

# Milton O. Candela-Leal

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[miltoncandela.github.io](https://miltoncandela.github.io)

## EDUCATION

- Tecnológico de Monterrey** - Monterrey, Mexico 2020 - Dec 2024  
BSc in Biomedical Engineering (95/100 = 3.8/4.0 GPA)
- International Baccalaureate** - Monterrey, Mexico 2018 - 2020  
Math HL, Psychology SL, Physics SL, ...  
Thesis: [Film & Psychology] *Harry Potter and the Prisoner of Azkaban* (2004), a Cultural and Ideological Instructor of the Millennial Viewer

## RESEARCH EXPERIENCE

- Tecnológico de Monterrey** - Monterrey, Mexico Mar 2021 - Jul 2023, Fall 2024  
*NSF IUCRC BRAIN Center*  
Advisor: Prof. Mauricio A. Ramírez-Moreno, PhD  
Projects: Cognitive state prediction via biometrics (EEG, ECG, Computer Vision) and machine learning: Mental fatigue, interest in STEM, emotion.  
- Force prediction employing Computer Vision's keypoints and RNN.
- MIT Media Lab** - Boston, MA, USA Summer 2024  
*Massachusetts Institute of Technology*  
Advisor: Samantha Chan, PhD  
Project: EEG slow wave brain analysis for sleep quality improvement.
- Harvard Medical School** - Boston, MA, USA Aug 2023 - Jul 2024  
*Boston Children's Hospital*  
Advisor: Prof. Kiho Im, PhD  
Projects: Fetal MRI subplate segmentation (attention U-Net), non-linear qMRI for congenital heart disease classification, MICCAI FeTA Challenge 2024.
- University of Houston** - Houston, TX, USA Spring 2022  
*NSF IUCRC BRAIN Center*  
Advisor: Prof. Jose L. Contreras-Vidal, PhD  
Project: EEG functional connectivity and bispectrum analysis between actors.

## JOURNAL ARTICLES

(† indicates equal contribution)

- Mandujano-Granillo, J.A., **Candela-Leal, M.O.**, Ortiz-Vazquez, J.J., ... Lozoya-Santos, J.J. (2024). Human-Vehicle Interfaces: A Review for Autonomous Electric Vehicles. *IEEE Access*, 12, 121635–121658. doi:[10.1109/ACCESS.2024.3450439](https://doi.org/10.1109/ACCESS.2024.3450439)
- Blanco-Ríos, M.A.†, **Candela-Leal, M.O.**†, Orozco-Romo, C., ... 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. doi:[10.3389/fnhum.2024.1319574](https://doi.org/10.3389/fnhum.2024.1319574). PubMed PMID:[38545515](https://pubmed.ncbi.nlm.nih.gov/38545515/)
- Candela-Leal, M.O.**, Gutiérrez-Flores, E.A., Presbítero-Espinosa, G., ... 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. doi:[10.3390/app12115424](https://doi.org/10.3390/app12115424)
- Ramírez-Moreno, M.A., Carrillo-Tijerina, P., **Candela-Leal, M.O.**, ... 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. doi:[10.3390/ijerph182211891](https://doi.org/10.3390/ijerph182211891). PubMed PMID:[34831645](https://pubmed.ncbi.nlm.nih.gov/34831645/)

## BOOK CHAPTERS

- Lozoya-Santos, J.J., Ramírez-Moreno, M.A., **Candela-Leal, M.O.**, ... Ramirez-Mendoza, R.A. (2022). Current and Future Biometrics: Technology and Applications. In R.A. Ramirez-Mendoza, J.J. Lozoya-Santos, R. Zavala-Yoé, ... H.G. Gonzalez-Hernandez (Eds.), *Biometry: Technology, Trends and Applications* (1st ed., pp. 1–30). Boca Raton, FL: CRC Press. doi:[10.1201/9781003145240-1](https://doi.org/10.1201/9781003145240-1). ISBN: 9781003145240.

