

Diego L. Guarín, Ph.D.

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Website: mea-lab.github.io

Education

- 09/2013 – 02/2017 **Ph.D. Biomedical Engineering**, McGill University, Montreal, Canada
Thesis: Identification of Dynamic Ankle Stiffness during Time-Varying Conditions
- 01/2012 – 08/2013 **MEng, Biomedical Engineering**, McGill University, Montreal, Canada
Thesis: Identification of Multiple-Input Single-Output Discrete Transfer Function Models. Application to Ankle Stiffness.
- 02/2009 – 11/2011 **MEng, Electrical Engineering**, Technological University, Pereira, Colombia
Thesis: Detecting Non-Linearity in Non-Stationary Time Series
- 02/2003 – 12/2008 **BEng, Engineering Physics** (*summa cum laude*), Technological University, Pereira, Colombia
Thesis: Gravitational Waves – Second Order Approximation

Additional Training

- 11/2020 AI for Medical Diagnosis and Prognosis, Coursera
- 11/2018 Undergraduate Mentoring Workshop, Harvard University, Cambridge, USA
- 03/2017 Intraoperative Nerve Monitoring, Mass. Eye and Ear Infirmary, Boston, USA.
- 06/2015 Summer School on Neurorehabilitation, Valencia, Spain

Experience

Professional Appointment

- 08/2022 – **University of Florida**
Assistant Professor
Department of Applied Physiology and Kinesiology
- 08/2020 – 07/2022 **Florida Institute of Technology**
Assistant Professor
Biomedical Engineering Program
- 04/2020 – 03/2022 **Vector Institute for Artificial Intelligence**
Postgraduate affiliate

Research Experience

- 05/2019 – 08/2020 **Postdoctoral Fellow**
Toronto Rehabilitation Institute, Ontario, Canada
Supervisors: Dr. Yana Yunusova and Dr. Babak Taati
- 05/2017 – 04/2019 **Postdoctoral Fellow**
Harvard University, Cambridge, USA
Supervisors: Dr. Tessa Hadlock and Dr. Nate Jowett
- 01/2012 – 04/2017 **Graduate Research Assistant**
McGill University, Montreal, Canada
Supervisor: Dr. Robert E. Kearney
- 02/2009 – 12/2011 **Graduate Research Assistant**
Technological University of Pereira, Pereira, Colombia
Supervisor: Dr. Alvaro A. Orozco

Teaching Experience

- 08/2022 – 05/2023 **Assistant Professor**
Applied Physiology and Kinesiology, University of Florida
Courses:
- *Data Sciences applied to Biomechanics*
- 08/2020 – 07/2022 **Assistant Professor**
Biomedical Engineering Program, Florida Institute of Technology
Courses:
- *Neuroengineering, BME 4444 | BME 5790*
- *Signals and Systems BME 3222*
- *Numerical Methods in Biomedical Engineering BME 3240*
- *Introduction to Programming and Machine Learning BME 4050*
- *Independent Study in BME – Application of EMG for facial analysis BME 4300*
- 01/2016 – 05/2016 **Graduate Teaching Assistant**
Biomedical Engineering, McGill University
Courses:
- *Modeling and Identification, BMDE 502*
- 09/2014 – 12/2014 **Graduate Teaching Assistant**
Biomedical Engineering, McGill University
Courses:
- *Biomedical Signals and Systems, BMDE 519*
- 09/2013 – 12/2013 **Graduate Teaching Assistant**
Biomedical Engineering, McGill University
Courses:
- *Biomedical Signals and Systems, BMDE 519*
- 02/2010 – 12/2011 **Undergraduate Instructor**
Electrical Engineering, Technological University of Pereira
Courses:
- *Principles of Electrical Engineering*

