SciTinyML
Scientific use of machine learning on low power devices
Regional Workshop - Africa

Introduction to Edge Impulse

Marcelo Rovai
Professor, UNIFEI - Brazil

Shawn Himel
Senior DevRel Engineer, Edge Impulse
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:05-1:20 PM UTC</td>
<td>Introduction to Edge Impulse</td>
<td>Shawn</td>
</tr>
<tr>
<td>1:20-1:35 PM UTC</td>
<td>Getting Started with Edge Impulse</td>
<td>Marcelo</td>
</tr>
<tr>
<td>1:35-1:50 PM UTC</td>
<td>Supervised learning and motion classification</td>
<td>Shawn</td>
</tr>
<tr>
<td>1:50-2:35 PM UTC</td>
<td>Hands-on Motion Classification</td>
<td>Marcelo</td>
</tr>
<tr>
<td>2:35-2:50 PM UTC</td>
<td>Unsupervised Learning and Anomaly Detection</td>
<td>Shawn</td>
</tr>
<tr>
<td>2:50-3:35 PM UTC</td>
<td>Hands-on Anomaly Detection</td>
<td>Marcelo</td>
</tr>
<tr>
<td>3:35-3:55 PM UTC</td>
<td>Conclusion and Q&amp;A</td>
<td>Marcelo and Shawn</td>
</tr>
</tbody>
</table>
Platform
The developer-first edge ML platform

- No royalty, no impact on BOM
- Your IP, stays your IP
- Total explainability, no black boxes
## Any sensor, any data, any use case

<table>
<thead>
<tr>
<th>Use cases</th>
<th>Ultra low power</th>
<th>Low-end MCU</th>
<th>High-end MCU</th>
<th>NPU</th>
<th>MPU</th>
<th>GPU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use cases</strong></td>
<td>• Wake word smart helmet</td>
<td>• Glass breaking detection</td>
<td>• MCSA (motor)</td>
<td>• Smart kitchen visual aid</td>
<td>• Worker safety assembly line</td>
<td>• Crowd management</td>
</tr>
<tr>
<td></td>
<td>• O&amp;G drill bit applied force prediction</td>
<td>• Pallet situation awareness</td>
<td>• Fire detection</td>
<td>• Fitness tracker</td>
<td>• Manufacturing</td>
<td>• Multi-object detection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pump anomaly detection</td>
<td>• Washing machine load</td>
<td>• KWS enterprise</td>
<td>• QA food conveyor</td>
<td>• Traffic detection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>estimation</td>
<td>headssets</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td><strong>Anomaly detection 10kB</strong></td>
<td><strong>Sensor fusion classification 50kB</strong></td>
<td><strong>Audio classification 18kB</strong></td>
<td><strong>Image classification 256kB</strong></td>
<td><strong>Object detection complex voice processing 1MB+</strong></td>
<td><strong>Video classification 1GB+</strong></td>
</tr>
<tr>
<td><strong>Sensor</strong></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
</tr>
<tr>
<td><strong>Audio</strong></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
</tr>
<tr>
<td><strong>Image</strong></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
<td><img src="https://example.com/%E2%9C%94%EF%B8%8F" alt="✔️" /></td>
</tr>
</tbody>
</table>
Develop edge ML applications **with Edge Impulse**

The infrastructure and integrations your data science and ML teams need.

- **Collect**: Rapidly build custom datasets
- **Design**: Develop models & algorithms
- **Test**: Track experiments
- **Deploy**: Accurately test model performance
- **Edge device**: Easily deploy on any edge target
Build valuable datasets at scale

- The infrastructure data science teams need
- Auto-labeling tools
- Integrations with most widely used data science tools
- Strong data traceability and quality control
- Secure data exchange portal
Advanced algorithm and ML expertise

- Advanced algorithm and DSP expertise
- No black boxes
- Explainable AutoML
- Knowledge sharing and collaboration between teams
Go to market faster, with confidence

- Hardware-aware development
- Full visibility across the whole ML pipeline
- Test your development against 24hrs of real world data
- Tune the post-processing algorithm to perform optimally
Deploy to any edge device with ease

- The largest silicon ecosystem
- Award-winning compiler
- Get access to full source code
- Full firmware integration for a number of devices
- Digital twin for performance profiling and analysis
- Enable brownfield and future greenfield
Comprehensive silicon support

Benefit from our silicon ecosystem
Customers
Advantech increases manufacturing productivity

Visual inspection system to flag delays on the production line in real-time

- A reported 15% overall increase in production line efficiency
- Faster detection of idle time raises assembly-line productivity
- Managers free up time to focus on production planning and operations
CASE STUDY

Oura goes deeper on deep sleep

Through the use of Edge Impulse’s advanced data infrastructure, Oura rapidly improved their algorithm

- Unprecedented sleep-scoring accuracy. A 17% point increase in scoring accuracy
- Improved correlation accuracy of 79%
- Data-driven development process enabled Oura’s data science team to scale
Nordic and Izoelektro predict power line failure

Smart power grid monitoring that improves the operation, stability, and reliability of electricity distribution.”

- Automated monitoring of poles and lines
- NB-IoT with 20 year battery life made possible by ML
- Avoid disastrous wildfires and reduce maintenance costs
Where’s my pallet

Reduce power use on battery operated devices in pallets indoors and outdoors.

**Implementation**

- A reported 15% overall increase in production line efficiency
- Faster detection of idle time raises assembly-line productivity
- Managers free up time to focus on production planning and operations