

Milton O. Candela-Leal

milton_candela@hotmail.com

miltoncandela.github.io

EDUCATION

- Tecnológico de Monterrey** - Monterrey, Mexico Aug 2020 - Dec 2024
B.S. in Biomedical Engineering (94.5/100 = 3.8/4.0 GPA)
- International Baccalaureate** - Monterrey, Mexico Aug 2018 - May 2020
Math HL, Psychology SL, Physics SL, ...
Thesis: *Harry Potter and the Prisoner of Azkaban* (2004), a Cultural and Ideological Instructor of the Millennial Viewer

RESEARCH EXPERIENCE

- Boston Children's Hospital** - Boston, MA, USA Aug 2023 - Jul 2024
Harvard Medical School
Advisor: Kiho Im, Ph.D.
Project: *High-res Fetal Subplate Segmentation*
Unsupervised VAE-GAN for Anomaly
Non-linear qMRI for CHD Classification
- NSF IUCRC BRAIN Center** - Monterrey, Mexico Mar 2021 - Jul 2023
TMX BRAIN Site - *Tecnológico de Monterrey*
Advisor: Mauricio A. Ramírez-Moreno, Ph.D.
Project: *Advanced Learner Assistance System (ALAS)*
Talent and Passion Detection Through Biometrics
Biomechanics for the Digital Twin
Neurohumanities Lab
Digital Twin of the Workspace
- NSF IUCRC BRAIN Center** - Houston, TX, USA Spring 2022
UH BRAIN Site - *University of Houston*
Advisor: Jose L. Contreras-Vidal, Ph.D.
Project: *Brain on Acting*

JOURNAL ARTICLES

(† indicates equal contribution)

- Blanco-Ríos, M.A.†, **Candela-Leal, M.O.**†, Orozco-Romo, C., Remis-Serna, P., ... Ramírez-Moreno, M.A. (2024). Real-time EEG-based Emotion Recognition for Neurohumanities: Perspectives from Principal Component Analysis and Tree-based Algorithms. *Frontiers in Human Neuroscience*, 18, 1319574. PMID: 38545515 [\[paper\]](#)
- Candela-Leal, M.O.**, Gutiérrez-Flores, E.A., Presbítero-Espinoza, G., Sujatha-Ravindran, A., ... Ramírez-Moreno, M.A. (2022). Multi-Output Sequential Deep Learning Model for Athlete Force Prediction on a Treadmill Using 3D Markers. *Applied Sciences*, 12(11), 5424 [\[paper\]](#)
- Ramírez-Moreno, M.A., Carrillo-Tijerina, P., **Candela-Leal, M.O.**, Alanis-Espinoza, M., ... Lozoya-Santos, J.J. (2021). Evaluation of a Fast Test Based on Biometric Signals to Assess Mental Fatigue at the Workplace—A Pilot Study. *International Journal of Environmental Research and Public Health*, 18(22), 11891. PMID: 34831645 [\[paper\]](#)
- Candela-Leal, M.O.**, Alanis-Espinoza, M., Murrieta-González, J., Lozoya-Santos, J.J., & Ramírez-Moreno, M.A. (*in press*). Neurocognitive Insights into STEM Learning: An Integrated Analysis of Bandpower and Functional Connectivity among Youth. *Thinking Skills and Creativity*

BOOK CHAPTERS

- Lozoya-Santos, J.J., Ramírez-Moreno, M.A., Diaz-Armas, G.G., **Candela-Leal, M.O.**, ... Ramírez-Mendoza, R.A. (2022). Current and Future Biometrics: Technology and Applications. In R.A. Ramírez-Mendoza, J.J. Lozoya-Santos, R. Zavala-Yoé, L.M. Alonso-Valerdi, ... H.G. Gonzalez-Hernandez (Eds.), *Biometry: Technology, Trends and Applications* (1st ed., pp. 1–30). Boca Raton, FL: CRC Press. ISBN: 9781003145240 [\[paper\]](#)