Service

- 10/2021 – **Associate Editor**
IEEE Transactions on Neural Systems and Rehabilitation Engineering
- 09/2020 – 07/2022 **Webmaster**
Biomedical Engineering Program, Florida Institute of Technology
- 04/2015 – 04/2017 **Chair**
IEEE-EMBS Montreal Chapter
Duties: Coordinate outreaching activities, generate annual reports, and manage branch activities
- 09/2012 – 09/2016 **VP Finances**
BioMedical Engineering Students Society of McGill University
Duties: Coordinate outreaching activities, generate financial reports, manage society financial operation, and obtain external funding
- 03/2003 – 12/2007 **Undergraduate Student Representative**
Engineering Physics Undergraduate Students Representative
Duties: Elected representative of undergraduate students in departmental meetings

Grants, Awards and Recognitions

Active Grants:

- Title: Video-based estimation of facial kinematics for detecting Parkinson's disease and predicting its severity.
Name of PI: Diego L. Guarin
Source of Support: The Center for Smart Use of Technologies to Assess Real World Outcomes | National Institutes of Health
Total Award Amount: \$36,206.03 USD
Status: Ongoing
Proposal Start and End dates: 08/2022 – 07/2023
Objective: The overall goal of this project is to establish the utility and validity of VirtualSLP for detecting PD and its severity based on biomarkers derived from facial kinematics computed from recordings obtained remotely using standard web cameras.

Previous Grants:

- Title: The Development and Validation of a Novel Tool for the Assessment of Bulbar Dysfunction in ALS.
Name of PI: Dr. Yana Yunusova (University of Toronto) and Dr. Jordan Green (Massachusetts General Hospital)
Role: Collaborator
Source of Support: National Institutes of Health National Institutes of Deafness and Communications Disorders.
Total Award Amount: \$186,859.40 USD
Proposal Start and End dates: 10/2021 – 09/2022
- Title: Video-based 3D face reconstruction for estimation of facial kinematics on older adults
Name of PI: Diego L. Guarin
Source of Support: Florida Tech's Research Incentive Program
Total Award Amount: \$50,000 USD
Proposal Start and End dates: 10/2020 – 11/2022
- Title: Artificial Intelligence-based Automatic Assessment of Motor Deficits in Parkinson's' Disease
Name of PI: Diego L. Guarin - Postdoctoral Fellowship at the University of Toronto
Source of Support: The Michael J. Fox Foundation for Parkinson's Research and the Weston Brain Institute
Total Award Amount: \$150,000 USD
Proposal Start and End dates: 05/2019 – 04/2021
- Title: Facial EMG for Neuroprosthetic Device Control in Facial Palsy
Name of PI: Nate Jowett (Harvard University)
Role: Collaborator
Source of Support: The American Academy of Facial Plastics & Reconstructive Surgery
Total Award Amount: \$50,000 USD
Proposal Start and End dates: 07/2019 – 06/2020

- Title: Facial Reanimation by Functional Stimulation and Inhibition
Name of PI: Diego L. Guarin – Postdoctoral Fellowship at Harvard University
Source of Support: Fonds de Recherche du Québec – Nature et technologies
Total Award Amount: \$50,000 USD
Proposal Start and End dates: 05/2017 – 04/2019
- Title: Identification of Dynamic Ankle Stiffness during Time-Varying Conditions
PI: Diego L. Guarin – Predoctoral Fellowship at McGill University
Source of Support: Fonds de Recherche du Québec – Nature et technologies
Total Award Amount: \$90,000 USD
Proposal Start and End dates: 09/2013 – 08/2017

Awards

- PostGraduate Affiliate of the Vector Institute for Artificial Intelligence, 2020. \$10.000 USD
- Graduate Student Recruitment Award, Biomedical Engineering Department, McGill University, 2012 \$15.000 USD
- Young Researcher Award, Colombian Department of Science, Technology and Innovation, 2009 - 2011 \$60.000 USD
- Jorge Roa Scholarship, Technological University, Pereira, Colombia, 2009 \$20.000 USD

Recognitions

- Best Student Paper Award, XXI Congress of the International Society of Electrophysiology and Kinesiology, 2016
- Young Ibero-American Leader Award – The Carolina Foundation, Spain, 2008
- Honors Programs, Technological University of Pereira, 2003 – 2008

