
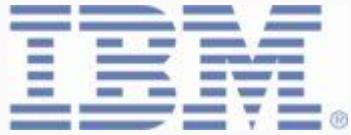


# Workshop on TinyML for Sustainable Development

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# Thanks!



**Bruno Flach**  
**Raquel Zarattini Chebabi**  
**Rodrigo Neumann Barros Ferreira**



**Harvard** John A. Paulson  
**School of Engineering**  
and Applied Sciences



# About ICTP

Founded in **1964** by Nobel Laureate Abdus Salam. Governed by tripartite agreement between Government of Italy, UNESCO and IAEA.

ICTP welcomes over **6000** scientists from 145+ nations per year for over 60 major scientific conferences. Over **200000** scientists since inception.

ICTP contributed to many scientific breakthroughs including **5 Nobel Prizes**.



# About ICTP-Brazil



ICTP Director Atish Dabholkar poses with Luciana Santos, Brazil's Minister of Science, Technology and Innovation, at the signing of a collaborative research agreement in the presence of Italian President Sergio Mattarella and Brazil President Luiz Inácio Lula da Silva.

# Workshop Agenda

Day 1

Monday

## **Introduction to (tiny)ML**

9:00 AM Workshop Opening and Schedule

9:15 AM Opening Keynote

9:45 AM Introduction to Embedded ML

10:30 AM Coffee Break

11:00 AM AI at the Edge with ARM and NVIDIA

11:30 AM Getting Started with Your Projects

12:00 PM Lunch

1:00 PM Project Caninos Loucos

1:45 PM Machine Learning Systems - Book Overview

2:10 PM First Hands-On TinyML Lab

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Marco Zennaro of ICTP

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Raquel Zarattini Chebabi of IBM Research Brazil

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Marcelo Rovai of Federal University of Itajuba - UNIFEI

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Peter Ing of ARM

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Rodrigo Neumann Barros Ferreira of IBM Research Brazil

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Marcelo Knörich Zuffo of Escola Politécnica da Universidade de São Paulo

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Vijay Janapa Reddi of Harvard University

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José Antonio Bagur Nájera of Universidad del Valle de Guatemala

# Workshop Agenda

Day 2	Tuesday	<p><b>Image and Video Applications</b></p> <p>9:00 AM Day Opening</p> <p>9:10 AM Convolutions and Computer Vision</p> <p>9:40 AM Applications of Video EdgeAI</p> <p>10:30 AM Coffee Break</p> <p>11:00 AM Co-inventing Physical AI Agents to Watch Over Facilities</p> <p>11:30 AM TinyML and Robotics</p> <p>12:00 PM Lunch</p> <p>1:00 PM Hands-On Computer Vision</p> <p>3:00 PM TinyML in Space</p> <p>3:20 PM Intelligent System for Identification of Leaf Diseases in Soybean Crops</p> <p>3:40 PM Bee Counting with FOMO and YOLO</p> <p>4:00 PM Getting On with Your Projects</p>	<p>Brian Plancher of <a href="#">Barnard College, Columbia University</a></p> <hr/> <p>Marcelo Rovai of <a href="#">Federal University of Itajuba - UNIFEI</a></p> <hr/> <p>Eric Pan of <a href="#">Seed Studio</a></p> <hr/> <p>José Antonio Bagur Nájera of <a href="#">Universidad del Valle de Guatemala</a></p> <hr/> <p>Walter Augusto Varella of <a href="#">Federal Institute of São Paulo</a></p>
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# Workshop Agenda

Day 3	Wednesday	<p><b>Audio Applications</b></p> <p>9:00 AM Day Opening</p> <p>9:10 AM Preprocessing for Audio</p> <p>10:00 AM Applications of Keyword Spotting (KWS)</p> <p>10:30 AM Coffee Break</p> <p>11:00 AM TinyML and Sustainability</p> <p>12:00 PM Lunch</p> <p>1:00 PM Hands-On Keyword Spotting</p> <p>3:00 PM Use of TinyML in Intensive Care Units (ICT)</p> <p>3:20 PM Sound based Projects</p> <p>4:00 PM Getting On with Your Projects</p>	<p>Jesús Alfonso López Sotelo of Universidad Autónoma de Occidente</p> <hr/> <p>Brian Plancher of Barnard College, Columbia University</p> <hr/> <p>Arnaldo de Carvalho Jr of Federal Institute of São Paulo</p>
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# Workshop Agenda

