Murilo Teixeira Silva

murilotxs@gmail.com • murilotsilva.github.io
St. John's, NL

Research Interests

Remote Sensing, Radio Oceanography, Machine Learning, Inverse Problems, Electromagnetic Scattering, Nonlinear Optimization, Computational Wave Propagation

Education

Memorial University of Newfoundland   2021
Ph.D., Engineering (Electrical); GPA: 4.00   *St. John's, NL*

Memorial University of Newfoundland   2017
M.Eng., Engineering (Electrical); GPA: 4.00   *St. John's, NL*

Instituto Federal de Educação, Ciência e Tecnologia da Bahia   2014
Industrial Electrical Engineering; GPA: 8.09/10   *Salvador, Brazil*

Professional Experience

C-CORE   Mar. 2021—Present
Electrical/Electronics Engineer, Systems Team   *St. John's, NL*

- Works with a cross-functional team to establish test plans and verification strategies to comply with the requirements established by clients such as Airbus and the European Space Agency
- Provides clarifications to inquiries raised by the clients and performs design and documentation adjustments when necessary
- Establishes minimum requirements and designed multiple verification support equipment for an active P-band satellite calibration system
- Collaborates in a project to deliver a review on the state of the art of high-power microwave technologies for the Defence Research and Development Canada

WorleyParsons   Sept. 2014 — May 2015
Technical Translator and Interpreter   *Camaçari, Brazil*

- Performed more than 900 hours of interpretation in a multinational and cross-functional team of technicians and engineers during installation and testing of electrical and instrumentation equipment at the BASF Camaçari Acrylic Center
- Translated technical notes and guidelines for the operation and maintenance of industrial equipment from English to Portuguese
- Aided in the communication between international and local leadership in planning and strategical meetings

Monsanto do Brasil   Aug. 2012 — Aug. 2013
Electrical and Instrumentation Engineer (Intern)   *Camaçari, Brazil*

- Worked with a cross-functional team on the prioritization and execution of scheduled and unscheduled maintenance
- Developed analytics on valve controller failure based on the text in maintenance tickets
- Improved the Downtime Classification System for the PIA plant, reducing classification time and misclassifications
- Participated in scheduled and unscheduled maintenance procedures during operation and maintenance shutdowns
- Managed the maintenance schedule of critical instruments and calibration standards

Research Experience

Memorial University of Newfoundland   Sept. 2015 – Apr. 2021
Graduate Researcher   *St. John's, NL*

- Derived new electric fields and radar cross-section expressions for monostatic and bistatic HF Radars observing ocean surfaces with extreme wave heights
- Developed a 37% more accurate wind speed estimator for buoy data using a NARX Neural Network
- Simulated more than 200 combinations of ocean conditions and noise levels and generated noise-contaminated radar cross-sections of the ocean surface using Matlab and Python, and developed a new nonlinear method to extract ocean information from noisy bistatic HF radar data from the ocean surface, achieving an average of 97.2% accuracy
- Aided in in-situ maintenance of HF radar sites in the Avalon Peninsula
- Collaborated with other researchers in the implementation of feature extraction and classification methods for GNSS-R and X-band marine radar images

C-CORE   Oct. 2018 – Feb. 2019
Research Assistant   *St. John's, NL*

- Simulated the radar cross-section of a satellite calibration standard using Altair FEKO and Ansys HFSS and determined the roughness requirements to have a minimum impact on the radar cross-section
- Aided in the choice of supporting structures by simulating the use of different materials and geometries to minimize their impact on the radar cross-section

CNPq   Aug. 2010 – Jul. 2014
Undergraduate Researcher   *Salvador, Brazil*

- Constructed a magnetic 6-DOF motion tracker using Arduino and Matlab, and developed an alternative closed-form solution to the tracking problem using Singular Value Decomposition
- Coded an automatic FEM mesh generator and a time varying electromagnetic FEM simulator in Fortran and C, which were used to evaluate the impact of sea proximity on electromagnetic field propagation
- Implemented an unsupervised neural network algorithm in Fortran to identify fixed and moving underwater objects in ULF EM data, and compensated for reducing the number of sensors in the simulations
- Used Finite Elements Method to construct a Poisson Equation solver in *C*, and analyzed numerical errors introduced by different FEM meshing techniques

PUBLICATIONS

PUBLICATION IN REFEREED JOURNALS

2021 **Silva, M. T.**, Huang, W., and Gill, E. W. **Mar. 2021**, "High-frequency radar cross-section of the ocean surface with arbitrary roughness scales: a generalized functions approach," *IEEE Trans. Antennas Propag.*, vol. 69, no. 3, pp. 1643–1657, DOI: 10.1109/tap.2020.3026330.

