tinyML® EMEA

Enabling Ultra-low Power Machine Learning at the Edge

tinyML EMEA Technical Forum 2021 Proceedings

June 7 – 10, 2021

Virtual Event

www.tinyML.org

KLEPSYDRA TECHNOLOGIES

A LOW POWER AND HIGH PERFORMANCE ARTIFICIAL INTELLIGENCE INFERENCE APPROACH FOR ONBOARD DATA PROCESSING

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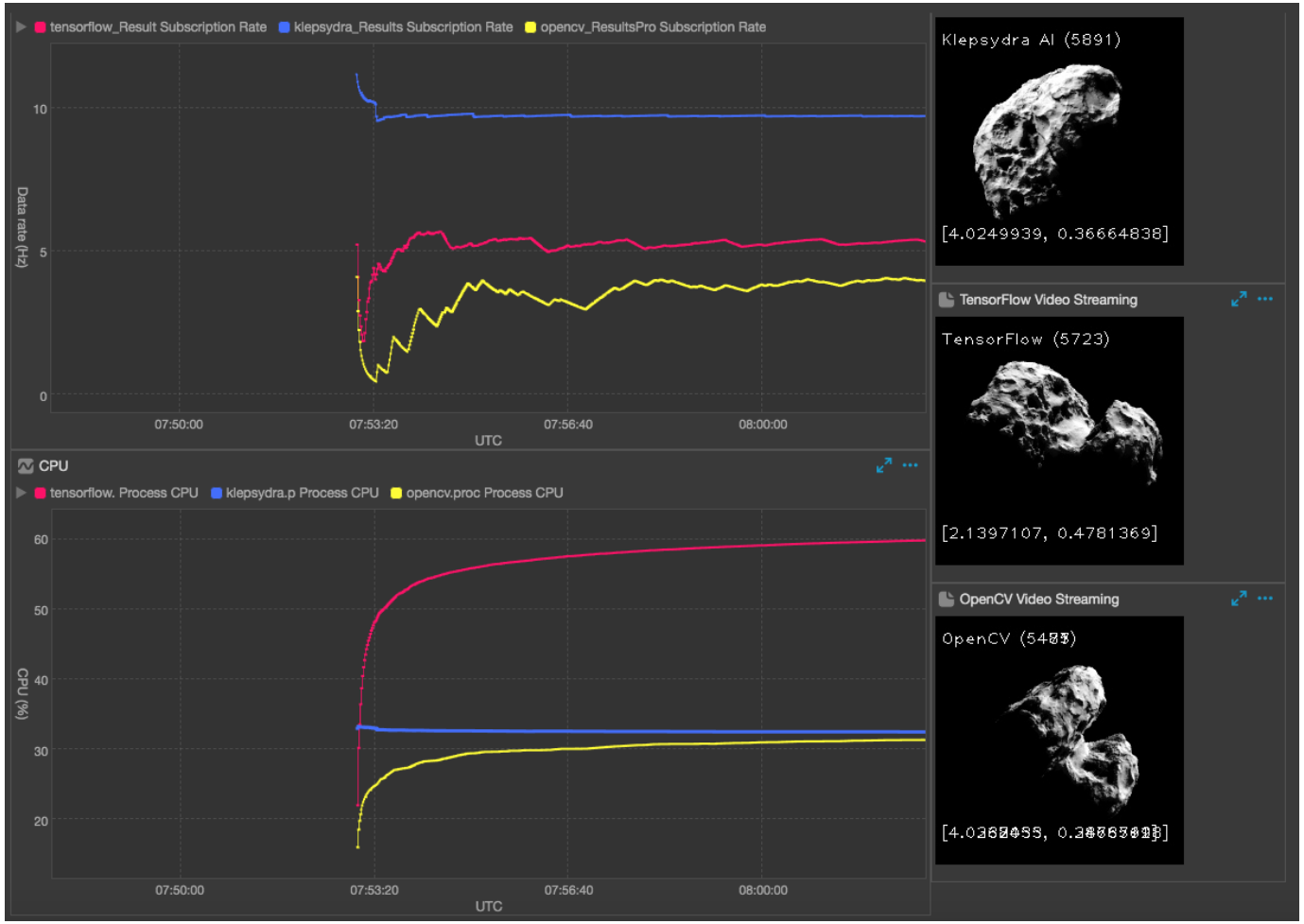
www.klepsydra.com

