Master thesis: Embedded bird sound recognition on intermittent platform.

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🔬 Internship Context

This master's internship is related to a collaborative project on the design of intermittent computing architectures on microcontrollers. In the context of deploying applications associated with the Internet of Things (IoT), embedded signal processing applications must be designed to operate with highly constrained computational resources [MBK]. For IoT dedicated to monitoring natural environments, it is also important to minimize interactions and maintenance to avoid disturbing the natural environment. Typically, systems need to adapt their workloads to the available energy [AAGB]. In the case of intermittent architectures, the device can go offline and resume its activity when it regains energy [LILN]. This paves the way for more complex computing processes on architectures that no longer have a battery but only a very low-capacity supercapacitor. Among the envisaged processes, using artificial intelligence techniques on the node presents major challenges, particularly in terms of memory management [LZC+].

Within the scope of this master's topic, the focus is on the application layer, aiming to implement neural networks for bird song recognition on an intermittent platform. This internship builds upon previous work that established a simulation environment, demonstrating i) the benefits of using Deep Learning (DL) techniques for bird song recognition [AZA+] and ii) the ability to synthesize small neural networks that can run on our intermittent platform [KH]. Based on these efforts, a new platform has been designed and will be used in the context of this master's work.

This master's internship takes place within the GRANIT team at IRISA. Its objective is to design and implement a neural network dedicated to bird song recognition on an intermittent platform.

🚀 Objectives

The primary goal of the internship is to:

- Take over the existing processing pipeline and verify the proper functioning of classification on a literature-based database.
- Test implementation frameworks for machine learning algorithms on MSP430.
- Implement a lightweight neural network on the experimental platform and validate the entire processing chain.

Subsequently, the tasks will include:

- Explore the trade-off between computational complexity, power consumption, and classification accuracy.
- Familiarize yourself with a platform for intermittent computing specific to bird song.
- Implement and test intermittent processing mechanisms on this platform.

💪 Skills

You are in your final year of engineering school or pursuing a master's degree. You have strong skills in digital signal processing and a basic understanding of artificial intelligence. Experience in microcontroller implementation is also desirable.

> This internship can validate a research master's degree. Note that, as part of the OWL project, a doctoral scholarship related to this internship topic will be funded, beginning in September 2024.

ℹ️ Information and Contacts

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💰: Monthly gratification 567€
⏱️: 6-month internship starting in February 2024
🌍: IRISA, Lannion, Brittany, France

📚 References

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[LILN] Seulki Lee, Bashima Islam, Yubo Luo, and Shahriar Nirjon. Intermittent Learning: On-Device Machine Learning on Intermittently Powered System. 3(4):1–30.

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[MBK] Tushar S. Muratkar, Ankit Bhurane, and Ashwin Kothari. Battery-less internet of things –A survey. 180:107385.