GASSER ELBANNA

Graduate Research Student at MIT/HMS | MSc. Student at EPFL | Bertarelli Fellow

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EDUCATION

MSc. in Life Sciences Engineering (Neuroscience & Neuro-engineering)
Sep 2020 – Ongoing

School of Life Sciences, EPFL, Switzerland

Average Grade: 5.6/6

BSc. in Systems and Biomedical Engineering
Aug 2015 – Jul 2020

Faculty of Engineering, Cairo University, Egypt

Grade: Distinction with Honors

EXPERIENCE

Graduate Research Student | Bertarelli Fellow
March 2022 – Ongoing

MIT/Harvard Medical School

Cambridge, MA, USA

- Exploring invariances and limitations in self-supervised speech models in speaker identity processing tasks.
- Conducting behavioral experiments using **GORILLA** to evaluate humans and models performance in speaker identity discrimination task.
- Mapping models' representations to brain activations.

Voice AI Intern
August 2021 – February 2022

Logitech Europe SA

EPFL Innovation Park, Switzerland

- Improve a self-supervised speech model (BYOL-S) via designing a hybrid training protocol to learn from data-driven and handcrafted features (Hybrid BYOL-S) using **PyTorch Lightning**.
- Using speech representation models (BYOL-A, TRILL, YAMNET, VGGish,...etc) to study voice stress analysis (Cognitive & Physical Load).

Audio Signal Processing Intern
July 2021 – August 2021

Idiap Research Institute

Martigny, Switzerland

- Build CNN model using **Pytorch** for estimating breathing patterns from voice samples.
- Experiment with different model architectures, loss functions and hyper-parameters to optimize performance.

ML & Data Visualization Research Assistant
March 2021 – Oct 2021

Machine Learning and Optimization Laboratory

EPFL, Switzerland

- Detecting and visualising patterns in medical data to guide targeted interventions and medical training (Epidemiology).
- Implement supervised and unsupervised anomaly detection ML Models for the Dynamic Project and using **Tableau** as a web-based dashboard development tool for visualization integrated with **Python** scripts to run ML models.

Computer Vision Intern
May 2020 – August 2020

Advintic

Cairo, Egypt

- Building a Deep learning-based Computer Vision system to detect main heart coronaries using U-Net Architecture in **TensorFlow**.

Research Intern
Aug 2019 – Oct 2019

ONE Lab (Opto-Nano-Electronics Lab), Cairo University

Cairo, Egypt

- Build a text to speech keyboard for autistic children by installing Linux image on a **Raspberry Pi** and install an open source TTS client **Festival**, then automate the process of speech generation.

ACHIEVEMENTS & AWARDS

Logitech Publication Award
July 2022

Logitech Europe SA

HEAR Competition in NeurIPS 2021
December 2021

Logitech AI Team

- Ranked first in emotion detection, speaker counting in a simulated cocktail party and music-speech discrimination tasks.

Bertarelli Fellowship in Translational Neuroscience and Neuroengineering
February 2021

Harvard Medical School

3D Printed Motoneuron Model registered at ModelDB
April 2020

Yale University

- vemoto6 Neuron Model

PUBLICATIONS

Conferences & Journals

- Elbanna, Gasser et al. (2022). "Hybrid Handcrafted and Learnable Audio Representation for Analysis of Speech Under Cognitive and Physical Load". In: *Proc. Interspeech 2022*, pp. 386–390. DOI: 10.21437/Interspeech.2022-10498.
- Cordey, Samuel et al. (2021). "Blood virosphere in febrile Tanzanian children". In: *Emerging Microbes & Infections*. Vol. 10. 1. Taylor Francis, pp. 982–993. DOI: 10.1080/22221751.2021.1925161.

Pre-prints

- "BYOL-S: Learning Self-supervised Speech Representations by Bootstrapping" (2022). In: *Submitted to HEAR-PMLR*.

Blogs & Talks

- *(Blog) Gender and Racial Disparities in Voice Applications* (2022).
- *(Talk) HEAR Competition Presentation at NeurIPS 2021* (2021).