CONFERENCE PROCEEDINGS

- Candela-Leal, M.O.**, Aguilar-Herrera, A.J., Ramírez-Moreno, M.A., Félix-Herrán L.C., ... Lozoya-Santos, J.J. (2024). Conscious Technologies Projects as a Hub for Real Life Challenges in Engineering Education. *15th Global Engineering Education Conference (EDUCON)*. Kos, Greece: IEEE
- Candela-Leal, M.O.**, Martínez-Díaz, D., Orozco-Romo, C., Aguilar-Herrera, A.J., ... Ramírez-Moreno, M.A. (2023). Biomechanics Digital Twin: Markerless Joint Acceleration Prediction Using Machine Learning and Computer Vision. In *2023 Future of Educational Innovation-Workshop Series Data in Action* (pp. 142-150). Monterrey, Mexico: IEEE [\[paper\]](#)
- Candela-Leal, M.O.**, García-Briones, J.M., Olivas-Martínez, G., Abrego-Ramos, R., ... Lozoya-Santos, J.J. (2021). Real-time Biofeedback System for Interactive Learning using Wearables and IoT. In *6th North American Industrial Engineering and Operations Management (IEOM)* (pp. 2959-2970). Monterrey, Mexico: IEOM (**best undergraduate paper award**) [\[paper\]](#) [\[award\]](#)
- Olivas-Martínez, G., **Candela-Leal, M.O.**, Ocampo-Alvarado, J.C., Acosta-Soto, L.F., ... Ramírez-Moreno, M.A. (2021). Detecting Change in Engineering Interest in Children through Machine Learning using Biometric Signals. In *2021 Machine Learning-Driven Digital Technologies for Educational Innovation Workshop* (pp. 33-40). Monterrey, Mexico: IEEE [\[paper\]](#)
- Aguilar-Herrera, A.J., Delgado-Jimenez, E.A., **Candela-Leal, M.O.**, Olivas-Martínez, G., ... Ramírez-Mendoza, R.A. (2021). Advanced Learner Assistance System's (ALAS) recent results. In *2021 Machine Learning-Driven Digital Technologies for Educational Innovation Workshop* (pp. 26-33). Monterrey, Mexico: IEEE [\[paper\]](#)

INVITED TALKS

- Candela-Leal, M.O.** (2023, April). Computer Vision and Facial Recognition [Invited talk]. Presented to Senior Undergraduate Computer Science Students in *Computing Seminar* at the Universidad Autónoma de Nuevo León, Monterrey, Mexico [\[slides\]](#) [\[certificate\]](#)
- Candela-Leal, M.O.** (2021, July). Biomechanics for the Digital Twin of Performance: Study Cases [Contributed talk]. Presented at the *Conscious Technologies for Smart Communities Workshop*, Monterrey, Mexico [\[slides\]](#) [\[certificate\]](#)

ABSTRACTS

- Candela-Leal, M.O.**, Lemus-Aguilar, M., Mondragon-Estrada, E., Hereida-Marin, I.B., ... Im, K. (2024, March). High-resolution Fetal Subplate Automatic Segmentation [Abstract: Oral presentation]. Presented at the *Fetal Neonatal Neuroimaging and Developmental Science Center (FNNDSC) Research Symposium*, Boston, MA [\[slides\]](#) [\[abstract\]](#) [\[certificate\]](#)
- Esparza-Esparza, S.A., **Candela-Leal, M.O.**, Yun, H.J., Grant, P.E., & Im, K. (2024, March). CHD Fetal Brain Analysis using Combined Quantitative MRI Features and Custom-build Loss Functions [Abstract: Oral presentation]. Presented at the *Fetal Neonatal Neuroimaging and Developmental Science Center (FNNDSC) Research Symposium*, Boston, MA [\[slides\]](#) [\[abstract\]](#)
- Tafoya-Milo, G., Amador-Izaguirre, S.A., **Candela-Leal, M.O.**, You, S., ... Im, K. (2024, March). Gestational Age-Informed VAE-GAN Anomaly Detection for Fetal Brain MRI [Abstract: Oral presentation]. Presented at the *Fetal Neonatal Neuroimaging and Developmental Science Center (FNNDSC) Research Symposium*, Boston, MA [\[slides\]](#) [\[abstract\]](#)
- Candela-Leal, M.O.**, Lozoya-Santos, J.J., & Ramírez-Moreno, M.A. (2023, October). Real-time Dual-feature Mental Fatigue State SVM Classification using EEG Delta Bandpower [Abstract: Poster presentation, Poster #35]. In *19th IEEE-EMBS International Conference on Body Sensor Networks (BSN)*, Boston, MA [\[poster\]](#) [\[abstract\]](#) [\[certificate\]](#)
- Alvarez-Espinoza, G.J., **Candela-Leal, M.O.**, Abrego-Ramos, R., Olivas-Martínez, G., ... Lozoya-Santos, J.J. (2021, October). ALAS: Advanced Learner Assistance System for Engineering Education using Wearable Sensors [Abstract: Poster presentation]. Presented at the *43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)* (p. 5101). <https://embs.org/2021> [\[abstract\]](#)
- Olivas-Martínez, G., Acosta-Soto, L., Ocampo-Alvarado, J., **Candela-Leal, M.O.**, ... Lozoya-Santos, J.J. (2021, October). Identifying Engineering Interest in Children through Machine Learning using Biometric Signals [Abstract: Poster presentation]. Presented at the *43rd Annual*