Publications

Book Chapter

1. **Diego L. Guarin** and Robert E. Kearney. “Estimation of Time-Varying, Intrinsic and Reflex Dynamic Joint Stiffness during Movement. Application to the Ankle Joint”, In Sartori, M., Valero-Cuevas, F. J., Schouten, A. C., Tresch, M., Nakamura, Y., & Sreenivasa, M. (Eds.). (2019). *Neuromechanics and Control of Physical Behavior: from Experimental and Computational Formulations to Bio-inspired Technologies*. Frontiers Media SA.

Journal Papers

1. Liliana Ein, Lauren Trzcinski, Luke Perry, Kee Yoon Bark, Tessa Hadlock, and **Diego L. Guarin**, “Embellishing Emotrics for a More Complete Emotion Analysis: Addition of the Nasolabial Fold.” *Facial Plastic Surgery & Aesthetic Medicine*, 2023 – IN PRESS
2. Leif Simmatis, Saeid Alavi Naeini, Deniz Jafari, Michael 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*, 2023 – IN PRESS
3. Jafari, Deniz, Leif Simmatis, **Diego L. Guarin**, Liziane Bouvier, Babak Taati, and Yana Yunusova. "3D Video Tracking Technology in the Assessment of Orofacial Impairments in Neurological Disease: Clinical Validation." *Journal of Speech, Language, and Hearing Research* pp 1-15, 2023

4. **Diego L. Guarin**, Babak Taati, Lorne Zinman, Agessandro Abrahao, and Yana Yunusova, "Video-based facial movement analysis in the assessment of bulbar ALS: Clinical Validation." *Journal of Speech, Language, and Hearing Research*, vol 65, No 12 pp 4667-4678, 2022
5. Joseph R. Dusseldorp, **Diego L. Guarin**, Martinus M. van Veen, Matt Miller, Nate Jowett, and Tessa A. Hadlock. "Automated Spontaneity Assessment after Smile Reanimation: A Machine Learning Approach." *Plastic and Reconstructive Surgery* vol 149, No. 6 pp 1393-1402, 2022
6. Chelsea Tanchip, **Diego L. Guarin**, Scotia McKinlay, Carolina Barnett, Sanjay Kalra, Angela Genge, Lawrence Korngut, Jordan R. Green, James Berry, Lorne Zinman, Azadeh Yadollahi, Agessandro Abrahao, and Yana Yunusova, "Validating automatic DDK analysis methods across dysarthria severity and syllable task in ALS", *Journal of Speech, Language, and Hearing Research*, vol 65, No 3, pp 940-953, 2022
7. Ronit Malka, Matthew Miller, **Diego L. Guarin**, Z. Fullerton, Tessa Hadlock, and Carlyne Banks, "Reliability between in-person and still photograph assessment of facial function in facial paralysis using the eFACE facial grading system," *Facial Plastic Surgery & Aesthetic Medicine*, vol 23, No 5, pp 344-349, 2021
8. Laura M. Cabañas-Weisz, **Diego L. Guarin**, and William A. Townley. "A Comparative Study of Autologous and Acellular Dermal Matrix Static Cheek Slings in Corrective Surgery for Facial Palsy." *Annals of Plastic Surgery*, Vol 87, No 6 pp 669-675, 2021
9. Matthew Miller, Tessa Hadlock, Emily Fortier, and **Diego L. Guarin**, "The Auto-eFACE: Machine Learning-Enhanced Program Yields Automated Facial Palsy assessment tool," *Plastic and Reconstructive Surgery*, vol 147, No. 2, pp 467-474, 2021
10. Andrea Bandini, Sia Rezaei, **Diego L. Guarin**, Madhura Kulkarni, Derrick Lim, Mark I. Boulos, Lorne Zinman, Yana Yunusova, and Babak Taati. "A new dataset for facial motion analysis in individuals with neurological disorders." *IEEE Journal of Biomedical and Health Informatics* 25, No. 4 pp 1111-1119, 2020
11. **Diego L. Guarin**, Yana Yunusova, Babak Taati, Joseph Dusseldorp, Suresh Mohan, Joana Tavares, Martinus M. van Veen, Emily Fortier, Tessa Hadlock, and Nate Jowett, "Towards an Automatic System for Computer-Aided Assessment in Facial Palsy," *Facial Plastic Surgery & Aesthetic Medicine*, Vol 22, No 1, pp 42-49, 2020
12. Ronit Malka, **Diego L. Guarin**, Suresh Mohan, Iván Coto Hernández, Pavel Gorelik, Ofer Mazor, Tessa Hadlock, and Nate Jowett. "Implantable Wireless Device for Study of Entrapment Neuropathy." *Journal of Neuroscience Methods*, vol 329, No 1, pp 108461, 2020
13. Joseph Dusseldorp, **Diego L. Guarin**, Martinus M. Van Veen, Nate Jowett, and Tessa A. Hadlock, "Spontaneity Assessment in Dually Innervated Gracilis Smile Reanimation," *JAMA facial plastic surgery*, vol 21, No 6, pp 551 – 557, 2019
14. Jacqueline J. Greene, Joana Tavares, **Diego L. Guarin**, Emily Fortier, Mara Robinson, Joseph Dusseldorp, Olivia Quatela, Nate Jowett, and Tessa Hadlock, "The Spectrum of Facial Palsy: The MEEI Facial Palsy Photo & Video Standard Set," *The Laryngoscope*, vol 130, No 1, pp 32-37, 2019
15. Jacqueline J. Greene, **Diego L. Guarin**, Nate Jowett, and Tessa Hadlock, "Clinician and Automated Assessments of Facial Function following Eyelid Weight Placement," *JAMA facial plastic surgery*, vol 21, No 5, pp 387-392, 2019
16. Joseph Dusseldorp, **Diego L. Guarin**, Martinus M. Van Veen, Nate Jowett, and Tessa A. Hadlock, "In the Eye of the Beholder: Changes in Perceived Emotion Expression after Smile Reanimation," *Plastic and Reconstructive Surgery*, vol 144, no 2, pp 457-471, 2019.

