Experiences in Teaching Tiny ML to Undergraduate and Graduate Students

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Who I am

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Thanks to TinyML 4D Academic Network!!!

https://tinyml.seas.harvard.edu/4D/

Workshop on Widening Access to TinyML Network by Establishing Best Practices in Education
Location

Cali Colombia

Universidad Autónoma de Occidente (UAO)
Why Teach Tiny ML?

- The best way to learn something is to teach it!!!
- Tiny ML has a huge potential to be applied in developing countries
- It isn't necessary to have a big infrastructure
- Lack of connectivity in rural zones
- It is possible to solve real problems with low cost solutions
- Teach ML with projects.

https://www.gartner.com/en/articles/4-emerging-technologies-you-need-to-know-about
General Information of the Under Graduate Course

- Artificial Intelligence in Mobile and Embedded Devices
- Two sections at week. 1.5 hour each one
- In person
- Sixteen weeks. Total 48 Hours
- First version 20 students
- Second version 23 students
- Third version 22 students
Course Structure

Part 1
- Fundamentals of TinyML

Part 2
- Applications of TinyML
- Deploying TinyML
Software Tools

- Deep Learning (TensorFlow-Keras)
- Google Colab
- Edge Impulse Studio
- IDE Arduino
- APP Inventor
Hardware Tools

- Arduino UNO - MEGA
- Arduino Tiny ML Kit
- Smartphones
- Raspberry Pi
Course Projects

- Image classification using app inventor with hardware interaction
- Motion classification using tiny ml kit with hardware interaction or app interaction
- Sound or image classification using tiny ml kit with hardware or app interaction
Course Projects
General Information of the Graduate Course

- Artificial Intelligence in Edge AI Devices
- One sections at week. 3 hour each one
- Blended (Hybrid)
- Sixteen weeks. Total 48 Hours
- First version 6 students
- Second version 12 students
Course Structure

Part 0
Fundamentals of TinyML

Part 1
Applications of TinyML
Deploying TinyML
Software Tools

- Deep Learning (TensorFlow-Keras)
- Google Colab
- Edge Impulse Studio
- IDE Arduino
- APP Inventor
Hardware Tools

• ESP 32 - ESP CAM
• Sensors: MPU 6050
• Raspberry Pi
Course Projects

● Motion classification using ESP 32 and MPU 6050 with hardware interaction or app interaction
● Sound classification using ESP 32 and microphone sensor with hardware interaction or app interaction
● Image classification using ESP CAM with hardware or app interaction
Course Projects

Superficie plana

Descendiendo

Ascendiendo

Inclinado a la Derecha

Inclinado a la Izquierda

Robot con sensor Inercial

Comunicación inalámbrica a través de ESPNOW

ESP32 conectado a EDGE IMPULSE

Robot con sensor Inercial

Comunicación inalámbrica a través de Bluetooth

Aplicación móvil para control y monitoreo del Robot
Course Projects
Course Projects
Some Final Thoughts

• The topic is very attractive for the students.
• The course is a good complement to others AI courses that we have at UAO.
• Different background of the student that is a little challenging for them and the professor.
• Arduino kits are very useful for the course.
• Include different hardware platform is challenging but necessary.
• The background of the students matters.