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EDUCATION

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

- **GPA**: 3.64 / 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:** ***Automated Dental Crown Generation Pipeline***, sponsored by **Atomica.ai**
- Developed *mcg*: a minimal geometry processing library in **C++** with a focus on speed. *mcg* is written to support graphics operations such as closest point computations and intersection tests, geometric operations such as mesh surface deformation (Laplacian deformer), halfedge-mesh operations such as enclosed faces inside loops, shortest path computations on the surface of mesh such as A*, and to provide spatial data structures such as BVHTree and KDTree.
- Developed virtual dental arch alignment algorithm (using *mcg*).
- Developed automated dental crown positioning algorithm (using *mcg*).
- Developed semi-automatic dental restoration pipeline (using *mcg*).
- Developed *fastmesh*: a lazy mesh file parser and optimizer in **Rust** with Python bindings (using PyO3) for accelerated mesh operations to serve 3D deep learning based tasks.

TECHNICAL SKILLS

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

EXPERIENCE

Computational Geometry Software Engineer (C++) Feb 2025 - Present
Atomica AI (Dental CAD software suite), Remote *Atlanta, GA, United States*

- Optimized BVHTree reducing memory consumption by 50% and build time.
- Worked on adaptive remeshing to reduce triangle count in planar areas.
- Implemented balanced KDTree data structure to support pointcloud operations.
- Worked on repair algorithms such as non-manifold vertex handling, collapsing, and hole stitching.
- Worked on dental crown generation tools with Laplacian surface deformer.

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

- Implemented state-of-the-art algorithms for SLAM and 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 sensor data via XML communication.
- Synchronized motion capture cameras with metabolic energy measurement systems.

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

zain: 64-bit Lua VM interpreter implementation in Zig Jul 2024 - present

- Implemented high-performance Lua lexer achieving ≈ 120 MB/s throughput.
- Implemented a recursive descent parser with precedence climbing algorithm.
- Developed a Lua 5.3 bytecode decompiler and verifier.

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

- Implemented client-server architecture with synchronous sockets for Rofi integration.
- 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 LaTeX 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.

OPEN-SOURCE CONTRIBUTIONS

- **Blender** a 3D creation suite and graphics software in C++.
- **PMP-Library** a polygon mesh geometry processing library in C++.
- **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 focused on data sonification, enhancing the perception of space imagery.
- Implemented a melody fitting algorithm for aligning classical music pieces with the input image.
- Received the **"Most Innovative Solution"** award and **25,000 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.

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 scientific and high-performance computing.

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

- Participated in a global competition for creating in-depth math, CS, and physics content.
- Secured a spot among the top 100 overall submissions.
- Ranked in the top 25 for non-video submissions (e.g., articles and games).