## CONFERENCE PROCEEDINGS

- Candela-Leal, M.O.**, Lozoya-Santos, J.J., Ramírez-Moreno, M.A. (*accepted*). Task Completion Time Estimation via EEG Theta Bandpower during Chess-Based Problem-Solving. In IEEE-EMBS BHI. Houston, TX: IEEE
- Candela-Leal, M.O.**, Aguilar-Herrera, A.J., Ramírez-Moreno, M.A., ... Lozoya-Santos, J.J. (2024). Conscious Technologies Projects as a Hub for Real Life Challenges in Engineering Education. In 15<sup>th</sup> EDUCON (pp. 665-675). Kos, Greece: IEEE. doi:[10.1109/EDUCON60312.2024.10578738](https://doi.org/10.1109/EDUCON60312.2024.10578738)
- Candela-Leal, M.O.**, Martínez-Díaz, D., Orozco-Romo, C., ... Ramírez-Moreno, M.A. (2023). Biomechanics Digital Twin: Markerless Joint Acceleration Prediction Using Machine Learning and Computer Vision. In 3<sup>rd</sup> FEI-WS (pp. 142-150). Monterrey, Mexico: IEEE. doi:[10.1109/IEEECONF56852.2023.10104757](https://doi.org/10.1109/IEEECONF56852.2023.10104757)
- Candela-Leal, M.O.**, García-Briones, J.M., Olivas-Martínez, G., ... Lozoya-Santos, J.J. (2021). Real-time Biofeedback System for Interactive Learning using Wearables and IoT. In 6<sup>th</sup> North American IEOM (pp. 2959-2970). Monterrey, Mexico: IEOM (**best undergraduate paper award**). doi:[10.46254/NA06.20210487](https://doi.org/10.46254/NA06.20210487)
- Olivas-Martínez, G., **Candela-Leal, M.O.**, Ocampo-Alvarado, J.C., ... Ramírez-Moreno, M.A. (2021). Detecting Change in Engineering Interest in Children through Machine Learning using Biometric Signals. In 1<sup>st</sup> FEI-WS (pp. 33-40). Monterrey, Mexico: IEEE. doi:[10.1109/IEEECONF53024.2021.9733772](https://doi.org/10.1109/IEEECONF53024.2021.9733772)
- Aguilar-Herrera, A.J., Delgado-Jimenez, E.A., **Candela-Leal, M.O.**, ... Ramirez-Mendoza, R.A. (2021). Advanced Learner Assistance System's (ALAS) recent results. In 1<sup>st</sup> FEI-WS (pp. 26-33). Monterrey, Mexico: IEEE. doi:[10.1109/IEEECONF53024.2021.9733770](https://doi.org/10.1109/IEEECONF53024.2021.9733770)

## INVITED TALKS

- Candela-Leal, M.O.**, & Valdivia-Padilla, A. (2024, August). Digital Twins in Education: Enhancing Student Well-being and Academic Performance with Biometric Insights and Machine Learning. U21 Health Sciences Group 2024 Annual Meeting, Amsterdam University Medical Centers, Amsterdam, Netherlands. (Theme: Data Driven Health Care and Teaching) (**student speaker award**) [[slides](#)]
- Candela-Leal, M.O.** (2023, April). Computer Vision and Facial Recognition. Presented to Senior Undergraduate Computer Science Students at Computing Seminar Course, Universidad Autónoma de Nuevo León (UANL) [one of Mexico's top eight universities], Monterrey, Mexico [[slides](#)]

## UNDER REVIEW

- Candela-Leal, M.O.**, Alanis-Espinosa, M., Murrieta-González, J., ... Ramírez-Moreno, M.A. (*under review*). Neurocognitive Insights into STEM Learning: An Integrated Analysis of Bandpower and Functional Connectivity among Youth. SAGE Open
- Ramírez-Moreno, M.A., Romero-Días, D.C., **Candela-Leal, M.O.**, ... Lozoya-Santos, J.J. (*under review*). Workplace measures of mental fatigue. In The Scientific Basis of Fatigue. Academic Press-Elsevier

## INTERNATIONAL CONFERENCE PRESENTATIONS

- 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 [Poster #35]. **Poster presentation** at the 19<sup>th</sup> IEEE-EMBS BSN, Boston, MA
- Alvarez-Espinoza, G.J., **Candela-Leal, M.O.**, Abrego-Ramos, R., ... Lozoya-Santos, J.J. (2021, October). ALAS: Advanced Learner Assistance System for Engineering Education using Wearable Sensors. **Poster presentation** at the 43<sup>rd</sup> IEEE-EMBS (p. 5101). <https://embs.org/2021>
- Olivas-Martínez, G., Acosta-Soto, L., **Candela-Leal, M.O.**, ... Lozoya-Santos, J.J. (2021, October). Identifying Engineering Interest in Children through Machine Learning using Biometric Signals. **Poster presentation** at the 43<sup>rd</sup> IEEE-EMBS (p. 5244). <https://embs.org/2021>

