-class classification**
Society for Neuroscience annual meeting
Chicago, Illinois, USA

2019 **Reducing the dimensionality of Kinarm data in transient ischemic attack and migraine**
McMaster-Queen's Neurosymposium
Hamilton, Ontario, Canada

2018 **Robotic assessment to identify impairments in individuals with transient ischemic attack or migraine**
Society for Neuroscience annual meeting
San Diego, California, USA

2017 **Persistent impairment after transient ischemic attack**
Society for Neuroscience annual meeting
Washington, DC, USA

2016 **Robotic assessment of transient ischaemic attack patients**
Southeastern Ontario Stroke Network annual meeting
Kingston, Ontario, Canada

2016 **Robotic Assessment of Transient Ischaemic Attack Patients**
Society for Neuroscience annual meeting
San Diego, California, USA

Professional activities

2022-ongoing **Head of Neuroscience – Cove Neurosciences, Inc.**
Led engagement with potential clients, oversaw research proposals in neuroscience/psychiatry therapeutic areas. Led team of neuroscience liaisons and trainees, managed preparation of academic papers. Performed company outreach e.g., at trade shows.

2023 (08 May) **Panelist – KITE Trainee Roundtable**
Led discussions on potential career paths for graduate students.

2023 (01 May) **Coordinator – machine learning/AI programming workshop – UHN postdoc association.**
Formed a collaboration with an external group (Coding Hive) to facilitate a workshop to teach machine learning and Python programming fundamentals to UHN postdocs.

2023 (Feb-ongoing) **Contributor – International Society for CNS Clinical Trials and Methodology (ISCTM).**
Ongoing collaborator with industry professionals, researchers, and clinicians to provide comment on clinical trial regulatory documents. April 2023: response to FDA externally-controlled trial guidance submitted. June 2023: preparation for submission to EMA on guidance regarding single-arm trials (SATs).

2023 (Jan-ongoing) **Coordinator – UHN postdoc association "Postdoc talks" speaker series.**
Conceptualized and recruited participants for ongoing speaker series meant to foster interdisciplinary scientific communication among UHN postdocs.

2022 (22 Sept)	**Coordinator and Lead – "Exploring careers outside of academia" workshop** https://uhntrainees.ca/career-development/workshops/pdf-appreciation-week-day-4/ Organized career panel event in collaboration with the Science to Business Network
2022 (14 July)	**Contributor – UHN "Talkin' Trash" sustainability blog** Provided individual contribution, reviewed by UHN staff, discussing ways to improve the environmental sustainability of AI methods for healthcare. Link: https://talkintrashwithuhn.com/2022/07/14/greening-healthcare-ai/.
2022 (10 June)	**Panelist – KITE Trainee Roundtable** Provided scientific feedback on KITE trainees' new research projects.
2022 (24 May)	**Coordinator – R carpentries workshop** Assisted in planning and preparing an R programming workshop in collaboration with The Carpentries and the UHN Postdoc Association, in an effort to provide basic R programming language instruction to trainees at UHN.
2022 (29 April)	**Coordinator and presenter – UHN-Office of Research Trainees Sustainability in Research seminar** Conceptualized and assisted in executing a workshop to promote sustainable research at UHN. Gave a brief talk on sustainability in AI research.
2022 (28 Feb)	**Coordinator – UHN Postdoc career panel** Planned and led a career panel event focusing on the availability of different career paths (government, academic, industry) to postdoctoral fellows at UHN. This was the first formal event held by the UHN Postdoc Association, and yet was attended by >100 participants.
2021-ongoing	**Team lead – UHN Postdoctoral fellows Association (UHNPA) professional development subcommittee** Led a subgroup of 9 individuals within the UHNPA. Arranged regular meetings and progress check-ins with individuals and the team to subserve task completion.
2021-2022	**Mentor – KITE Peer Mentorship program** Mentored a new PhD student by providing non-academic support and advice
2021	**Presenter and planner – Rehabilitation Sciences Institute Graduate Students' Union seminar on applying theory to research** Planned event with other event coordinators and gave a presentation describing ways to apply theory to research in science

2019	**Moderator – Centre for Neuroscience Studies student research day** Moderated student research talk session
2018-2019	**Committee member – Centre for Neuroscience Studies student leadership committee** Coordinated student activities and facilitated communication between students and faculty
2018	**Organizer – Centre for Neuroscience Studies student research day** Assisted with organization and administration of graduate student-run research day
2016-2019	**Presenter – Discovery Days in Health Sciences** Provided demonstrations of robotic technology used in neurological assessment to local high school students (Kingston, ON), and gave an overview of the applications of technological assessment tools in neurology
2014-2019	**Group leader – Brain Awareness Day** Led a group of local grades 5-6 students through Queen's University campus to participate in neuroscience education sessions
2014-2020	**Presenter – Brain Reach** Presented a series of lectures on basic neuroscience concepts at local elementary schools (Kingston, ON) to encourage interest in neuroscience and general STEM topics

Professional memberships

2023-	**International Society for CNS Clinical Trials and Methodology (ISCTM)**
2021-	**UHN postdoc association**
2021-	**Digital Medicine (DiMe) society**
2021-	**IEEE Member**
2016-2020	**Society for Neuroscience**

Employment

2020-	Postdoctoral fellow, University of Toronto, Toronto, Ontario, Canada
2016-2020	Research Assistant, Department of Biology, Queen's University, Kingston, Ontario, Canada
2016-2020	Math and science tutor, Kingston Tutoring Company, Kingston, Ontario, Canada