PhD Position: Design of Low-Power Analog and Mixed-Signal ICs for Machine Learning Applications (On-Site)

We invite applications for a **funded PhD position** focused on the design of **analog and mixed-signal integrated circuits (ICs)** for the implementation of **machine learning algorithms**. This research aims to develop **cutting-edge, energy-efficient solutions** at the intersection of **hardware design and artificial intelligence (AI)**, contributing to the next generation of AI hardware.

This position is offered at the **School of Electrical and Computer Engineering, National Technical University of Athens (NTUA)** under the supervision of **Dr. Paul Sotiriadis**, in close collaboration with **a dedicated team of postdoctoral researchers who will provide constant guidance and mentoring throughout the project**.

Project Overview

The goal of this PhD research is to **design application-specific analog and mixed-signal ICs** optimized for executing **machine learning algorithms** with **ultra-low power consumption** and **high computational precision**. The innovation of the project lies in three key areas:

- **Algorithm Optimization**

  Tailoring and optimizing machine learning algorithms for efficient hardware implementation.

- **Advanced Circuit Design**

  Applying state-of-the-art analog and mixed-signal IC design techniques to enhance performance, reduce area, and minimize power consumption.

- **Complete System Development**

Building an end-to-end hardware system for machine learning applications, with an emphasis on **continuous learning** and real-time **signal processing**.

The project will culminate in the **design, simulation, implementation, and experimental validation** of a **low-power analog processor** specifically designed for machine learning applications.

Importantly, the successful candidate will benefit from the **constant support and technical guidance of experienced postdoctoral researchers**, ensuring steady progress and skills development in both the hardware and algorithmic aspects of the work.

This PhD builds on an **established line of award-winning research** in low-power analog AI hardware, with an impressive record of **publications and international recognition**.

Related Publications (Previous Work)

This PhD will **continue and expand upon the group's prior contributions** to the field, including:

1. **Design of a Low-Power Analog Integrated Deep Convolutional Neural Network**
   Foufas et al., *IEEE Transactions on VLSI Systems*, 2025.
2. **A Power and Area Efficient Analog Classifier for Electrical Impedance Tomography Applications**

   Alimisis et al., *Circuits, Systems, and Signal Processing*, Springer, 2025.
3. **An Ultra-Low Power Adjustable Current-Mode Analog Integrated Neural Network Classifier**

   Alimisis et al., *AEU-International Journal of Electronics and Communications*, Elsevier, 2024.

4. **Power Efficient Analog Hardware of the Learning Vector Quantization Algorithm for Brain Tumor Classification**

   Alimisis et al., *IEEE Transactions on VLSI Systems*, 2024.

5. **Low-Power Analog Integrated Architecture of the Voting Classification Algorithm for Diabetes Disease Prediction**

   Alimisis et al., *IEEE Transactions on Biomedical Circuits and Systems*, 2024.

6. **A Radar-Based Human Fall Detection System Using Analog Decision Tree Hardware**

   Alimisis et al., *IEEE Open Journal of Circuits and Systems*, 2024.

Related Best Paper Awards (Track Record of Excellence)

The team's research has been **recognized with numerous Best Paper Awards**, including:

- **IEEE MOCAST 2025**: Best Student Paper — Analog Decision Tree for Diabetic Retinopathy Detection.
- **Springer 2nd AI Conference 2024**: Best PhD Paper — Vector-Length Calculator for Fetal Health Classification.
- **IEEE ICM 2023**: Best Paper — Modulo-based Classifier for Lung Cancer Classification.
- **Springer 1st AI Conference 2023**: Best PhD Paper — Bell-shaped Analog Classifier for Medical Diagnosis.
- **IEEE ICM 2022**: Best Paper — Bayesian Analog Classifier for Thyroid Disease Detection.
- **SBCCI Symposium**: Best Paper — Adjustable Gaussian Kernel Circuit for AI Hardware.

- **IEEE ICM 2021**: Best Paper — Analog Realization of Fractional-Order Lung Models.

Your Profile

We are looking for **highly motivated candidates** who:

- Hold a **Master's degree** in **Electrical Engineering, Computer Engineering, or a related field**, with excellent academic performance.
- Are passionate about **interdisciplinary research** combining **hardware design**, **machine learning**, and **bioengineering or AI applications**.
- Have knowledge of:
    - **Analog, mixed-signal, and/or digital circuit design.**
    - **Ultra-low-power design techniques (including subthreshold operation).**
    - **Machine learning algorithms** and **signal processing fundamentals**.
- Have experience or strong interest in:
    - **IC design tools** such as **Cadence, Synopsys**.
    - **Embedded programming and/or Python**.
- Are **curious, innovative, and eager to learn**.
- Have **strong communication and teamwork skills**.

Throughout the PhD, the candidate will be **closely supported by postdoctoral researchers**, providing **technical guidance, mentorship, and assistance in experimental validation and publication efforts**.

Key Responsibilities

As part of this PhD project, your tasks will include:

- **Designing analog and mixed-signal integrated circuits** for machine learning applications.
- **Optimizing algorithms** for efficient hardware execution.
- **Developing signal processing techniques** that enable **continuous learning** in analog systems.
- Collaborating with **academic and industry partners** and **working under the constant supervision of experienced postdocs**.
- Presenting results at **international conferences** and publishing in **top-tier journals**.

What You Will Gain (Learning Outcomes)

By the end of the PhD, you will have gained:

- **In-depth knowledge** of analog and mixed-signal IC design and verification.
- Expertise in **low-power hardware design** for AI systems.
- Strong skills in **signal processing** and **hardware-software co-design**.
- Experience in **developing and validating complete hardware systems**.
- **Close mentoring** by postdoctoral researchers to accelerate your research and career development.
- A competitive profile for careers in:
    - **Semiconductor industries**
    - **AI hardware start-ups**
    - **Biomedical engineering**

- **Academic research and teaching**

Why Join Us?

- Access to **state-of-the-art EDA tools** and fabrication technologies.
- **Close supervision by faculty and continuous guidance by postdoctoral researchers.**
- Opportunities for **collaboration with leading academic and industrial partners**.
- A **stimulating and award-winning research environment** with a proven record of impact.

Application & Contact

If you are passionate about advancing the frontiers of **AI hardware and low-power circuit design**, we encourage you to apply.

Application: Interested candidates are encouraged to apply through NTUA's official PhD program channels. For inquiries or more information about the project scope and supervision, please contact

Prof. Paul Sotiriadis at **pps@ieee.org .**

Dr. Vassilis Alimisis at **alimisisv@mail.ntua.gr**