Abdelrahman Taha

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Personal Statement

I am a Communications and Information Engineering undergraduate at Zewail City with a strong focus on computational neuroscience and connectomics. My research interests include PDE-based diffusion modeling and network control theory to study how structural connectivity shapes functional dynamics and activity in the brain using dMRI and fMRI data. I have hands-on experience developing Python pipelines for connectome analysis, supported by a strong foundation in machine learning, stochastic modeling, and signal processing.

Education

Zewail City of Science and Technology, BS in Communications and Information Engineering — OCT 2023 – JUL 2027

- GPA: 3.779/4.0 (link to my Unofficial Transcript)
- **Coursework:** Machine Learning, Communications Theory, Propability and Stochastic process, Statistical inference and Data analysis, Digital signal processing, Operating Systems, Information Theory & Coding

City language school, High School (Thanaweya Amma Math division) — OCT 2020 – AUG 2023

- Grade: 96.46% (link to my Transcript)
- **About** Ranked 360 out of 98685 students in Egypt.

Experience

Zewail City of Science and Technology — Sep 2025 – Present

Undergraduate Research Assistant — *Department of Mathematics*

- Developing graph-based PDE diffusion models on structural connectomes to predict functional connectivity from dMRI and resting-state fMRI.
- Using Network Control Theory to quantify regional controllability and control energy for transitions between brain network states.
- Building reproducible Python pipelines for connectome construction and dynamical modeling (NiBabel, SciPy).
- Investigating relationships between diffusion dynamics, network topology, and controllability measures in health and disease.

Undergraduate Research Assistant — *Biomedical Sciences Lab*

- Preprocessed and analyzed datasets for anti-microbial peptides studies, extracting features and visualizing patterns with Python (Pandas, NumPy, Matplotlib) – enabled hypothesis testing on peptide efficacy. [Quantify: processed 10k+ sequences]
- Applied ML techniques (XGBoost and Random forest) and different feature selection techniques like: Variance threshold, Boruta, random forest feature importance and recursive feature elimination.
- Developed scalable Python pipelines for data cleaning/feature engineering.

Junior Teaching Assistant — *Database Management Systems*

- Assisted in teaching SQL and ASP.NET (Razor Pages).
- Supported students in lab sessions and assignments.

AI Trainer, Outlier – Remote — Apr 2025 – Present

- Trained and evaluated large language models on complex reasoning tasks in mathematics and programming, with a focus on C++ and Python
- Assessed model outputs for accuracy, logical coherence, and problem-solving effectiveness in technical domains

Networking Intern, Banque Misr, Cairo — Jul 2025

- Applied OSI model, subnetting, and routing protocols (BGP/IBGP) to enterprise data infrastructure, building foundations for scalable ML systems.

Projects

Numerical Solution of the 2D Incompressible Navier–Stokes Equations Lid-Driven Cavity Flow Using a Fractional Step Method GitHub Repository

- Implemented a 2D incompressible Navier–Stokes solver for lid-driven cavity flow using a fractional step method.
- Applied finite-difference discretization and iterative pressure–velocity coupling to ensure numerical stability and convergence.
- Analyzed flow dynamics through visualization of velocity fields, streamlines, and pressure evolution under varying boundary conditions.
- Tools Used: MATLAB, Numerical Methods

Audio Signal Denoising and Spectral Analysis using Digital Signal Processing Techniques GitHub Repository

- Applied digital signal processing techniques to analyze and remove a 15.2 kHz sinusoidal interference from an audio signal.
- Implemented Welch's method for power spectral density estimation using various windowing functions (Kaiser, Hanning, Hamming, Rectangular).
- Designed and evaluated FIR filters under performance and latency constraints; selected the Kaiser Window filter for optimal results.
- Verified interference suppression by comparing pre- and post-filter spectra using MATLAB.
- Tools Used: MATLAB, Signal Processing Toolbox

Pulse Code Modulation (PCM) GitHub Repository

- Designed and simulated a complete Pulse Code Modulation (PCM) communication chain in MATLAB including anti-aliasing filtering, sampling, quantization, encoding, companding/expanding, and reconstruction.
- Analyzed quantization noise, signal-to-noise ratio (SNR), and reconstruction error under varying sampling rates and bit resolutions.
- Evaluated system behavior in both time and frequency domains to study distortion, bandwidth, and filtering effects.
- Tools Used: MATLAB, Digital Signal Processing

Ambulance Management System GitHub Repository

- Developed an Ambulance management system that has three main users: cars, hospitals, and patients.
- Managed different patient types: Emergency, Normal, Special, and car types accordingly.
- Utilized data structures such as priority queue, linked queue, and stack.
- Tools Used: C++, Data Structures

Clinic Reservation Website GitHub Repository

- Built a full-stack web app for scheduling doctor appointments
- Implemented user authentication, responsive UI, and real-time appointment filtering
- Tools Used: ASP.NET Razor Pages, Bootstrap, HTML, JavaScript. ADO.NET and Microsoft SQL Server

Technologies

Neuroimaging/Connectomics: NiBabel, dMRI/fMRI (CIFTI/NIFTI), structural & functional connectomes, graph Laplacians

Modeling & Control: PDE diffusion models, Network Control Theory, SciPy

Machine Learning & Data: Python (NumPy, Pandas, Scikit-learn), feature engineering, XGBoost, Random Forest

Digital Signal Processing: FFT, Welch PSD, FIR/IIR filters, MATLAB

Full-Stack: C++, SQL, ASP.NET, Django/Flask, JavaScript

Courses & Trainings

Courses: Machine Learning Specialization (Coursera), Python Data Structures (Coursera), Learning How to Learn (Coursera)

Trainee – Full Stack Web Development using Python, Aug 2025
Information Technology Institute (ITI) – Remote

- Gained hands-on experience in backend development with Django and Flask, frontend integration, and database management using SQLite

Volunteering

RiseUp Startup Features, Cairo Apr–May 2025

- Organized B2B networking, mentorship clinics, and investor matching.

TEDx ZewailCity UST, Giza Nov 2023 – May 2025

- Coordinated speaker outreach, logistics, and tech setup for TEDx events.