TINY ML

KLEPSYDRA AI LIVE DEMO



https://klepsydra.com/klepsydra-ai-online-demo/

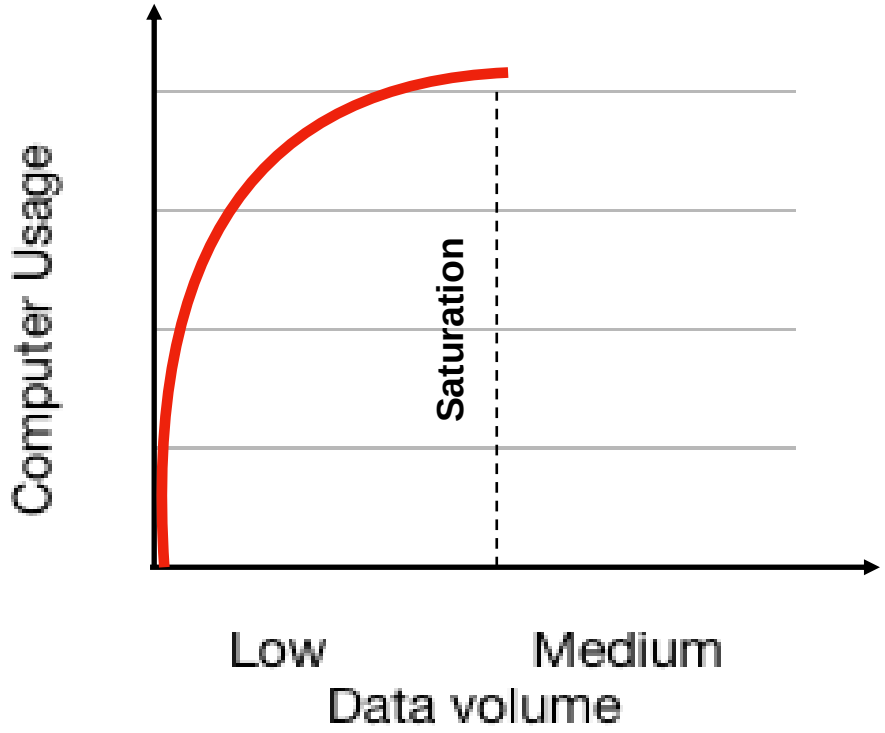
Technical Specifications:

- AI model: Multibranch DNN based on AlexNet for 224x224x3 images
- Processor: Intel 3.3GHz Dual core
- Data rate: 10 Frames per second (FPS)
- Implementations: Klepsydra AI, Tensor Flow Lite, Open CV
- OS: Ubuntu 20.04

Edge computing challenges

- Cloud interaction dependency
- Over dimensioned hardware and therefore excessive costs
- Safety issues:
  - Data loss
  - Long latencies
  - Unreliable systems

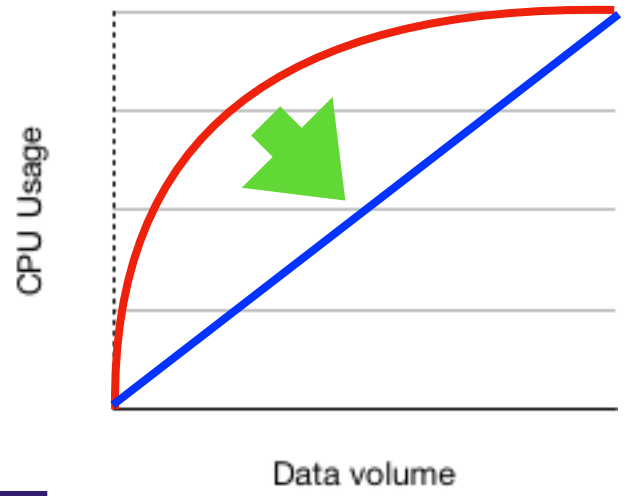
- Constraints can vary :
  - Low CPU
  - Low Latency
  - High Throughput



KLEPSYDRA AI APPROACH

Trading Software

- **Bigger computer did not solve the problem**
- **Use revolutionary data processing software**
- **Top investment banks make billions using these techniques.**