17. **Diego L. Guarin** and Robert E. Kearney, "Unbiased Estimation of Human Joint Intrinsic Mechanical Properties during Movement," IEEE Trans. on Neural Systems and Rehabilitation Engineering, vol 26, no 10, pp 1975-1984, 2018
18. Jacqueline J. Greene, Joana Tavares, **Diego L. Guarin**, Nate Jowett, and Tessa Hadlock, "Surgical Refinement Following Free Gracilis Transfer for Smile Reanimation," Annals of Plastic Surgery, vol 81, no 3, pp 329 – 334, 2018
19. **Diego L. Guarin**, Joseph Dusseldorp, Tessa A. Hadlock, and Nate Jowett, "A Machine Learning Approach for Automated Facial Measurements in Facial Palsy." JAMA facial plastic surgery, vol 20, no 4, pp 335-337, 2018
20. **Diego L. Guarin** and Robert E. Kearney "Estimation of Time-Varying, Intrinsic and Reflex Dynamic Joint Stiffness during Movement. Application to the Ankle Joint", Frontiers in Computational Neuroscience, 2017
21. **Diego L. Guarin** and Robert E. Kearney, "Identification of a Time-Varying, Box-Jenkins Model of Intrinsic Joint Compliance," IEEE Trans. on Neural Systems and Rehabilitation Engineering, vol 25, no 8, pp 1211-1220, 2017
22. Edilson Delgado-Trejos, Juan Sebastian Hurtado-Jaramillo, **Diego L. Guarin** and Alvaro A. Orozco, "Pseudo-Periodic Surrogate Data in Speech Signals to Determine Intrinsic Dynamics," Ingenieria y Desarrollo, vol 31, no 2, pp 185 – 201, 2013
23. **Diego L. Guarin**, Alvaro Orozco, and Edilson Delgado, "A New Method for Bearing Diagnosis Using Lempel-Ziv Complexity," Tecno-Logicas, no 26, pp. 29-112, 2011

