Open Thesis / Project / Paid Student Job

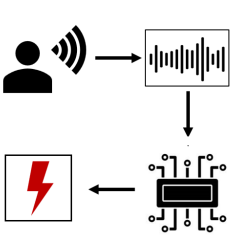
Speaker Distress Detection using Low-Power Embedded IoT Devices

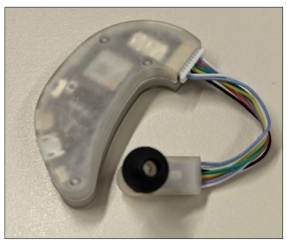
Note: *this work is suitable for a MSc project/thesis, and can also be performed as a* ***paid student job****.*

Motivation

With the emergence of powerful speaker recognition systems like Alexa and Siri, people are getting used to give voice commands instead of resorting to other physical inputs (e.g., keyboards, buttons). Together with the rapid growth of the Internet of Things (IoT), an increasing number of embedded devices are being deployed in various settings, and these can highly benefit from the ability of listening to their surrounding and gain context awareness. However, low-power IoT devices are often not as powerful as Alexa or Siri, only have a fraction of their memory and processing power, and cannot always rely on a cloud service to perform heavy computations (e.g., machine learning tasks).

Our goal is to let low-power IoT devices (i.e., deeply embedded devices with limited memory and computational resources) perform speaker distress detection *autonomously*: this could be used to automatically look for help when distress is detected in a person's voice. Within our group, we have built a low-power custom earpiece embedding cheap microphones and others sensors that can be used to carry out this task. Our aim is to study how state-of-the-art systems based on machine learning techniques can be shrunk to fit the constraints of low-power IoT devices, and evaluate whether the shrunk models can still sustain a high detection accuracy.





Goals and Tasks

Within this context, students can explore several directions and perform different tasks, such as:

- Understand how state-of-the-art distress detection systems work, and investigate how they can be shrunk to fit on tiny embedded devices;
- Develop a novel lightweight distress detection model/scheme that fits even on the smallest IoT devices;
- Develop a prototype of a distress detection system running on a constrained IoT device (e.g., our custom earpiece embedding the `nRF5340`).
- Leverage sensors such as heart rate and/or pulse oximeter sensors to create very accurate and personal distress detection devices.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical Engineering.

Required Prior Knowledge

- Basic knowledge of machine learning;
- Solid skills in Python and C programming;
- Experience with microcontrollers.

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