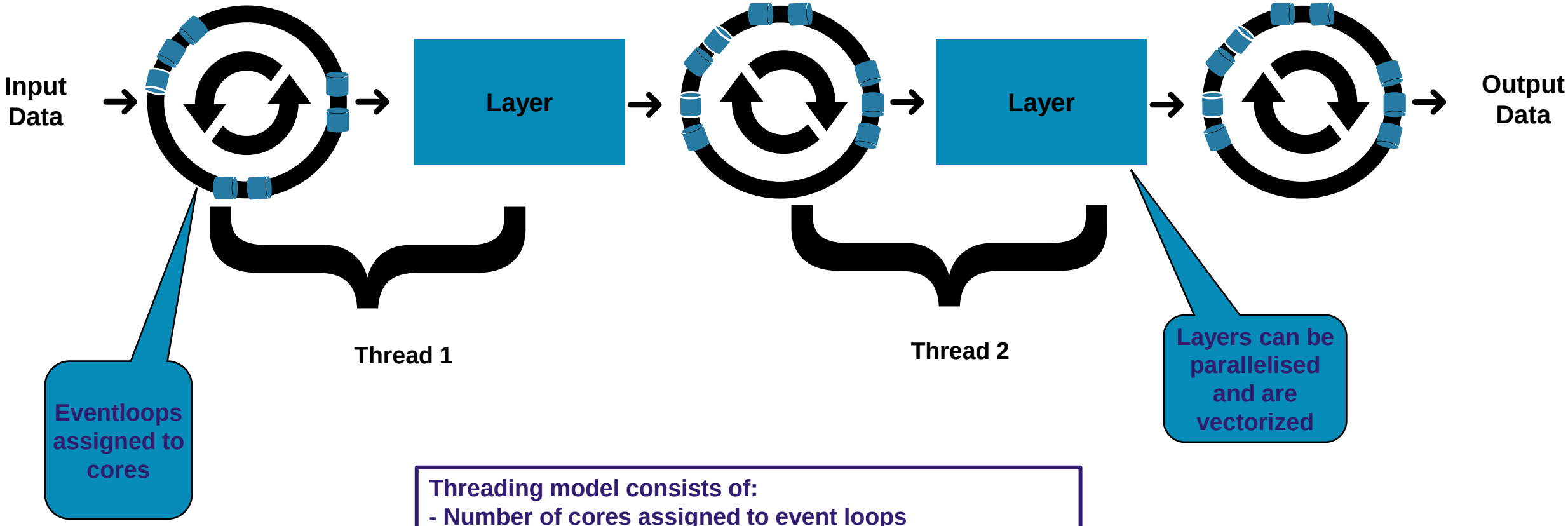


Parallelisation

Pipeline

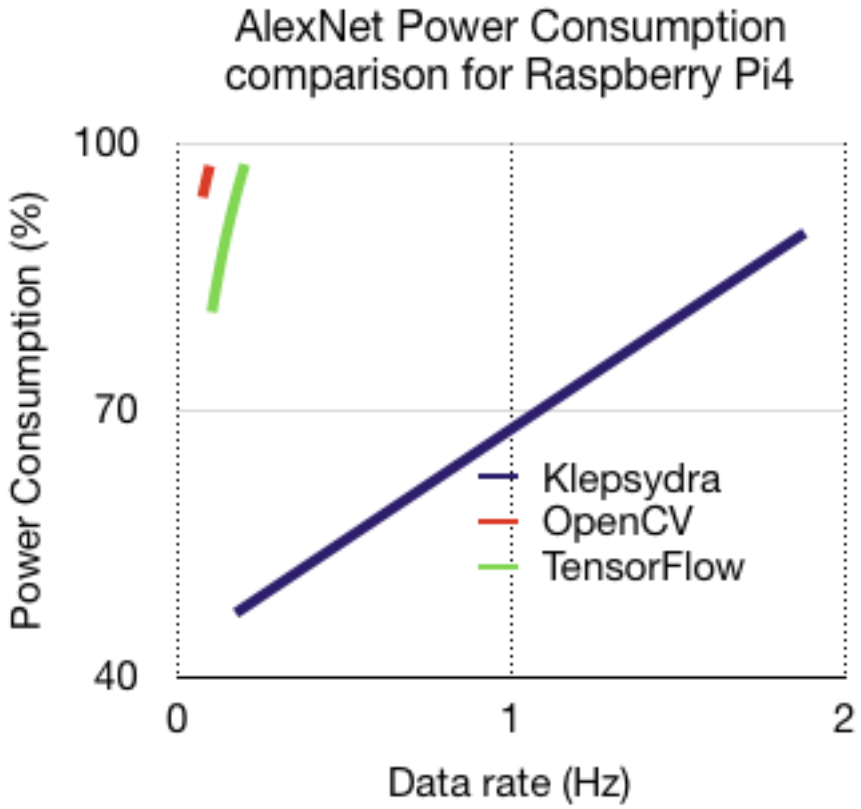
KLEPSYDRA AI APPROACH

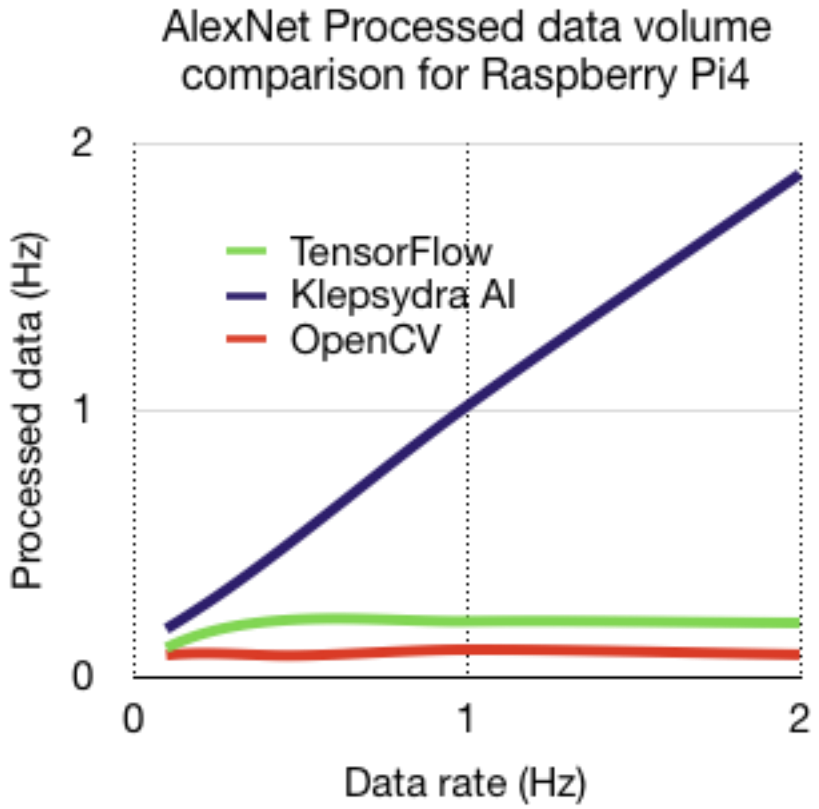
KLEPSYDRA AI THREADING MODEL



Threading model consists of:
- Number of cores assigned to event loops
- Number of event loops per core
- Number of parallelisation threads for each layer