Peer-Reviewed Conference Papers

1. Saeid Alavi Naeini, Leif Simmatis, Deniz Jafar, **Diego L. Guarin**, Yana Yunusova, Babak Taati, " Automated Temporal Segmentation of Orofacial Assessment Videos," in 2022 IEEE-EMBS International Conference on Biomedical and Health Informatics, Ioannina, Greece, 2022
2. **Diego L. Guarin**, Aidan. Dempster, Andrea Bandini, Yana Yunusova and Babak Taati, "Estimation of Orofacial Kinematics in Parkinson's Disease: Comparison of 2D and 3D Markerless Systems for Motion Tracking," in 2020 15th IEEE International Conference on Automatic Face and Gesture Recognition, Buenos Aires, AR, 2020 pp. 705-708
3. Guy Tsor, **Diego L. Guarin**, Nate Jowett, and Robert E. Kearney, "Eyelid and Blink Tracking in an Animal Model of Facial Palsy," 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Hawaii, USA, 2018
4. **Diego L. Guarin** and Robert E. Kearney, "Evidence of Invariance in the Lower Leg Muscles Response due to Stretch Reflex Excitation during Movement", XXI Congress of the International Society of Electrophysiology and Kinesiology, Chicago, USA, 2016
5. **Diego L. Guarin** and Robert E. Kearney, "An Instrumental Variable Approach for the Identification of Time-Varying, Hammerstein Systems," 17th IFAC Symposium on System Identification, Beijing, China, pp. 196-201, 2015
6. Kian Jalaeddini, Masha A. Golkar, **Diego L. Guarin**, Ehsan Sobhani and Robert E. Kearney, " Parametric methods for identification of time-invariant and time-varying joint stiffness models," 17th IFAC Symposium on System Identification, Beijing, China, pp. 196-201, 2015
7. Ehsan Sobhani, Masha A. Golkar, **Diego L. Guarin**, Kian Jalaeddini and Robert E. Kearney, " Methods for the identification of time-varying Hammerstein systems with application to the study of dynamic joint stiffness," 17th IFAC Symposium on System Identification, Beijing, China, pp. 196-201, 2015
8. **Diego L. Guarin** and Robert E. Kearney, "Time-Varying Identification of Ankle Dynamic Joint Stiffness During Movement with Constant Muscle Activation," 37th Annual International

Conference of the IEEE Engineering in Medicine and Biology Society, Milan, Italy, pp. 6740–6743, 2015

9. **Diego L. Guarin** and Robert E. Kearney, “Multiple-Input/Single-Output identification of the dynamic relation between EMG and torque at the human ankle during isometric contractions,” 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago, USA, pp. 2057-2060, 2014
10. **Diego L. Guarin**, Kian Jalaeddini and Robert E. Kearney “Identification of a Parametric, Discrete-time Model of Ankle Stiffness,” 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 5065-5070, 2013
11. Mina Ranjbaran, Kian Jalaeddini, **Diego L. Guarin**, Robert E. Kearney and Henrietta L. Galiana “Analysis and modeling of noise in biomedical systems,” 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 997 - 1000, 2013
12. **Diego L. Guarin** and Robert E. Kearney, “A NARMAX method for the identification of time-varying joint stiffness,” 34th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, San Diego, USA, pp. 6518 - 6521, 2012
13. Juan S. Hurtado-Jaramillo, **Diego L. Guarin** and Alvaro A. Orozco, “Complex Networks: Application to pathology detection in voice signals,” 34th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, San Diego, USA, pp. 4229 - 4232, 2012
14. **Diego L. Guarin**, Edilson Delgado-Trejos and Alvaro A. Orozco, “Nonlinear statistics for bearing diagnosis,” 11th International Conference on Information Science, Signals Processing and their Applications, Montreal, Canada, pp. 413 - 418, 2012
15. **Diego L. Guarin**, Edilson Delgado-Trejos and Alvaro A. Orozco, “Testing for nonlinearity in non-stationary physiological time series,” 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires, Argentina, pp. 2671 - 2674, 2011

