Pablo Tostado-Marcos, Ph.D

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Work Experience

Meta Reality Labs (CTRL-Labs), NYC, NY — 08/2024 - current
Research Scientist - Full-Time

Translational Neuroengineering Lab — 09/2019 - 07/2024
Research Scientist - PhD candidate & Postdoctoral Researcher
University of California San Diego | PIs: Vikash Gilja & Timothy Q. Gentner

- Utilized statistical and machine learning-based modeling approaches to investigate the neural mechanisms underlying vocal production.
- Developed a novel ML-based model architecture aimed at neural-to-audio (spectrogram) translation using SOTA audio codecs for BCI applications.
- Developed a pioneering surgical approach for monitoring populations of hundreds of neurons in freely-singing birds utilizing Neuropixels probes.

Meta Reality Labs (CTRL-Labs), NYC, NY — 06/2022 - 10/2022
Research Scientist - Intern

- Worked on wrist-based wearable technology that translates electromyographic signals (EMG) into digital commands.
- Collected multimodal datasets and developed ML-based approaches to identify and correct prevalent failure modes in our data acquisition pipelines that resulted in increased accuracy of our generalized models.

Integrated Systems Neuroengineering Lab — 09/2017 - 09/2019
Research Scientist - PhD candidate
University of California San Diego | PI: Gert Cauwenberghs

- Developed new types of artificial neural networks that owing to their stochastic nature are more resilient in learning and generalizing to complex patterns in big data, while operating at much less energy and complexity than current AI/ML hardware.
- Validated these architectures in classification tasks using public image datasets.

Limb Motor Control Lab — 09/2016 - 09/2017
Research Scientist - Research Scholar
Northwestern University, Chicago | PI: Lee E. Miller

- Developed a wireless interface aimed at restoration of reaching and grasping function following paralysis in Rhesus macaques through intracortically-controlled functional electrical stimulation (FES) of upper limb muscles.
- Developed novel model architectures for sequence-to-sequence translation (neural activity to EMG signals) using LSTMs.

GMV Innovating Solutions, Madrid, Spain 09/2015 - 09/2016
Software Engineer

- Designed and built a treatment planning and visualization tool to assist with the task of Intraoperative Radiation Therapy in patients with breast cancer.
- Worked extensively with radiologists and hospitals to validate prototypes.

Brain & Behavior Lab 09/2014 - 09/2015

Research Scientist - MSc student
Imperial College London, UK | PI: Aldo Faisal

- Built a real-time system for 3D end-point and grasp control of robotic actuators using Motion Capture and Eye-Tracking technology.
- This gaze-driven system achieved under 2cm error in the 3D Euclidean space and users reported intuitive, low-cognitive load control right from their first trial.

Education

University of California San Diego, La Jolla, CA 09/2017 - 09/2023
Ph.D in Bioengineering | Specialization in ML/AI and Computational Neuroscience
Dissertation: A songbird model for vocal prostheses - Multi-region neural population dynamics of vocal production.

Imperial College London, London, UK 09/2014 - 09/2015
MSc in Biomedical Engineering | Specialization in Neurotechnology (Distinction)
Thesis: Continuous calibration and gaze-driven end-point grasp control of robotic actuators.

Universidad Carlos III de Madrid, Madrid, Spain 09/2010 - 09/2014
Bachelor of Science in Bioengineering | Specialization in Medical Devices
Thesis: Computational model of Skin-On-A-Chip device.