International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (p. 5244). <https://embc.embs.org/2021> [\[abstract\]](#)

Candela-Leal, M.O., Prado-Maillard, E.C., Avendaño-Arredondo, B.J., Otálora-Millán, M.P., & Jasso-Ayala, J.C. (2021, February). *Harry Potter and the Prisoner of Azkaban* (2004), a Cultural and Ideological Instructor of the Millennial Viewer [Abstract: Oral presentation]. Presented at the *51th Research and Development Congress: International Baccalaureate Extended Essay Session*, Monterrey, Mexico [\[slides\]](#) [\[extended essay \(spanish version\)\]](#) [\[certificate\]](#)

PROJECTS

| | |
|---|-----------------|
| High-res Fetal Subplate Segmentation - (<i>Harvard Medical School</i>) [abstract] - Upsampled, aligned, and corrected subplate segmentation in a higher resolution - Implemented Bivariate Gaussian Smoothing (BGS) for step-like boundaries - Trained an U-Net leveraged by transfer-learning for automatic segmentation | Spring 2024 |
| Non-linear qMRI for CHD Classification - (<i>Harvard Medical School</i>) [abstract] - Designed Recursive RF importance (RRFi) for feature selection (20,453) - Created a 5-feature kNN model with 0.88 F1-score (0.10 better than baseline) - Discovered and proposed new biomarkers in fetal CHD brain identification | Spring 2024 |
| Unsupervised VAE-GAN for Anomaly - (<i>Harvard Medical School</i>) [abstract] - Trained an age-informed GAN model in typically developed fetal brains - Detected abnormalities in Ventriculomegaly (VM) fetal subjects (AUC = 90%) - Designed a novel age encoding: Bidirectional Ordinary Encoding (BOE) | Spring 2024 |
| Real-time Emotion Recognition - (<i>TMX BRAIN Site</i>) [journal] (<i>Neurohumanities Lab</i>) - Created an 8-channel EEG-based VAD 15 emotion recognition model - Designed a channel selection pipeline using lobe-based PCA and RF - Reduced 32-channel DEAP dataset dimensionality into optimal OpenBCI config | Fall 2022, 2023 |
| Digital Twin of the Workspace - (<i>TMX BRAIN Site</i>) [internal poster] - Designed a throughput monitoring system via Human Action Recognition (HAR) - Integrated Velodyne LiDAR pointcloud with CV tracking using CCTV footage - Fitted a RNN HAR model (Walking, Running, Jumping) using CV human keypoints | 2022 |
| Brain on Acting - (<i>UH BRAIN Site</i>) [internal poster] - Recorded a play using 32-electrode EEG on two actors and the director - Calculated bispectrum signal for the combination of pairs using MATLAB - Assessed the difference in moments of gaze via Wilcoxon Rank-Sum Test | Spring 2022 |
| Biomechanical Force Prediction - (<i>TMX BRAIN Site</i>) [journal] [proceeding] (<i>Biomechanics for the Digital Twin</i>) - Used OpenPose API and DLT to markerless track an individual's joints - Designed and trained an RNN using Tensorflow and Keras in Python - Predicted the force exerted by using raw human pose keypoints | 2021 - 2022 |
| Mental Fatigue Prediction - (<i>TMX BRAIN Site</i>) [journal] [proceeding] [poster] (<i>Advanced Learner Assistance System [ALAS]</i>) - Feature engineered 4-electrode EEG & ECG wearables features using R - Developed and tuned a ML algorithm that predicted mental fatigue via Python - Used the least amount of combined features (2) to achieve high accuracy (93%) | 2021 |
| Interest in STEM Prediction - (<i>TMX BRAIN Site</i>) [proceeding] (<i>Talent and Passion Detection Through Biometrics</i>) - Trained ML regression models with biometrics (EEG, ECG, and CV emotions) - Predicted change in vocational interest after a STEM lecture using Python - Validated with STEM-CIS psychometric test, the algorithm achieved 80% accuracy | Fall 2021 |

