

Milton O. Candela-Leal

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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] <i>Harry Potter and the Prisoner of Azkaban</i> (2004), a Cultural and Ideological Instructor of the Millennial Viewer	

RESEARCH EXPERIENCE

MIT Media Lab - Boston, MA, USA	Summer 2024
<i>Massachusetts Institute of Technology</i>	
Advisor: Samantha Chan, PhD	
Project: EEG slow wave brain analysis for sleep quality improvement.	
Harvard Medical School - Boston, MA, USA	2023 - 2024
<i>Boston Children's Hospital</i>	
Advisor: Prof. Kiho Im, PhD	
Projects: Fetal MRI subplate segmentation (attention U-Net), non-linear qMRI for congenital heart disease classification, VAE-GAN for anomaly detection.	
Tecnológico de Monterrey - Monterrey, Mexico	2021 - 2023
<i>NSF IUCRC BRAIN Center</i>	
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.	
University of Houston - Houston, TX, USA	Spring 2022
<i>NSF IUCRC BRAIN Center</i>	
Advisor: Prof. Jose L. Contreras-Vidal, PhD	
Project: EEG functional connectivity and bispectrum analysis between actors.	

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. 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., 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. doi:[10.3390/app12115424](https://doi.org/10.3390/app12115424)
- Ramírez-Moreno, M.A., Carrillo-Tijerina, P., **Candela-Leal, M.O.**, Alanis-Espinosa, 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. 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., Diaz-Armas, G.G., **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, L.M. Alonso-Valerdi, ... 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.

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 travel award**)

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

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. In 15th Global Engineering Education Conference (EDUCON). Kos Island, 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., 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. 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., 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**). doi:[10.46254/NA06.20210487](https://doi.org/10.46254/NA06.20210487)

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. 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.**, Olivas-Martinez, G., ... Ramirez-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. doi:[10.1109/IEEECONF53024.2021.9733770](https://doi.org/10.1109/IEEECONF53024.2021.9733770)

UNDER REVIEW

Candela-Leal, M.O., Alanis-Espinosa, M., Murrieta-González, J., Lozoya-Santos, J.J., & Ramírez-Moreno, M.A. (*under review*). Neurocognitive Insights into STEM Learning: An Integrated Analysis of Bandpower and Functional Connectivity among Youth. Thinking Skills and Creativity

Mandujano-Granillo, J.A., **Candela-Leal, M.O.**, Ortiz-Vazquez, J.J., Ramírez-Moreno, M.A., ... Lozoya-Santos, J.J. (*under review*). Human-Vehicle Interfaces: A Review for Autonomous Electric Vehicles. IEEE Access

Ramírez-Moreno, M.A., Romero-Días, D.C., **Candela-Leal, M.O.**, Hernández-Mustieles, M.A., & Lozoya-Santos, J.J. (*under review*). Workplace measures of mental fatigue. In The Scientific Basis of Fatigue. Academic Press-Elsevier

Candela-Leal, M.O., Lozoya-Santos, J.J., Ramírez-Moreno, M.A. (*under review*). Task Completion Time Estimation via EEG Theta Bandpower during Chess-Based Problem-Solving. IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI). Houston, TX: IEEE

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 19th IEEE-EMBS International Conference on Body Sensor Networks (BSN), Boston, MA

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. **Poster presentation** at the 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBS) (p. 5101). <https://embs.embs.org/2021>

Olivas-Martinez, 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. **Poster presentation** at the 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBS) (p. 5244). <https://embs.embs.org/2021>

CONFERENCE PRESENTATIONS

Oral Presentations

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

Poster Presentations

NSF BRAIN Summer Annual IAB Meeting	(Phoenix, AZ)	2023
21 st Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2023
BMEX: Engineering and Health Sciences Symposium	(Monterrey, Mexico)	2023
20 th Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2022
NSF BRAIN Summer Annual IAB Meeting	(Houston, TX)	2022
19 th Expo Ingenierías at Conexión Tec	(Monterrey, Mexico)	2022
18 th Expo Ingenierías at Conexión Tec	(Virtual)	2021
17 th Expo Ingenierías at Conexión Tec	(Virtual)	2021

HONORS AND AWARDS

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

TEACHING

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

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

PROJECTS

High-res Fetal Subplate Segmentation - <i>Harvard Medical School</i>	2024
<ul style="list-style-type: none"> - Upsampled, aligned, and corrected subplate segmentation in a higher resolution - Implemented Bivariate Gaussian Smoothing (BGS) for step-like borders - Trained an U-Net leveraged by transfer-learning for automatic segmentation 	
Non-linear qMRI for CHD Classification - <i>Harvard Medical School</i>	2024
<ul style="list-style-type: none"> - 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 	
Unsupervised VAE-GAN for Anomaly - <i>Harvard Medical School</i>	2024
<ul style="list-style-type: none"> - 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) 	
Real-time Emotion Recognition - <i>Tecnológico de Monterrey</i> (<i>Neurohumanities Lab</i>)	2022-2023
<ul style="list-style-type: none"> - 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 	
Digital Twin of the Workspace - <i>Tecnológico de Monterrey</i>	2022
<ul style="list-style-type: none"> - 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 	
Brain on Acting - <i>University of Houston</i>	2022
<ul style="list-style-type: none"> - 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 	
Biomechanical Force Prediction - <i>Tecnológico de Monterrey</i>	2021-2022

(Biomechanics for the Digital Twin)

- 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

Mental Fatigue Prediction - *Tecnológico de Monterrey*

2021

(Advanced Learner Assistance System [ALAS])

- 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%)

Interest in STEM Prediction - *Tecnológico de Monterrey*

2021

(Talent and Passion Detection Through Biometrics)

- 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

AUDITED COURSES

Harvard - Department of Psychology

PSY 3340 Research Seminar in Cognition, Brain, and Behavior - *T. Ullman*

Spring 2024

PSY 1322 The Cognitive Science of Making Up Your Mind - *T. Ullman*

Spring 2024

MIT - Department of Brain and Cognitive Sciences (BCS)

9.014 Quantitative Methods and Computational Models in Neuroscience - *M. Jazayeri*

Fall 2023

9.66 Computational Cognitive Science - *J. Tenenbaum*

Fall 2023

PROFESSIONAL DEVELOPMENT

MIT - Department of Brain and Cognitive Sciences (BCS)

(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

Tecnológico de Monterrey

(Course) Data Science - *Crystal System*

(150 h) 2022

(Workshop) Biosignal processing in Python - *Neuroengineering and Neuroacoustics*

2021

(Hackathon) HackMTY

2021

(Hackathon) B-Hack - *43th National Biomedical Engineering Congress*

2020

(Course) Systemic Change - *Ashoka*

2020

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

Healthcare IT Support

(20 h) 2021

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