      Silva, M. T., Huang, W., and Gill, E. W. **Dec. 2021**, "High-frequency radar cross-section of the ocean surface with arbitrary roughness scales: higher-orders and generalized form," *IEEE Trans. Antennas Propag.*, vol. 69, no. 10, pp. 6723–6738, DOI: 10.1109/TAP.2021.3070153.

2020 **Silva, M. T.**, Huang, W., and Gill, E. W. **Feb. 2020**, "Bistatic high-frequency radar cross-section of the ocean surface with arbitrary wave heights," *Remote Sensing*, vol. 12, no. 4, p. 667, DOI: 10.3390/rs12040667.

      Silva, M. T., Shahidi, R., Gill, E. W., and Huang, W. **Jul. 2020**, "Nonlinear extraction of directional ocean wave spectrum from synthetic bistatic high-frequency surface wave radar data," *IEEE J. Ocean. Eng.*, vol. 45, no. 3, pp. 1004–1021, ISSN: 0364-9059. DOI: 10.1109/JOE.2019.2909961.

2019 **Silva, M. T.**, Gill, E. W., and Huang, W. **Nov. 2019**, "Electromagnetic scattering in curvilinear coordinates using a generalized functions method," *Radio Sci.*, vol. 54, no. 11, pp. 1099–1111, ISSN: 0048-6604. DOI: 10.1029/2018rs006783.

2018 **Silva, M. T.**, Gill, E. W., and Huang, W. **Jul. 2018**, "An improved estimation and gap-filling technique for sea surface wind speeds using NARX neural networks," *J. Atmos. Oceanic Technol.*, vol. 35, no. 7, pp. 1521–1532, ISSN: 0739-0572. DOI: https://doi.org/10.1175/JTECH-D-18-0001.1. [Online]. Available: http://journals.ametsoc.org/doi/10.1175/JTECH-D-18-0001.1.

2017 **Silva, M. T.**, Santos, E. T. F., Batista, L. S., Araújo, J. M., and Batista, L. S. **Aug. 2017**, "Alternative analytical solution for position and orientation in electromagnetic motion tracking systems," *WSEAS Transactions on Systems*, vol. 16, pp. 225–233, ISSN: 2224-2678. [Online]. Available: http://www.wseas.org/multimedia/journals/systems/2017/a505802-879.php.

2016 **Silva, M. T.**, Batista, L. S., and de Albuquerque, F. M. V. **Jan. 2016**, "Feature extraction of structures in sea water using self-organizing maps and electromagnetic waves," *TEMA (São Carlos)*, vol. 16, no. 3, pp. 261–274, ISSN: 2179-8451. DOI: 10.5540/tema.2015.016.03.0261. [Online]. Available: http://tema.sbmac.org.br/tema/article/view/836.

Publication in refereed conference proceedings

2020 **Silva, M. T.**, Gill, E. W., and Huang, W. **Jul. 2020**, "HF radar cross-section of ocean surfaces with arbitrary wave heights," in *Proceedings of the 2020 IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting*, IEEE. DOI: 10.1109/IEEECONF35879.2020.9330260.

Silva, M. T., Huang, W., and Gill, E. W. **Oct. 2020**, "Second-order correction to the HF radar cross-section of the ocean surface at electromagnetically-high sea states," in *Global OCEANS 2020*, IEEE. DOI: 10.1109/IEEECONF38699.2020.9389414.

2018 **Silva, M. T.**, Shahidi, R., Gill, E. W., and Huang, W. **Oct. 2018**, "An improved nonlinear extraction of directional ocean wave spectrum from bistatic HFSWR using Tikhonov regularization in Hilbert scales," in *Proceedings of OCEANS 2018 MTS/IEEE Charleston*, Charleston, SC, USA: IEEE, pp. 1–6, ISBN: 978-1-5386-4814-8. DOI: 10.1109/OCEANS.2018.8604551. [Online]. Available: https://ieeexplore.ieee.org/document/8604551/.

