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AcouSmartEDGE An Embedded AI -Enabled Acoustic-Aware Anomaly Detection EDGE Device for Environmental & Industrial Monitoring Applications

Egypt-Japan University of Science & Technology

A team of researchers from EJUST has developed AcouSmartEDGE, a solution that addresses challenges such as high cloud costs and latency commonly associated with traditional digital transformation approaches. This is achieved by moving intelligence directly to the device, enabling autonomous operation critical for industrial maintenance and environmental monitoring where connectivity is spotty or privacy is a priority. The system's core novelty is its Deep Contrastive Twin Network, which allows the device to learn "normal' acoustic signatures locally. Unlike standard models, it adapts to new environmental "norms' without cloud intervention, maintaining accuracy even as ambient conditions shift. This dynamic adaptability is paired with a lightweight architecture requiring only ~260 kB of RAM, achieving a near-instantaneous detection latency of just 25-27 ms on low-power microcontrollers. The team has successfully delivered a full-stack ecosystem—including firmware, a mobile app, and a web dashboard—validated across diverse scenarios. "From identifying malfunctions in TAKISAWA industrial cutting machines to detecting water leaks and pump failures, the system is a truly application-agnostic tool. Furthermore, our research on "Resource-Aware Contrastive Scattering Meta-Learning' has been published in the prestigious Q1 Wiley Journal, Advanced Intelligent Systems' says Dr. Rami Fakhry Zewail, Assistant Professor, EJUST.

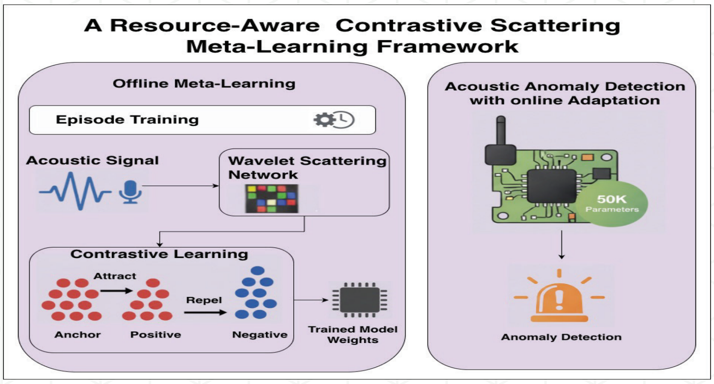


Figure 1: Graphical Abstract - Contrastive Meta-Learning Anomaly Detection Framework