Publications

- **Tostado-Marcos P**, Arneodo EM, Brown DE, Perez XA, Kadwory A, Stanwicks LL, Alothman A, Gentner TQ, Gilja V (2024). "Neural population dynamics of songbird RA and HVC during learned motor-vocal behavior" - in press.
- Brianna M. Karpowicz, Joel Ye, Chaofei Fan, **Pablo Tostado-Marcos**, [...], Chethan Pandarinath (2024). "Few-shot Algorithms for Consistent Neural Decoding (FALCON) Benchmark" - Conference on Neural Information Processing Systems (NeurIPS).
- Sainburg T, McPherson TS, Arneodo EM, Rudraraju S, Turvey M, Thielman B, **Tostado-Marcos P**, Thielk M, Gentner TQ (2024). "Context-dependent sensory modulation underlies Bayesian vocal sequence perception" - Nature Neuroscience.
- Alothman A, Wei C, **Tostado-Marcos P**, Trautmann E, Arneodo EM, Gentner TQ, Gilja V (2023). "Unsupervised channel compression methods in neural prostheses design" - submitted.

- **Tostado-Marcos P**, Pedroni B, Cauwenberghs G (2019) "Performance Trade-offs in Weight Quantization for Memory-Efficient Inference" - IEEE Artificial Intelligence Circuits and Systems (AICAS).
- Barroso FO, Yoder B, Tentler D, Wallner JJ, Kinkhabwala AA, Jantz MK, Flint RD, **Tostado-Marcos P**, Pei E, Satish AD, Brodnick SK, Suminski AJ, Williams JC, Miller LE, Tresch MC (2019). "Decoding neural activity to predict rat locomotion using intracortical and epidural arrays" - Journal of Neural Engineering.
- Barroso FO, Yoder B, Wallner J, Jantz MK, **Tostado-Marcos P**, Pei E, Tysseling V, Miller LE, Tresch MC (2018). "Cortically controlled FES for restoration and rehabilitation of function following SCI in rats" - International Conference on NeuroRehabilitation (ICNR).
- **Tostado-Marcos P**, Abbott WW, Faisal AA (2016). "3D gaze cursor: continuous calibration and end-point grasp control of robotic actuators" - IEEE International Conference of Robotics and Automation (ICRA).

  Video: Gaze-driven robotic actuator

Teaching Experience

Mentored 7 Ph.D and MS students in neuroengineering and AI/ML research projects.
Graduate Teaching Assistant
BENG 2: Introduction to Computer Programming, U.C. San Diego
BENG 140b: Neurophysiology, U.C. San Diego
BENG 230B: Cell and Molecular Biology, U.C. San Diego
BENG 260/PHYS 270: Neurodynamics, U.C. San Diego

Personal Projects

derivator-ML: Transformer-based Language Model (LM) trained to generate derivatives of input functions (text-to-text) - San Diego 2024
neural-rabbit: Explored Temporal Convolutional Neural Network architectures to decode rabbit ECoG signals into various presented visual stimuli - San Diego 2023
IEEE Neurotech Entrepreneurs Workshop - Phoenix 2019
Hack/HLTH (Hackathon winner): iOS app that uses sequenced genomic data to make personalized predictions on drug metabolism - Las Vegas 2018
H1rnN1: Open sourced research project using recurrent neural networks for predicting protein mutations in Influenza virus - San Diego 2018

Grants & Awards >$500k

Kavli Institute for Brain & Mind Innovative Research: $50k research grant - 2021
Travel grant: IEEE AICAS, Hsinchu, Taiwan - 2019
Fulbright Fellow: Tuition and stipend for 2 years of graduate studies - 2018
La Caixa Fellow: Tuition and stipend for 2 years of graduate studies - 2016
Distinction: Highest honors awarded by Imperial College to MSc graduates - 2015
UCEAP International Mobility Scholarship: Tuition and stipend - UC Irvine 2012
Excellence Scholarship: University tuition fees - Spanish Government 2010

Skills

Programming languages: Python, C++, C, C#/DevExpress, MATLAB

Frameworks: Pytoch, Tensorflow/Keras, NumPy, SciPy, Scikit-learn, Pandas

Hardware: 3D printing, Solidworks, Onshape

Other: Git, Linux/Unix systems, Containers (Docker), Protobuf, AWS, Adobe Illustrator, Adobe Premiere Pro, Adobe Photoshop, Sketch, LaTeX

Languages

English, Spanish, Italian, French