TinyML workshop

Brazil, 22-26 July 2024

Logistics

Venue: IBM Brazil, R. Tutóia, 1157 - Vila Mariana, São Paulo - SP, 04007-900

Hotels:

Pullman, Rua Joinville, 515 - Vila Mariana, São Paulo - SP, 04008-011

Canopy by Hilton Sao Paulo Jardins, R. Saint Hilaire, 40 - Jardim Paulista, São Paulo - SP, 01423-040

Mercure São Paulo Grand Plaza Paulista, R. Leôncio de Carvalho - Paraíso, São Paulo - SP, 04003-010

Schedule:

- 9 to 12: Lectures
- 12 to 1: Lunch
- 1 to 4: Labs / Cases
- 4 to 6: free time for project discussion

Monday 22 – Intro

9:00 Workshop Opening and Schedule (15)

9:15 Opening talk, Prof. Galvão, CNPq (45)

10:00 Opening Keynote (AI and Sustainability), Bruno Flach, IBM Brazil Lab Director (45)

10:45 Coffee Break

11:15 Introduction to Embedded ML, VJ (15) + Marcelo (30)

12:00 Lunch

1:00 "Caninos Loucos": Marcelo Zuffo, Brazil

1:45 How to do an ML Project + Edge Impulse Overview (ML Flow etc.), Marcelo

2:00 Lab: Setting up the TinyML tools and 1st Example (Ardunio/EI/CLI/IDE/etc.), Marcelo

3:00 Starting Projects (SDGs and Datasets), Rodrigo

Tuesday 23 – Vision

9:00 Convolutions for Computer Vision (Intro to CV on Hardware), Brian (30)

9:30 Applications of Video EdgeAI: FOMO, YOLO, Marcelo (60)

10:30 Coffee Break

11:00 Eric Pan (Video) on Video applications for SDGs (30)

11:30 Opportunities for TinyML and Robotics, Brian

12:00 Lunch

1:00 Lab: Hands-On Computer Vision, Marcelo

3:00 Case studies/demo (Vision):

- TinyML in Space, Jose Antonio Bagur, Guatemala
- Bee Counting with FOMO and YOLO, M.Rovai, J. Alberto, Brazil
- TBD

Wednesday 24 – Audio

9:00 Preprocessing for Audio, Jesus (60)

10:00 Keyword spotting applications ***TBD?*** (30)

10:30 Coffee Break

11:00 TinyML and Sustainability, Brian

12:00 Lunch

1:00 Lab: Keyword spotting with TinyML ***TBD?***

3:00 Case studies/demo (Audio):

- TinyML on ICT - Walter Varella, Brazil
- TBD
- TBD

Thursday 25 – Education in TinyML / Movement

9:00 Teaching (Tiny)ML, Panel/Group Discussion, led by David, Flavio

10:00 Coffee Break

10:30 Case studies: Jesus, Marcelo, Silvia Sotelo, Jose Antonio, teaching to non-technical students, Moises

11:30 Micro:bit (TBC)

12:00 Lunch

1:00 Lab: Hands-on Motion Classification and Anomaly Detection,

3:00 Case Studies (Time-Series Data - Movement):

- "Development of an algorithm that predicts hand movement in the game rock, paper and scissors with the use of TinyML" - Brian Arenas, Colombia
- Car Accident Prevention - Fajardo, George, Peru
- "ECG with TinyML" - José Alberto Ferreira Filho, Brasil

Friday July 26 – Advanced TinyML topics

9:00 Ethics of TinyML, TBD

9:45 Microsoft Mosquito project, David's contact (?)

10:15 Hardware X, David

10:30 Coffee Break

11:00 LSTM and LLMs, Marcelo Rovai

11:20 Federated Learning in TinyML, Claudio Miceles, Brazil

11:40 Enabling TinyML Training on Low-Power Devices, Tiago de Souza, Brazil

12:00 Lunch

1:00 Closing keynote: Pete from TinyML Foundation

1:45 Project Presentations from Teams

3:15 TinyML4D Overview, Marco

Proposed Projects

SDG #	Title	Description
2	Plant diseases	Food security is endangered by the spread of plant diseases that reduce productivity. The early detection of plant diseases can help raise awareness and incentivise farmers to seek professional help and mitigate the potential damage. In this project, you can build a TinyML model to identify plant diseases based on images of leaves and provide technological support for small farmers in isolated areas.
3	Mosquito breeding grounds	Mosquito-borne diseases affect hundreds of millions of people worldwide every year, leading to many deaths and diseases. In urban environments, most of the mosquito breeding grounds (MBG) are due to human intervention: pots, tires, barrels, bottles and any puddle of stagnant water. In this project, you can build a TinyML-powered system to spot and tag MBG locations using computer vision tools on drone aerial images. This information is useful when coordinating the health services response.
11	Traffic jams	In major urban areas, traffic jams have a negative impact on the access to the workplace and cause loss of job opportunities. Mental health is also affected by the long hours spent daily in traffic during commute. The ubiquity of traffic cameras at highways and intersections present an interesting data source that enables several monitoring activities. In this project, you can build a TinyML model to detect and quantify traffic jams to help drivers avoid hotspots and reduce their time in transit.
11	Acoustic rain gauges	Landslide and flooding events are a frequent source of property and human loss in Latin American cities. The damage is usually greater in poorer neighbourhoods, with slanted hills and insufficient flood management systems. Access to early warning systems can help save lives and trigger a preemptive evacuation from endangered areas. In this project, you can build a low-cost acoustic rain gauge to collect and process rain volume time series data that can be used to inform an early warning system.
11	Accessibility	People with limited vision / obstacles / lack of mobility Obstacle identification system / computer vision / use label to issue audible warning (text-to-speech)
3	Mosquito Detection and Classification by Sound	The direct monitoring of mosquito populations in field settings is a crucial input for shaping appropriate and timely control measures for mosquito-borne diseases. The proposed project is low-power, low-cost and can run without human intervention in resource-constrained areas.