## CONFERENCE PRESENTATIONS

### Oral Presentations

FNNDS Research Symposium	(Boston, MA)	2024
Conscious Technologies for Smart Communities Workshop	(Virtual)	2021
51 <sup>th</sup> Research and Development Congress	(Virtual)	2021

### Poster Presentations

NSF BRAIN Summer Annual IAB Meeting	(Phoenix, AZ)	2023
21 <sup>st</sup> Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2023
BMEX: Engineering and Health Sciences Symposium	(Monterrey, Mexico)	2023
20 <sup>th</sup> Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2022
NSF BRAIN Summer Annual IAB Meeting	(Houston, TX)	2022

19 <sup>th</sup> Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2022
18 <sup>th</sup> Expo Ingenierías at Conexión Tec	(Virtual)	2021
17 <sup>th</sup> Expo Ingenierías at Conexión Tec	(Virtual)	2021

## HONORS AND AWARDS

Outstanding Student Award (1% engineering trajectories), Tecnológico de Monterrey	2023, 2024
Student Speaker Award (\$1600 USD), U21 Health Sciences Group	2024
1 <sup>st</sup> Place - Undergraduate Student Paper Competition, 6 <sup>th</sup> North American IEOM	2021
1 <sup>st</sup> Place - R&D Improvement Proposals (\$250 USD), 18 <sup>th</sup> Conexión Tec	2021
Academic Talent Scholarship, Tecnológico de Monterrey	2020

## TEACHING

German A2 Teacher, Mentoora	2022-2024
Middle School Math and Spanish Teacher, Aprendamos Juntos	2021-2022
Independent High School Physics Teacher	Fall 2019
FIRST® LEGO® League Mentor, Little Minds	Spring 2019

## SKILLS SUMMARY

<b>Languages</b>	Python (3 years), MATLAB (2 years), R (1 year), Shell (3 months), SQL (3 months) English (C1), German (B1), Spanish
<b>Frameworks</b>	Numpy, Scipy, Pandas, Matplotlib, Scikit-learn, OpenCV, TensorFlow, Keras, BrainFlow Lattice, Dplyr, TidyR, Caret, GA, Ggplot, Shiny
<b>Tools</b>	FSL, FreeSurfer, MRtrix3, ANTs, NiBabel, PyDicom, IRTK, NUC, TorchIO
<b>Platforms</b>	Git, Anaconda, CUDA, CMake, Tableau, Microsoft Excel, G*Power, Overleaf, $\LaTeX$ Linux, ROS, Windows, Arduino, Raspberry

## PROJECTS

<b>FeTA Challenge @ MICCAI - Harvard Medical School</b>	2024
<ul style="list-style-type: none"> <li>- 7-label dataset (CSF, GM, WM, Ventricles, Cerebellum, Deep GM, Brainstem)</li> <li>- Pre-processed multi-site data; evaluated model zoo performance on in-house data</li> <li>- Trained a MRI U-Net model with spatial, intensity and resolution augmentation</li> </ul>	
<b>High-res Fetal Subplate Segmentation - Harvard Medical School</b>	2024
<ul style="list-style-type: none"> <li>- Upsampled, aligned, and corrected subplate segmentation in a higher resolution</li> <li>- Implemented Bivariate Gaussian Smoothing (BGS) for step-like borders</li> <li>- Trained a MRI U-Net leveraged by transfer-learning for automatic segmentation</li> </ul>	
<b>Non-linear qMRI for CHD Classification - Harvard Medical School</b>	2024
<ul style="list-style-type: none"> <li>- Designed Recursive RF importance (RRFi) for feature selection (20,453)</li> <li>- Created a 5-feature kNN model with 0.88 F1-score (0.10 better than baseline)</li> <li>- Discovered and proposed new biomarkers in fetal CHD brain identification</li> </ul>	
<b>Unsupervised VAE-GAN for Anomaly - Harvard Medical School</b>	2024
<ul style="list-style-type: none"> <li>- Trained an age-informed GAN model in typically developed fetal brains</li> <li>- Detected abnormalities in Ventriculomegaly (VM) fetal subjects (AUC = 90%)</li> <li>- Designed a novel age encoding: Bidirectional Ordinary Encoding (BOE)</li> </ul>	
<b>Cognitive Load Dynamics in Chess - Tecnológico de Monterrey</b>	2023
<ul style="list-style-type: none"> <li>- Designed, led, and processed 37 chess players under ambient/white noise</li> <li>- Calculated Task Completion Time (TCT) based on EEG biomarker theta C4</li> <li>- Validated TCT with Cognitive Load Theory (CLT), stratifying by chess level</li> </ul>	
<b>Real-time Emotion Recognition - Tecnológico de Monterrey</b> (Neurohumanities Lab)	2022-2023
<ul style="list-style-type: none"> <li>- Created an 8-channel EEG-based VAD 15 emotion recognition model</li> <li>- Designed a channel selection pipeline using lobe-based PCA and RF</li> <li>- Reduced 32-channel DEAP dataset dimensionality into optimal OpenBCI config</li> </ul>	
<b>Digital Twin of the Workspace - Tecnológico de Monterrey</b>	2022
<ul style="list-style-type: none"> <li>- Designed a throughput monitoring system via Human Action Recognition (HAR)</li> <li>- Integrated Velodyne LiDAR pointcloud with CV tracking using CCTV footage</li> <li>- Fitted a RNN HAR model (Walking, Running, Jumping) using CV human keypoints</li> </ul>	
<b>Brain on Acting - University of Houston</b>	2022
<ul style="list-style-type: none"> <li>- Recorded a play using 32-electrode EEG on two actors and the director</li> <li>- Calculated bispectrum signal for the combination of pairs using MATLAB</li> </ul>	