PROJECTS

Me Too Quotes Analysis
Sep 2021 – Dec 2021

Course Project at Data Science Lab

- Analyze Quotebank data in addition to twitter dataset to study the impact of traumatic/non-traumatic incidents on resurrecting the MeToo movement using NLP in **Python**.
- Build a web blog with the data story to illustrate the results.

Learning Adaptive Behavior Through Competition
July 2021 – Sep 2021

Semester Project at Mathis Group for Computational Neuroscience and AI

- Design a training procedure which allows an agent to succeed in a progressively larger and more complex set of environments.
- Changing dynamics due to environmental perturbations and generating unsupervised curriculum for adaptation using **RLlib**.

Impact of Motivation on Performance and Neuronal Activity in Mice Engaged in a Sensory Detection Task
Feb 2021 – June 2021

Semester Project at Laboratory of Sensory Processing

- Analyze behavioral parameters (Engagement, Performance and Cumulative Reward) and Psychometric functions in mice whisker-deflection detection task.
- Analyze neural parameters (Firing Rate and PCA) recorded from S1, mPFC and tjM1 brain regions.
- Correlation analysis between neural and behavioral parameters.

Applying VoxelMorph Framework to C. Elegans Brain Data for image regisration
Oct 2020 – Dec 2020

Course Project at Laboratory of Physics of Biological Systems

- Apply image registration on 3D volumes of brain data in **TensorFlow**.
- Create a deformation field for each 3D volume in a specific time frame relative to first frame.

Analytical Surface EMG Model connected to Motoneuron Model for ALS Early Detection
Aug 2019 – Aug 2020

Graduation Project

- Building a motoneuron model using **NEURON** simulating early ALS biophysical features and a sEMG model using **Python**.

Computer Vision GUI
May 2020

- Building user-friendly GUI to implement Hough Transform, Harris Corner Detector, Template Matching and SIFT Algorithms on given images using **penCV** and **PyQt5**.

Mini Autonomous Car
Oct 2019

- Building a self-driving car which detects lanes using **OpenCV** (Hough transform & Contouring).
- Detecting obstacles using ultrasonic sensor connected with **Arduino** that overrides the steering control in case avoiding obstacles.

Wireless Data Transfer
Sep 2019

- Generating pseudo random numbers that simulate patient data and transfer it wirelessly to a server using **BLE chip**.
- Visualizing the data acquired from the server in a web app developed using **Django** to simulate real-time vital signal tracking.

Wireless WiFi-based Indoor Localization for Elderly
Sep 2019

- Indoor localize elderly people through **ESP** embedded in a bracelet using WiFi technology.

Volume Rendering Application for Head and Ankle Images
April 2019

- Loading DICOM images for ankle and head then apply Surface Rendering using adjustable ISO value and Ray Cast Rendering using adjustable transfer function using **VTK and Qt Designer**.

MRI Simulator Software
March 2019

- Implement a generalized MRI simulator with the preparation sequences (IR, T2 Prep. and Tagging) and pulse sequences (GRE, SSFP and SE) in a GUI using **PyQt5**.
- Implement a shepp-logan for testing and validation.

Voice Recognition Software
Feb 2019

- Using the spectrogram of saved voices to classify sounds using KNN classifier.

Vocal Performance Assessment for Parkinson's Patients
Dec 2018

- Build a LSVT (Lee Silverman Voice Treatment) binary classifier using KNN.

Compute Spike Triggered Average in the H1 neuron
Aug 2018

- Compute the STA from one of the neurons, H1, which encodes horizontal motion in the fly's brain, in a region called the lobula plate.

SKILLS

Technical Development
Python and MATLAB

Desktop Development
C and C++

Deep Learning Frameworks
Tensorflow, Keras, Pytorch, RLlib and VoxelMorph

Modeling
NEURON, NMODL and HOC Language

Graphics and Visualization
OpenGL, VTK and Tableau

Embedded Systems
Raspberry Pi, ESP and Arduino