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EDUCATION

Bachelor of Science in Computer & Systems Engineering 2020 - 2025
Ain Shams University *Cairo, Egypt*

- Senior year 2 (year 5/5) | **GPA**: 3.62 / 4.00 | **Class rank: 4/160**
- **Relevant Courses:** Compiler Design, Operating Systems, Embedded Systems, Network Security, Discrete Math, Image Processing, Machine Learning, Deep Learning, Database Systems, Artificial Intelligence, Software Engineering, Distributed Systems, Data Structures, Design of Algorithms.
- **Thesis:** ***Dental Crown Generation with Generative AI***, sponsored by **Atomica.ai**
  Contributions:
  - Developed a geometric kernel in Rust with Python bindings for accelerated mesh operations.
  - Implemented a dental arch (Occlusion) alignment algorithm.

TECHNICAL SKILLS

- **Programming-Languages:** Python, Lua, C++, Rust
- **Graphics:** OpenGL, SDL, ASSIMP
- **Tools & Platforms:** Linux, Bash, CMake, git

EXPERIENCE

Software Engineering Intern Oct 2023 - Feb 2024
ASMARINE (Autonomous Underwater Vehicles team) *ASU, Cairo, Egypt*

- Implemented state-of-the-art algorithms in SLAM & Computational Geometry.
- Optimized code for resource-constrained computers.

Undergraduate Research Assistant Jun - Sep 2023
Human Centered Mechatronics Lab *ASU Virtual Hospitals, ASU*

- Implemented a TCP communication tunnel to retrieve data from various sensors through XML.
- Synchronized motion capture cameras with the metabolic energy consumption system.
- Automated sensor calibration process.

Optimization & Signal Processing Intern Aug - Oct 2022
Dynamic Systems & Digitalization cluster - Cardiff University *ASU, Cairo*

- Utilized the Akaike Information Criterion estimator for precise determination of signal onset time.
- Implemented TDOA algorithm with particle swarm optimization to localize acoustic sources.

PERSONAL PROJECTS

mesher: 3D Triangular mesh viewer and inspector, [Code] Sep 2024

- Implemented a mesh viewer with OpenGL API, supporting lighting, and camera movement.
- Implemented triangle selection algorithm with BVH and Möller–Trumbore algorithm.

mark: CLI-based Bookmark manager, [Code] Aug 2024

- Developed a CLI tool for global bookmark management built on top of rofi.
- Implemented client-server architecture with async sockets for Rofi communication.
- Created a wrapper around TinyDB with orjson for efficient bookmark storage and querying.
- Added a parser for the Netscape bookmark file format and various export options.

automata-cli: Automata Renderer and Minimizer, [Code] Nov 2023

- Built a CLI tool to parse and manipulate program-like automata specifications.
- Enabled minimization, format conversion, and custom algorithm manipulation.
- Supported rendering automata into various formats for document embedding.

cv.py: YAML to TeX Adapter, [Code] Feb 2023

- Created a CLI tool to easily convert YAML files into LaTeX-based CVs.
- Enabled users to focus on content creation while the tool manages the formatting process.
- Supported CV compilation through either a cloud-based LaTeX compiler or local compilation.

Implementation of A* on Open Street Maps Data, [Code] Feb 2023

- Implemented A* algorithm with KDTree and KNN to compute the shortest path on OSM data.
- Utilized the randomized median of medians algorithm to accelerate KDTree construction.
- Developed the algorithm on top of an extended Kalman filter and embedded microcomputer.

OPEN-SOURCE CONTRIBUTIONS

- **NetworkX** a network analysis library and graph theoretic algorithms in Python.
- **SymPy** a computer algebra & symbolic computation in Python.

HACKATHONS & COMPETITIONS

NASA Space Apps Cairo Summer 2023
The American University in Cairo

- Developed a project centered on data sonification, enhancing the perception of space imagery.
- Implemented a melody fitting algorithm: aligning classical music pieces with the input image.
- Received the **"Most Innovative Solution"** award and **25k EGP** prize.

NASA Space Apps Cairo Summer 2022
The American University in Cairo

- Developed a web interface for ISS 3D virtual tracking in real-time.
- Implemented orbital propagation algorithm and a sun tracking algorithm for ISS solar panels.
- Awarded 500$ AWS Credit Points Prize.

AWARDS & HONORS

SciPy 2024 Conference July 2024
SciPy, NumFocus *Tacoma, WA, USA*

- Selected to attend SciPy Conference 2024 with full financial aid.
- Engaged with leading experts in the field of scientific and high performance computing.

Top 100 entries & Top 25 Articles Summer 2022
Summer of Math Exposition (SoME#2) *3Blue1Brown & Leios Labs*

- Secured a spot among the top 100 overall submissions.
- Ranked in the top 25 for non-video submissions (e.g., articles and games).

ARTICLES

The Generalization of Fifteen Puzzle, [Article][Code] Jul 2023

- Discussed the generalization and solvability of the fifteen puzzle with group theory.
- Implemented a PQ solver using weighted iterative deepening A*.

Diffusion Equation: A computational approach, [Article] May 2022

- Analyzed the diffusion equation as both a mathematical and computational model.
- Worked on generalizing results to higher dimensions.