- Assessed the difference in moments of gaze via Wilcoxon Rank-Sum Test	
<b>Biomechanical Force Prediction</b> - <i>Tecnológico de Monterrey</i> ( <i>Biomechanics for the Digital Twin</i> )	2021-2022
- 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	
<b>Mental Fatigue Prediction</b> - <i>Tecnológico de Monterrey</i> ( <i>Advanced Learner Assistance System [ALAS]</i> )	2021
- 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%)	
<b>Interest in STEM Prediction</b> - <i>Tecnológico de Monterrey</i> ( <i>Talent and Passion Detection Through Biometrics</i> )	2021
- 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	

## MEMBERSHIPS

SACNAS	March 2024 - March 2025
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## AUDITED COURSES

<b>Harvard - Department of Psychology</b>	
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
<b>MIT - Department of Brain and Cognitive Sciences (BCS)</b>	
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

## PROFESSIONAL DEVELOPMENT

<b>MIT - Department of Brain and Cognitive Sciences (BCS)</b>	
(Workshop) Exploring New Horizons: Strategies for Success in new Scientific Field	2024
(Symposium) McGovern Institute: Transformational Strategies in Mental Health	2024
(Symposium) McGovern-MEGIN: MEGnificent brain discoveries	2024
<b>Tecnológico de Monterrey</b>	
(Course) Data Science - <i>Crystal System</i>	(150 h) 2022
(Workshop) Biosignal processing in Python - <i>Neuroengineering and Neuroacoustics</i>	2021
(Hackathon) HackMTY	2021
(Hackathon) B-Hack - <i>43<sup>th</sup> National Biomedical Engineering Congress</i>	2020
(Course) Systemic Change - <i>Ashoka</i>	2020

## COURSERA SPECIALIZATIONS

<b>Johns Hopkins University</b>	
Data Science	(288 h) 2021
Neuroscience and Neuroimaging	(42 h) 2020
Health Informatics	(56 h) 2020
Patient Safety	(54 h) 2020
Healthcare IT Support	(20 h) 2021
<b>University of Michigan</b>	
Applied Data Science with Python	(145 h) 2021
<b>DeepLearning.AI</b>	
AI for Medicine	(72 h) 2021
<b>Imperial College London</b>	
Infectious Disease Modelling	(65 h) 2021
<b>Alberta Machine Intelligence Institute</b>	
Machine Learning: Algorithms in the Real World	(41 h) 2020
<b>IBM - edX</b>	
Fundamentals of AI	(80 h) 2020
<b>Rice University</b>	

Fundamentals of Immunology	(69 h) 2020
<b>University of Colorado System</b>	
Applied Cryptography	(34 h) 2020
<b>University System of Georgia</b>	
Six Sigma Green Belt	(49 h) 2020
<b>Duke University</b>	
Excel to MySQL: Analytic Techniques for Business	(109 h) 2021