HONORS AND AWARDS

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|---|-----------|
| Outstanding Student Award (top 1% best 2022 engineering trajectories) | 2023 |
| 1 st Place - Research and Improvement Proposals at 18 th Conexión Tec | Fall 2021 |
| 1 st Place - Undergraduate Paper Competition at 6 th NA IEOM | 2021 |
| Outstanding IB Extended Essay - 51 th Research and Development Congress | 2021 |
| Scholarship for Academic Talent - <i>Tecnológico de Monterrey</i> | 2020 |
| 2 nd Place - Nuevo León State Chess Tournament (Youth Category) | 2020 |

TEACHING

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|---|-------------|
| German A2 Teacher - <i>Mentoor</i> | 2022-2024 |
| Middle School Math and Spanish Teacher - <i>Aprendamos Juntos</i> | 2021-2022 |
| Independent High School Physics Teacher | Fall 2019 |
| FIRST® LEGO® League Mentor - <i>Little Minds</i> | Spring 2019 |

SKILLS SUMMARY

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| Languages | Python (3 years), MATLAB (2 years), R (1 year), SQL (3 months) English (C1), German (B1), Spanish |
| Frameworks | Numpy, Scipy, Matplotlib, Pandas, Scikit-learn, TensorFlow, Keras, BrainFlow, Flask Lattice, Dplyr, Tidyr, Caret, GA, Ggplot, Shiny |
| Tools | FSL, FreeSurfer, MRtrix3, ANTs, NiBabel, PyDicom, IRTK GitHub, Anaconda, CUDA, cuDNN, Tableau, Microsoft Excel, Overleaf, \LaTeX |
| Platforms | Linux, ROS, Windows, Arduino, Raspberry |
| Soft Skills | Leadership, Problem Solving, Teamwork, Self-Learning, Time Management |

AUDITED COURSES

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|--|-------------|
| MIT - Department of Brain and Cognitive Sciences (BCS) | |
| 9.014 Quantitative Methods and Computational Models in Neuroscience - <i>M. Jazayeri</i> | Fall 2023 |
| 9.66 Computational Cognitive Science - <i>J. Tenenbaum</i> | Fall 2023 |
| Harvard - Department of Psychology | |
| PSY 3340 Research Seminar in Cognition, Brain, and Behavior - <i>T. Ullman</i> | Spring 2024 |
| PSY 1322 The Cognitive Science of Making Up Your Mind - <i>T. Ullman</i> | Spring 2024 |

COURSERA SPECIALIZATIONS

| | |
|--|--------------|
| Johns Hopkins University | |
| Data Science | (288 h) 2021 |
| Neuroscience and Neuroimaging | (42 h) 2020 |
| Health Informatics | (56 h) 2020 |
| Patient Safety | (54 h) 2020 |
| University of Michigan | |
| Applied Data Science with Python | (145 h) 2021 |
| DeepLearning.AI | |
| AI for Medicine | (72 h) 2021 |
| Imperial College London | |
| Infectious Disease Modelling | (65 h) 2021 |
| Alberta Machine Intelligence Institute | |
| Machine Learning: Algorithms in the Real World | (41 h) 2020 |
| IBM - edX | |
| Fundamentals of AI | (80 h) 2020 |
| Rice University | |
| Fundamentals of Immunology | (69 h) 2020 |
| University of Colorado System | |
| Applied Cryptography | (34 h) 2020 |
| University System of Georgia | |
| Six Sigma Green Belt | (49 h) 2020 |
| Duke University | |
| Excel to MySQL: Analytic Techniques for Business | (109 h) 2021 |