Emanuel Azcona

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EDUCATION

Northwestern University

- **Ph.D. Electrical Engineering, expected June 2022**
  Dissertation Focus: *Analysis of Graph Convolutional Networks on Mesh Manifolds Representing Human Brain Morphology: A Deep Learning Perspective on Structural Brain Atrophy in Association to Alzheimer's Disease*
- **M.S. Electrical Engineering, June 2019**

New York University

- **B.S. Electrical Engineering, May 2017, *cum laude***
  Thesis: *Supervised Machine Learning Approach to Predicting NBA Playoff Contention Using Individual Player Statistics*

TECHNICAL SKILLS

Scripting Languages: Python, MATLAB, C++, LaTeX, Bash, SQL, LabVIEW

Tools/Libraries: Tensorflow, Keras, PyTorch, Matplotlib, NumPy/SciPy, Pandas, Scikit-learn, Git

INDUSTRY / RESEARCH EXPERIENCE

PhD Candidate & Research Assistant *September 2017 – Present*

Katsaggelos Image & Video Processing Lab, Northwestern University *Evanston, IL*

- Developed novel residual graph neural network (NN) approach to using mesh manifolds of human brain cortex and subcortical structures to classify subjects with Alzheimer's dementia (AD) apart from healthy controls (HC) with an accuracy of 96.35%
- Benchmarked residual graph NN model versus other machine learning methods such as a standard multilayer perceptron, ridge, and random forest classifier for the AD versus HC problem, for which it outperformed every time
- Adapted network visualization approach: "Grad-CAM," for graphs to interpret influential brain regions in the AD vs HC task
- Developing variational mesh autoencoder for generating human brain meshes conditioned on features associated to aging

Artificial Intelligence Intern II *June – August 2019*

Stats Perform *Chicago, IL*

- Replicated my own research findings from the previous summer's work in compression, reconstruction, and generation of player tracking data in soccer from the France Ligue 1 using graph convolutional networks (GCNs)
- Developed and pushed GCN libraries written in Python into production for use in company products & internal research

Artificial Intelligence Intern *June – August 2018*

Stats Perform *Chicago, IL*

- Developed scripts for accessing and filtering multi-agent soccer tracking data from Amazon Web Services (AWS) database
- Worked in an Agile, collaborative environment surveying machine learning solutions for multi-agent tracking prediction
- Designed graph convolutional autoencoder for compressing human tracking data to with a 1mm average reconstruction error
- Developed project template for temporal-graph convolutional network for predicting future player tracking data prior to leaving

Research Assistant *May – August 2016*

New York University Department of Electrical & Computer Engineering *New York, NY*

- Analyzed optical coherence tomography for correlating retinal thickness in patients with(out) Parkinson's disease
- Formulated real-time Python implementation of digital sound synthesis tool using the Function Transformation Method to model string and drum instruments described by partial differential equations

PUBLICATIONS / WRITTEN WORK

- **Azcona E.A.** *et al.* (2020) Interpretation of Brain Morphology in Association to Alzheimer's Disease Dementia Classification Using Graph Convolutional Networks on Triangulated Meshes. *Proceedings of International Workshop on Shape in Medical Imaging in Conjunction with MICCAI 2020.* LNCS, vol 12474. Springer. https://doi.org/10.1007/978-3-030-61056-2_8
- Wu Y., Besson P., **Azcona E.A**, et al. (2020, October 15). Novel age-dependent cortico-subcortical morphologic interactions predict fluid intelligence: A multi-cohort geometric deep learning study. Preprint available on bioRxiv. https://doi.org/10.1101/2020.10.14.331199. *Submitted for journal peer review*.