Saba Machavariani

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Personal Website

Education

- **Tbilisi I. Vekua Physics Mathematical School #42** 2020 – Present

Experience

- **Founder & COO, G-AID**: Engineered autonomous aerial drone with safety-first navigation, tourist-avoidance, and restricted-zone compliance. Developed landslide risk analysis (LSTM) and landscape-monitoring toolkit using TensorFlow/OpenCV. Won Alte University Start-up marathon, raised $5k+ from GITA. Featured in Entrepreneur Magazine. (May 2024 – Present)
- **Scientific Cybersecurity Association (SCSA)**: Conducted vulnerability detection and penetration testing. Performed Wireshark traffic analysis, OSINT investigations, and structured web penetration testing. Reported credential exposure and proposed security updates. (Mar 2025 – Present)
- **Robotics Mentor, Montessori School**: Mentored students in competitive robotics, redesigned syllabus to target all levels of experience and background. Hosted 10+ hands-on seminars. (Aug 2025 – Present)
- **Competitive Robotics Teacher, Vekua School**: Coached school-wide robotics teams in competitive programming and autonomous systems design. Mentored 20+ students across multiple projects. (Jan 2024 – May 2025)
- **Team Member, FIRST Global Team Georgia**: Developed ML-powered vision systems using AprilTag pose-estimation with OpenCV and TensorFlow. Led computer vision and autonomous navigation development. Won Katherine Johnson Silver Award for Engineering Documentation. (Jul 2024 – Oct 2025)

Honors & Achievements

- **Katherine Johnson Silver Award, FIRST Global Challenge**: Awarded for excellence in robotics engineering documentation and outstanding autonomous system design among 190+ nations. (Oct 2025)
- **Team Member, IOAI Team Georgia**: Represented Georgia at International Olympiad in Artificial Intelligence, competing in AI/ML individual challenges and robotics team contests. Placed top 100 in AI safety task. (Aug 2025)
- **5th Place, National AI Olympiad**: Secured top 5 finish nationally in final round; qualified for IOAI Georgian Team. (May 2025)
- **2nd Place, National Arduino Olympiad by Alte**: Designed gas leakage and air parameters (temperature, humidity, dust) monitoring system for warehouses and homes using Arduino and sensor signal processing. (Jun 2025)
- **1st Place, National STEM Olympiad**: Designed and engineered smart home security system for duplex flats using Arduino and sensor signal processing. Secured top position in Physics-Mathematical schools' competition. (June 2024)
- **Engineering innovation award, FIRST global national round**: Constructed and programmed 30% faster robot than the second fastest, by utilizing Inverse Kinematics and A* search (June 2024)

Research & Publications

- **Multi-Technique Non-Destructive Provenance Analysis of Azurite Pigment**: Presented at IChTo 2025. Developed non-invasive spectroscopic techniques using MA-XRF, Raman, and FORS with PCA/LDA analysis to determine geographical origins of azurite samples for art authentication. (2025)
- **Comprehensive Research on Magnetic Music and Sound Generation**: Presented at IYNT 2024 national round. Explored acoustic phenomena through magnetic field interactions, deriving frequency equations for magnetically-damped oscillating systems. Analyzed patterns using Wolfram and MATLAB. (2024)
- **Magnetic Assist**: Researching for IYPT 2025. Investigated magnetic field interactions and applications in mechanical assistance systems with focus on energy optimization. Conducted 25+ experiments. Published trajectory dataset on HuggingFace.

Notable Projects

- **G-AID – Autonomous Aerial Drone System**: Production-grade autonomous drone with safety-first navigation, landslide risk analysis, and landscape monitoring. Stack: TensorFlow, OpenCV, Python, Computer Vision.
- **FIRST Global Challenge – ML-Powered Robotics**: AprilTag pose-estimation with OpenCV/TensorFlow and ROS integration. Achieved full autonomy—only instance across 190+ competing nations. Wheel spin/drift finetuning through Kalman filter and sensor/human input fusion improved targeting to 89% success rate. Engineering Notebook —

- **FIRST Global Challenge Performance Engineering**: Scraped rankings, match schedules, and match breakdowns from results.first.global. Discovered 2 strategies – neglecting side ecosystems and parking near dispensers resulted in top 20% performance across near all top-tier matches. Reproduced Eco Equilibrium scoring model (distribution factor, protection multiplier, coop bonuses, fouls) for local validation. Tracked alliance form, defensive pressure, penalty drag. Built schedule-aware Monte Carlo simulator for rank/score distributions and per-match win odds.
- **IPPOG International Masterclasses – Particle Physics ML**: Applied semi-supervised/anomaly detection methods (Isolation Forest, One-Class SVM) with physics-informed feature engineering (invariant mass, angular separation) on high-volume ATLAS data. Addressed class imbalance using SMOTE and customized weighting to maximize Recall. Candidate anomalies subjected to kinematic consistency checks for signal validation. Presented and discussed findings with CERN; AGH (Poland) and UAM/CSIC (Spain) representative students. (2024)
- **SCSA Security Patches**: Vulnerability detection and penetration testing. Wireshark traffic analysis, OSINT investigations, and web security assessments. Reported critical vulnerabilities.

Skills

- **Languages & Frameworks**: Python, C/C++, Rust, Go, Dart — PyTorch, TensorFlow, OpenCV, JAX, Scikit-learn, LangChain
- **Tools & Infrastructure**: Docker, Kubernetes, CUDA, ROS, Arduino, Raspberry Pi — Wireshark, Burp Suite, OSINT

Languages

- **Georgian**: Native **English**: Full professional proficiency **Russian**: Professional working proficiency