Silva, M. T., Huang, W., and Gill, E. W. **May 2018**, "Filling gaps in wind speed data - a neural networks approach," in *Proceedings of 2018 OCEANS - MTS/IEEE Kobe Techno-Oceans (OTO)*, Kobe, Japan: IEEE, pp. 1–5, ISBN: 978-1-5386-1654-3. DOI: 10.1109/OCEANSKOBE.2018.8559341. [Online]. Available: https://ieeexplore.ieee.org/document/8559341/.

2017 **Silva, M. T.**, Gill, E. W., and Shahidi, R. **Jun. 2017**, "A new nonlinear approach to extraction of ocean wave spectra from bistatic Doppler HF-radar data," in *Proceedings of OCEANS 2017 - Aberdeen*, vol. 2017-Octob, IEEE, pp. 1–6, ISBN: 9781509052783. DOI: 10.1109/OCEANSE.2017.8084790. [Online]. Available: http://ieeexplore.ieee.org/document/8084790/.

2014 **Silva, M. T.** and Batista, L. S. **Jul. 2014**, "Sea proximity influence over EM plane wave scattering using the finite element method," in *Proceedings of the 2014 16th International Symposium on Antenna Technology and Applied Electromagnetics (ANTEM)*, Victoria, BC, Canada: IEEE, pp. 1–2, ISBN: 978-1-4799-2225-3. DOI: 10.1109/ANTEM.2014.6887726. [Online]. Available: http://ieeexplore.ieee.org/document/6887726/.

2013 **Silva, M. T.** and Batista, L. S. **Jul. 2013**, "Modelagem por elementos finitos da influência da maritimidade na propagação de ondas eletromagnéticas," in *Proceedings of the 65a Reunião Anual da Sociedade Brasileira Para o Progresso da Ciência*, SBPC, Recife. [Online]. Available: http://www.sbpcnet.org.br/livro/65ra/resumos/resumos/7129.htm.

2012 **Silva, M. T.** and Batista, L. S. **Oct. 2012**, "Modelagem por elementos finitos da propagação de ondas eletromagnéticas em regiões litorâneas," in *Proceedings of the VII Congresso Norte e Nordeste de Pesquisa e Inovação, 2012*, IFTO, Palmas, pp. 1–6. [Online]. Available: http://propi.ifto.edu.br/ocs/index.php/connepi/vii/paper/view/4771.

2011 **Silva, M. T.** and Batista, L. S. **Dec. 2011**, "Comparação de malhas automáticas para o método dos elementos finitos aplicados à simulação matemática da equação de Poisson," in *Proceedings of the VI Congresso Norte e Nordeste de Pesquisa e Inovação, 2011*, IFRN, Natal, pp. 205–214. [Online]. Available: http://portal.ifrn.edu.br/pesquisa/editora/livros-para-download/vi-connepi-engenharia-iv.

Honours and Awards

2021 **Fellow of the School of Graduate Studies**, *Memorial University of Newfoundland*
Awarded in recognition of outstanding academic achievement throughout the graduate program.

2020 **Wally Read Best Young Professional Paper Award**, *IEEE Newfoundland and Labrador Section*
Awarded to the best young professional paper presented on the Annual Newfoundland Electrical and Computer Engineering Conference (NECEC)

2020 **Honourable Mention - Student Paper Competition**, *2020 IEEE AP-S/URSI Conference*
Top 34 out of 203 submissions to the competition

2020 **C.J. Reddy Student Travel Grant for Graduate Students**, *IEEE Antennas and Propagation Society*
Travel grant for the 2020 IEEE AP-S/URSI Conference, awarded for excellence in research in antennas and propagation. Converted to educational grant due to the COVID-19 pandemic

2020 **Kenneth Hickey Award in Ocean Sensing**, *Memorial University of Newfoundland*
Awarded for excellence in ocean sensing research.

2018 **Finalist, Student Poster Competition**, *OCEANS'18 MTS/IEEE Charleston*
Top 20 student paper, travel expenses paid to present at the conference.

2017 **Fellow of the School of Graduate Studies**, *Memorial University of Newfoundland*
Awarded in recognition of outstanding academic achievement throughout the graduate program.

2012 **Best Research of the Year (All Categories)**, *Instituto Federal de Educação, Ciência e Tecnologia da Bahia*
Chosen as the best research work of the year among 83 competitors.

Teaching Experience

Memorial University of Newfoundland — 2016-2020
Teaching Assistant — *St. John's, NL*
Courses: ENGI 1020 (Introduction to Programming), ENGI 3821 (Circuit Analysis), ENGI 3424 (Engineering Mathematics), ENGI 4430 (Advanced Calculus for Engineering), ENGI 6813 (Electromagnetic Fields), ENGI 9816 (Antenna Theory).