Conference abstracts

1. **Diego L. Guarin** and Yana Yunusova, “The Role of Articulatory Kinematics in the assessment of Bulbar Dysfunction in ALS,” Motor Speech Conference, Charleston, South Carolina., USA, 2022
2. Reeman Marzouqah, Gabriela Acevedo, **Diego L. Guarin**, Mark Boulos and Yana Yunusova “Oral and speech kinematics for the evaluation of pre-post outcomes in a post-stroke clinical trial,” Motor Speech Conference, Charleston, South Carolina., USA, 2022
3. Leif Simmatis, **Diego L. Guarin**, Yana Yunusova and Babak Taati, “A novel multimodal assessment platform – VirtualSLP: Technical validation study,” Motor Speech Conference, Charleston, South Carolina., USA, 2022
4. Felix Maldonado, Gabriela Acevedo, and Diego L. Guarin, “A Novel Approach for Assessing Facial Function,” 2021 BMES Annual Meeting in Orlando, Florida, USA, 2021
5. Gabriela Acevedo, Yana Yunusova and **Diego L. Guarin**, “: Sensibility of Acoustic Measures to Mild Levels of Speech Impairments in Stroke Survivors,” 2021 BMES Annual Meeting in Orlando, Florida, USA, 2021
6. **Diego L. Guarin**, Babak Taati, Andrea Bandini, Tessa Hadlock and Yana Yunusova, “Improving Deep Learning Networks for Automatic Orofacial Assessment across Clinical Populations,” Motor Speech Conference, Santa Barbara, California, USA, 2020
7. Chelsea Tanchip, Yana Yunusova, Ashley Waito, Cindy Cui, Jordan Green and **Diego L. Guarin**, “A Complexity-Based Approach for Automatic Diadochokinesis Analysis in Amyotrophic Lateral Sclerosis,” Motor Speech Conference, Santa Barbara, California, USA, 2020
8. **Diego L. Guarin**, Joseph Dusseldorp and Nate Jowett, “High-Frequency Alternating Current Neural Blockade as an Alternative Treatment for Spasticity,” Conference of the American Society for Peripheral Nerve, Palm Desert, CA, 2019

9. **Diego L. Guarin** and Nate Jowett, "Facial Muscle Electromyography Activity for Neuroprosthetic Device Control in Facial Reanimation: Dynamic Relation between Facial Surface EMG and Facial Displacements," Conference of the American Society for Peripheral Nerve, Palm Desert, CA, 2019
10. Robert E. Kearney, Ehsan Sobhani and **Diego L. Guarin**, "Temporal expansion and Nonlinear Parameter Varying Approaches to the Identification of Time-Varying Dynamic Joint Stiffness," 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Hawaii, USA, 2018 (invited talk)
11. **Diego L. Guarin** and Nate Jowett, "Relation between Facial Surface EMG and Facial Displacements," 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Hawaii, USA, 2018
12. **Diego L. Guarin** and Robert Kearney, "Identification of Time-Varying, Intrinsic and Reflex Dynamic Ankle Stiffness during Imposed Walking Movements with Constant Muscle Activation," 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando, FL, 2016
13. **Diego L. Guarin** and Robert Kearney, "Estimation of Time-Varying, Intrinsic Joint Stiffness. Application to the Prediction of Passive Joint Torque," International Symposium on the Neuromechanics of Human Movement, Heidelberg, Germany, 2016
14. **Diego L. Guarin** and Robert Kearney, "Time-Varying Identification of Ankle Dynamic Joint Stiffness During Movement with Constant Muscle Activation," Summer School on Neurorehabilitation, Valencia, Spain, 2015