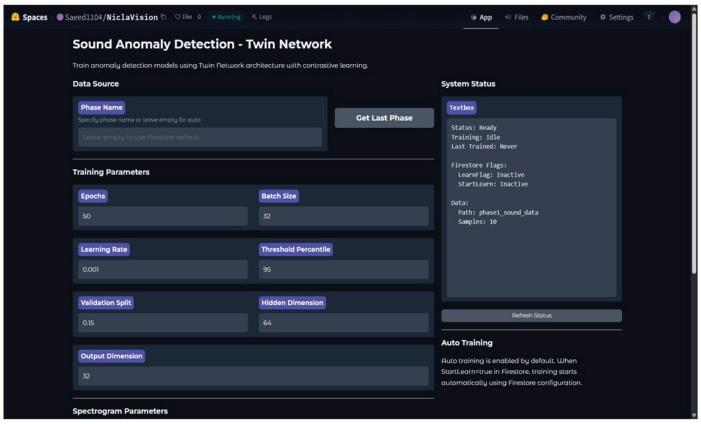


Figure 2: Web Management Platform - Sound Anomaly Detection Interface

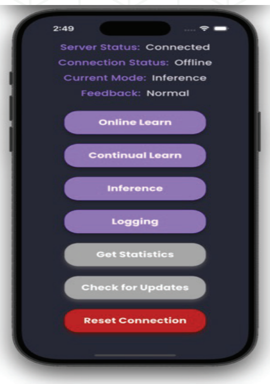
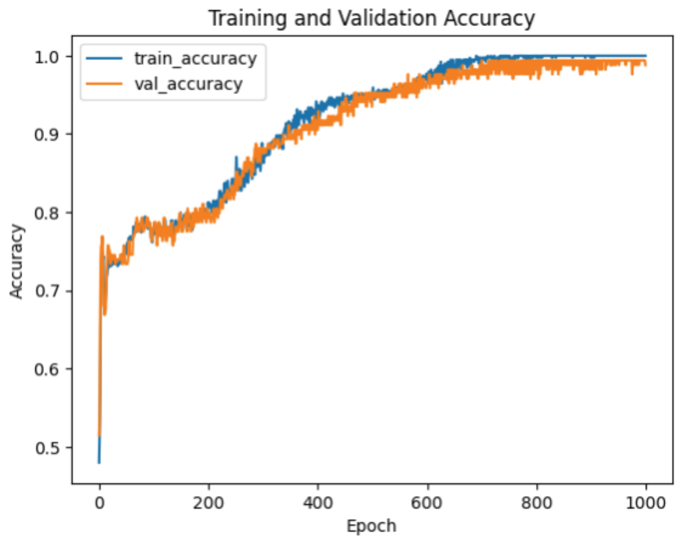


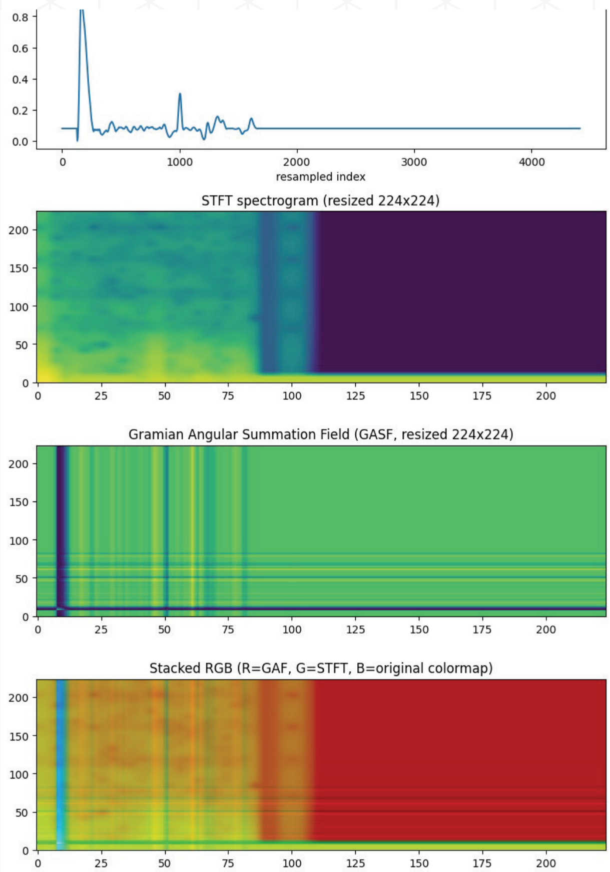
Figure 3: Mobile App Interface - State Control and Feedback

AI-Powered Microfluidic Platform Achieves ~99% Accuracy for Non-Invasive Bladder Cancer Diagnosis

Egypt-Japan University of Science and Technology

Researchers from EJUST developed an integrated diagnostic system combining microfluidics, Raman spectroscopy, and deep learning to address the urgent need for a non-invasive and accurate alternative to cystoscopy, the current bladder cancer diagnostic method, which is invasive, painful, and often discourages patient follow-up. The core novelty lies in transforming one-dimensional Raman spectral signals into two-dimensional image representations (spectrograms and angular fields), enabling a deep convolutional neural network to extract both spectral and morphological features from urine samples. This approach overcomes the low sensitivity of conventional urine cytology, especially for low-grade tumors. Our solution offers several advantages: it is non-invasive (using easily obtained urine), rapid (automated analysis), and achieves very high classification performance (≈99% accuracy in distinguishing cancerous from non-cancerous samples). A fabricated microfluidic chip efficiently isolates urothelial cells—the relevant cancer indicators—from other urine components like bacteria and red blood cells. Key deliverables include: 1) a functional spiral microfluidic chip for cell separation, 2) a complete preprocessing and feature engineering pipeline, and 3) a validated AI classification model ready for clinical translation. "Despite challenges in sample collection, the system demonstrates strong potential to replace or reduce unnecessary cystoscopies, lower healthcare costs, and improve patient compliance. This framework is also adaptable to other cancers, such as prostate and cervical cancer, using urine or Pap smears' says Haitham El-Hussieny, Professor, EJUST.