SENAI CIMATEC — March 2012
Instructor — *Salvador, Brazil*
Course: Basic Mathematics

Presentations

2020 **Silva, M. T.**, Gill, E. W., and Huang, W. **Nov. 2020**, "Effects of electromagnetically-large waves on the second-order radar cross section of the ocean surface in the HF band," in *29th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2020)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador, Canada.

2019 **Silva, M. T.**, Gill, E. W., and Huang, W. **Nov. 2019**, "First-order high-frequency scattering for ocean surfaces with large roughness scales," in *28th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2019)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador, Canada.

Silva, M. T., Gill, E. W., and Huang, W. **Aug. 2019**, "High-frequency radar cross-section for an ocean surface with arbitrary heights," in *Radiowave Oceanography Workshop 2019*, Ocean Networks Canada, Victoria, BC, Canada.

2018 **Silva, M. T.**, Shahidi, R., Gill, E. W., and Huang, W. **Nov. 2018**, "Empirical initial value estimation for nonlinear extraction of ocean wave spectra from bistatic HF radar data," in *27th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2018)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador.

2017 **Silva, M. T.**, Gill, E. W., and Huang, W. **Nov. 2017**, "The use of artificial neural networks in hindcasting and filling gaps in buoy wind speed data under extreme winds," in *26th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2017)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador.

2016   **Silva, M. T.**, Gill, E. W., and Shahidi, R. **Nov. 2016**, "A change of variables for ocean wave spectrum extraction from bistatic second-order Doppler HF-radar data," in *25th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2016)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador.

2015   **Silva, M. T.**, Batista, L. S., and de Albuquerque, F. M. V. **Nov. 2015**, "Dimensionality reduction on EM data for underwater object detection using self-organizing maps," in *24th Annual Newfoundland Electrical and Computer Engineering Conference (NECEC 2015)*, IEEE Newfoundland and Labrador Section, St. John's, Newfoundland and Labrador.

2013   **Silva, M. T.** and Batista, L. S. **Oct. 2013**, "Artifical intelligence applied to the control and monitoring of marine environments," in *II Simpósio de Guerra de Minas*, Marinha do Brasil, Salvador, Brazil.

2012   **Silva, M. T.** and Batista, L. S. **Oct. 2012**, "Numerical simulation of strucutres under electromagnetic fields," in *IX Seminário de Iniciação Científica, Tecnológica e Inovação*, IFBA, Vitória da Conquista, BA, Brazil.

2011   **Silva, M. T.** and Batista, L. S. **Oct. 2011**, "Automatic and adaptive mesh generator for finite elements method applications," in *VIII Seminário de Iniciação Científica do Instituto Federal da Bahia*, IFBA, Salvador, Brazil.

COMMUNITY SERVICE

VOLUNTEERING

NECEC Conference   2020 – Present
Organizing Committee Member   *St. John's, NL*

IEEE - Newfoundland and Labrador Section   2019 – Present
Communications Officer (Webmaster)   *St. John's, NL*

Eastern Newfoundland Science & Technology Fair   2019
Judge, Special Awards   *St. John's, NL*

Oceans '17 MTS/IEEE Aberdeen Conference   2017
Session Co-Chair, Sonar and Transducers   *Aberdeen, Scotland, UK*

PEER-REVIEWS

Journals	IEEE Geoscience and Remote Sensing Letters, Canadian Journal of Electrical and Computer Engineering, Radio Science, Frontiers in Marine Science
Conferences	2020 IEEE 92nd Vehicular Technology Conference: VTC2020-Fall

TECHNICAL SKILLS

Programming	MATLAB (expert), Python (proficient), C (proficient), Fortran (proficient), DXL (basic)
Libraries	NumPy (proficient), SciPy (proficient), Matplotlib (proficient), xarray (basic), cartopy (basic)
Web	Jekyll (proficient), HTML (proficient), CSS (proficient), YAML (proficient), XML (proficient)
Tools & Software	Excel (advanced), LaTeX (advanced), Jupyter Notebooks (proficient), Git (proficient), SVN (proficient), Rational DOORS (proficient), Emacs (proficient), HFSS (proficient)
Data Formats	NetCDF (proficient)
OS	Windows (expert), Linux (advanced)

LANGUAGES

Portuguese (native), English (fluent), Spanish (reading: advanced, writing: intermediate, speaking: basic)