Day 4	Thursday	<p><b>TinyML Education</b></p> <p>9:00 AM Day Opening</p> <p>9:10 AM Teaching (Tiny)ML Panel/Group Discussion</p> <p>10:00 AM Coffee Break</p> <p>10:30 AM Education Case Studies</p> <p>11:00 AM Experiences using TinyML tools in teaching biomedical engineering</p> <p>11:30 AM Micro:bit and TinyML</p> <p>12:00 PM Lunch</p> <p>1:00 PM Hands-On Motion Classification and Anomaly Detection</p> <p>3:00 PM TinyML Rock Paper Scissors</p> <p>3:20 PM Car Accident Prevention</p> <p>3:40 PM ECG with TinyML</p> <p>4:00 PM Getting On with Your Projects</p>	<p>David Cuartielles of Arduino (Co-Founder) and of Malmö University</p> <hr/> <p>Flavio du Pin Calmon of Harvard University</p> <hr/> <p>Jeremy Ellis of School District 75, Mission</p> <hr/> <p>Jesús Alfonso López Sotelo of Universidad Autónoma de Occidente</p> <hr/> <p>Marcelo Rovai of Federal University of Itajuba - UNIFEI</p> <hr/> <p>Silvia Sotelo-Lopez of Universidad Pontificia Bolivariana</p> <hr/> <p>José Antonio Bagur Nájera of Universidad del Valle de Guatemala</p> <hr/> <p>Moises Meza of Universidad Peruana Cayetano Heredia</p> <hr/> <p>Jose Scodiero of Micro:bit Educational Foundation</p> <hr/> <p>Brayan Arenas of Universidad Pontificia Bolivariana</p> <hr/> <p>Fajardo S. George of Toulouse Lautrec Private Institute of Higher Technological Education</p> <hr/> <p>José Alberto Ferreira Filho of Federal University of Itajuba - UNIFEI</p>
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# Workshop Agenda

Day 5	Friday	<p><b>Advanced Topics</b></p> <ul style="list-style-type: none"><li>9:00 AM Day Opening</li><li>9:10 AM Ethics of TinyML</li><li>9:40 AM LSTMs and Other TinyML Models</li><li>10:10 AM Hardware X</li><li>10:30 AM Coffee Break</li><li>11:00 AM LLMs at the Edge</li><li>11:20 AM Federated Learning for TinyML</li><li>11:40 AM On-Device TinyML Training</li><li>12:00 PM Lunch</li><li>1:00 PM Closing Keynote</li><li>1:45 PM Team Project Presentations</li><li>3:15 PM TinyML4D Future Opportunities and Networking</li></ul>	<p><a href="#">David Cuartielles of Arduino (Co-Founder) and of Malmö University</a></p> <hr/> <p><a href="#">Marcelo Rovai of Federal University of Itajuba - UNIFEI</a></p> <hr/> <p><a href="#">Jesús Alfonso López Sotelo of Universidad Autónoma de Occidente</a></p> <hr/> <p><a href="#">Tiago de Souza Farias of Federal University of Sao Carlos</a></p> <hr/> <p><a href="#">Evgeni Gousev of tinyML Foundation</a></p> <hr/> <p><a href="#">Marco Zennaro of ICTP</a></p>
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# Open Material

The material used in the workshop (slides, videos, code) will be **openly available** for you to use as a teacher/student/practitioner.

TinyMLedu webpage:

<https://tinyml.seas.harvard.edu/SustainableDev-24/>

ICTP official webpage: <https://indico.ictp.it/event/10499>

Tell me and I forget,  
teach me and I may  
remember, involve me  
and I learn.

– Benjamin Franklin

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and I learn.

- ~~Benjamin Franklin~~
- Xun Kuang