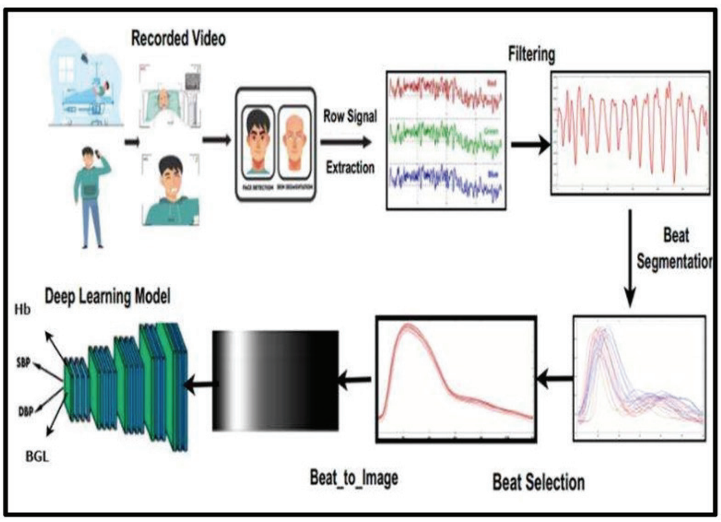




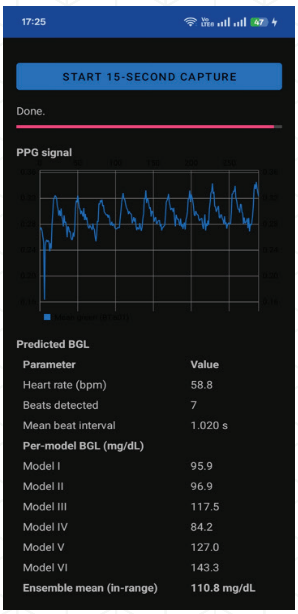
Contactless Blood Glucose Level Monitoring System

Aswan University

A research team from Aswan University has successfully developed a "Contactless Blood Glucose Level Monitoring System' (CBGLM) addressing an urgent global and local crisis, as diabetes stands as a leading cause of mortality in Egypt. Traditional finger-prick tests require patients to endure painful, recurring, and infection-prone needle punctures multiple times a day. The innovative system replaces that physical burden entirely, unlocking a seamless, non-invasive method to monitor blood sugar levels. The core novelty powering this technology is a sophisticated pipeline that extracts remote photoplethysmography (rPPG) signals directly from a standard mobile-camera video of a patient's fingertip. Moving away from traditional, bulky medical hardware and expensive near-infrared sensors, the team introduced a hyper-efficient signal-processing combination: a SPICE-based sparse filter paired with a Hilbert adaptive demodulator. This pipeline cleans and isolates the heartbeat signals from raw video frames, feeding them into six advanced deep-learning regression models trained across the clinical BGL range of 70 to 300+ mg/dL. The advantages of this solution are game-changing for the ICT and healthcare sectors. It runs entirely on ubiquitous, commodity smartphone hardware, requiring no expensive wearables or recurring costs for disposable test strips. The final project deliverables include a fully functioning, integrated prototype connected to a digital-health platform utilizing secure mobile-to-cloud transport. "Including a feature in Engineering Applications of Artificial Intelligence—the lab-validated system is now primed for multi-site clinical trials, signaling a impending paradigm shift toward completely pain-free, accessible wellness tracking' says Osama A. Omer, professor at Faculty of Engineering, Aswan University.



Project Execution Visualized



Mobile application for the resulting project