KLEPSYDRA AI PERFORMANCE



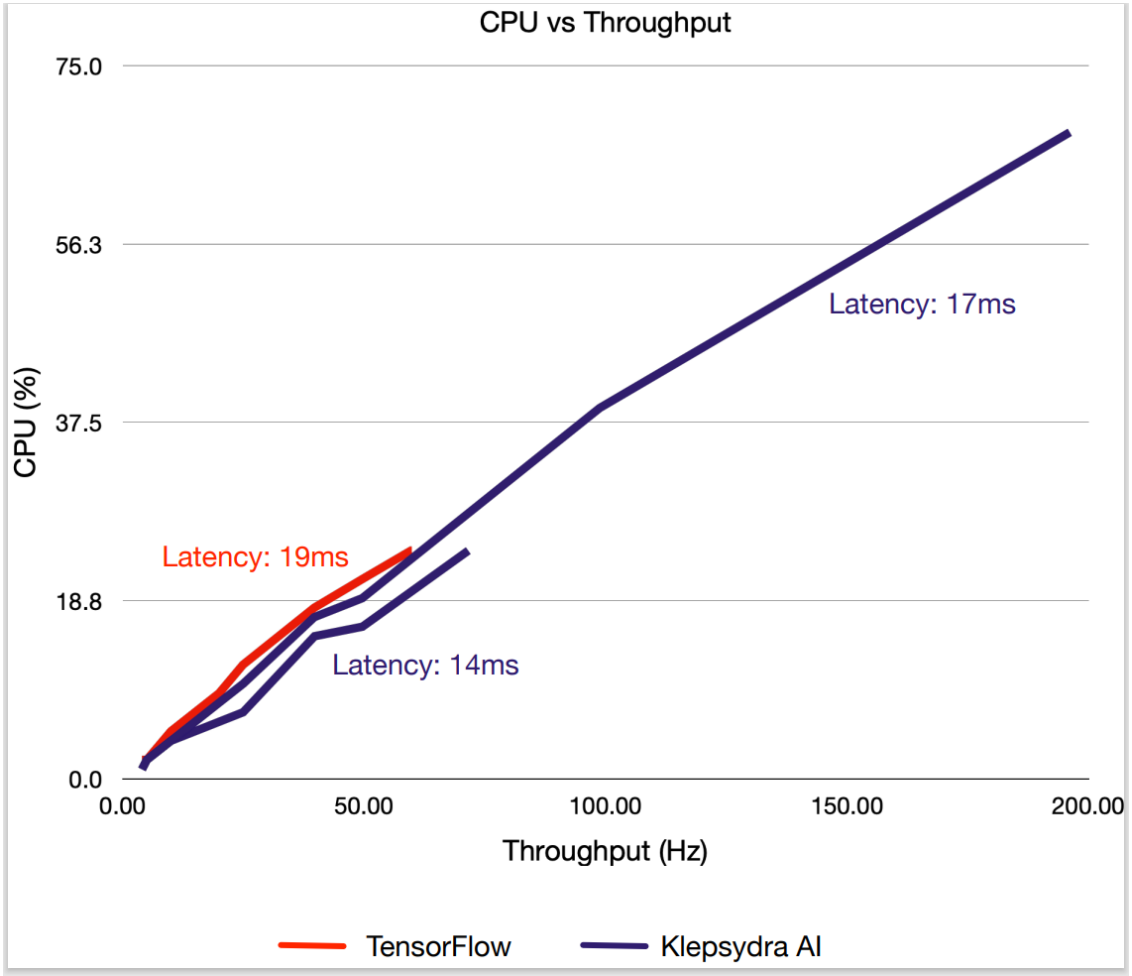


KLEPSYDRA AI PERFORMANCE

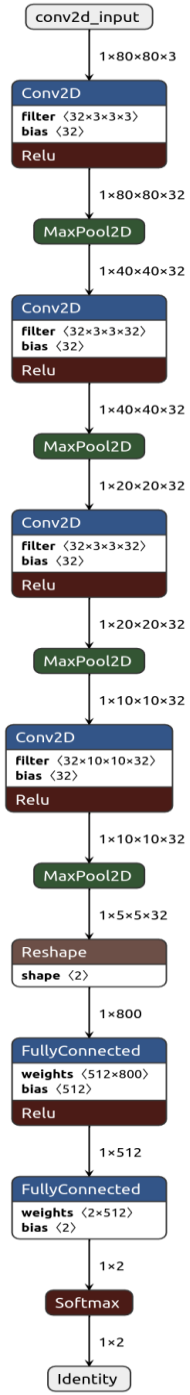
Smaller networks:

- **Image size 80 x 80**
- **Tuning for throughput**

At best latency, limited by FPU



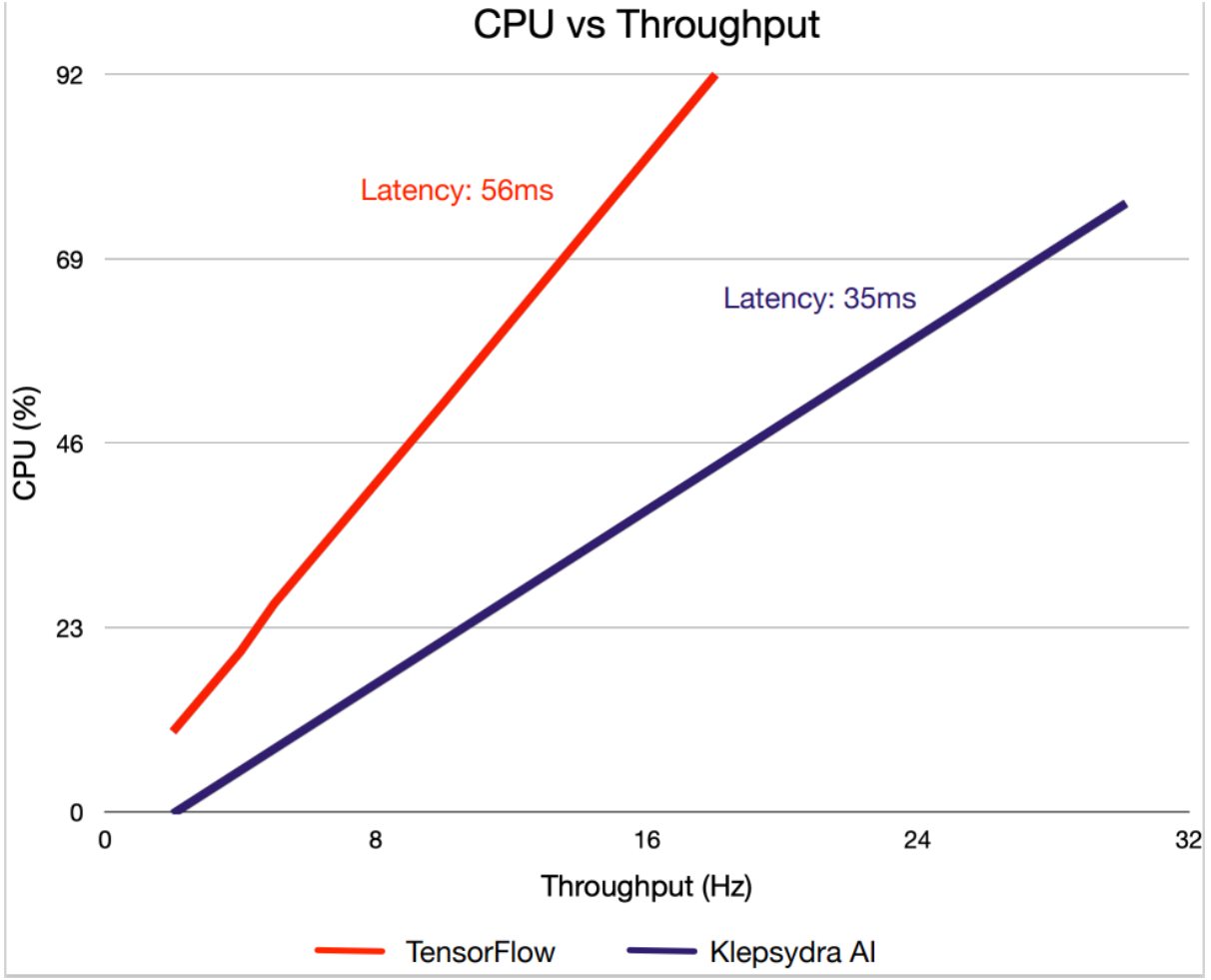
Raspberry Pi 4 : Ubuntu 20.04



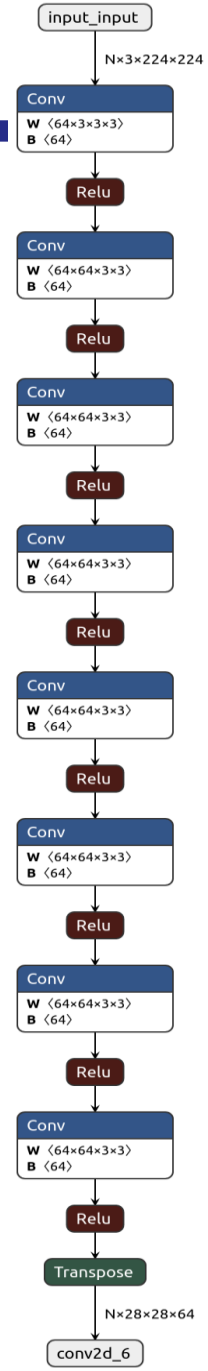
KLEPSYDRA AI PERFORMANCE

“Heavy” convolutions

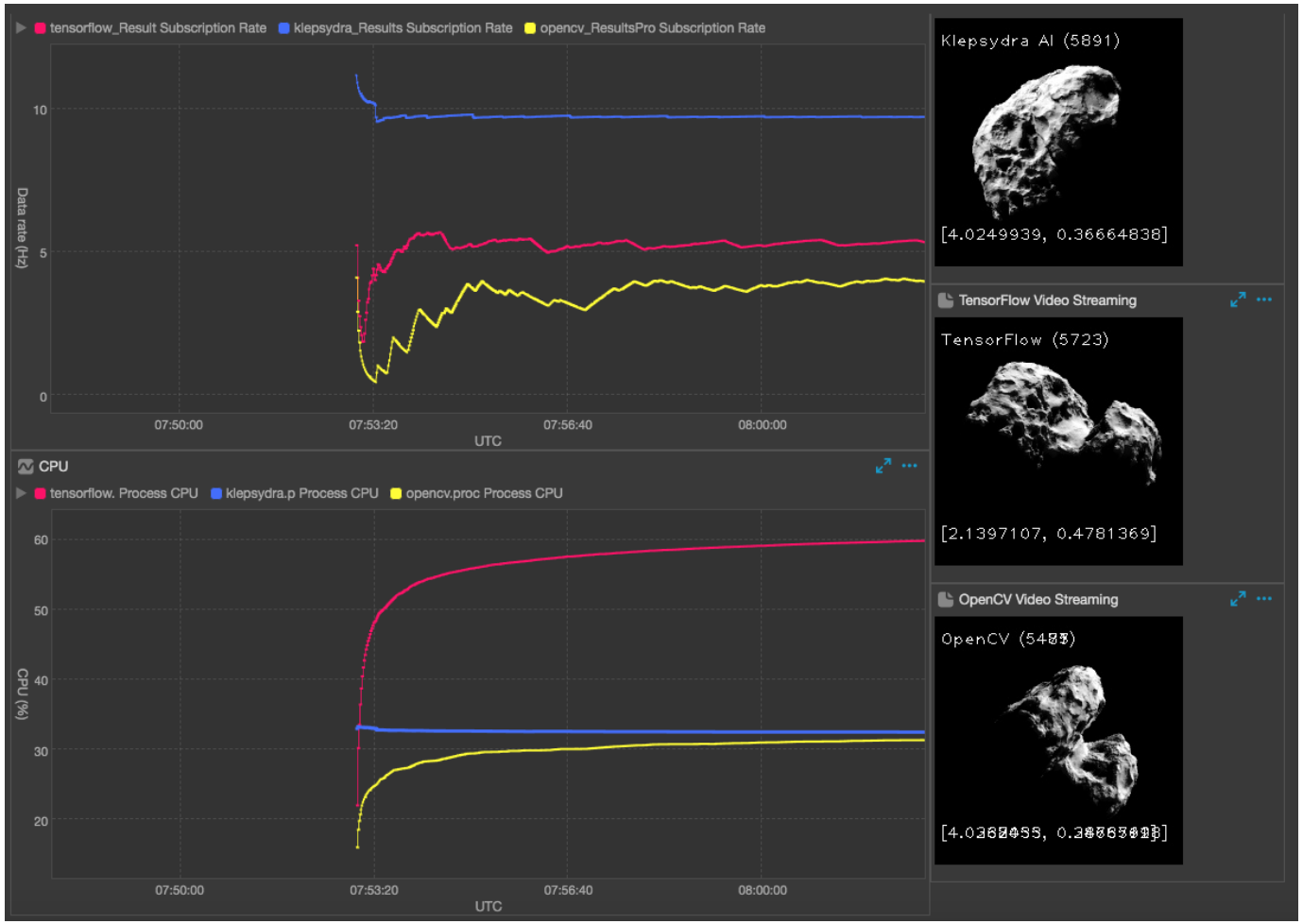
- **Image size 224 x 224**
- **Padding same**



Intel : Ubuntu 20.04



KLEPSYDRA AI DEMO ONLINE



Conclusions:

- More deterministic.
- Zero data loss.
- Klepsydra CPU usage is 50% less than TensorFlow's.
- Klepsydra Throughput is 2x more than TensorFlow's and even more with respect to OpenCV!

https://klepsydra.com/klepsydra-ai-online-demo/

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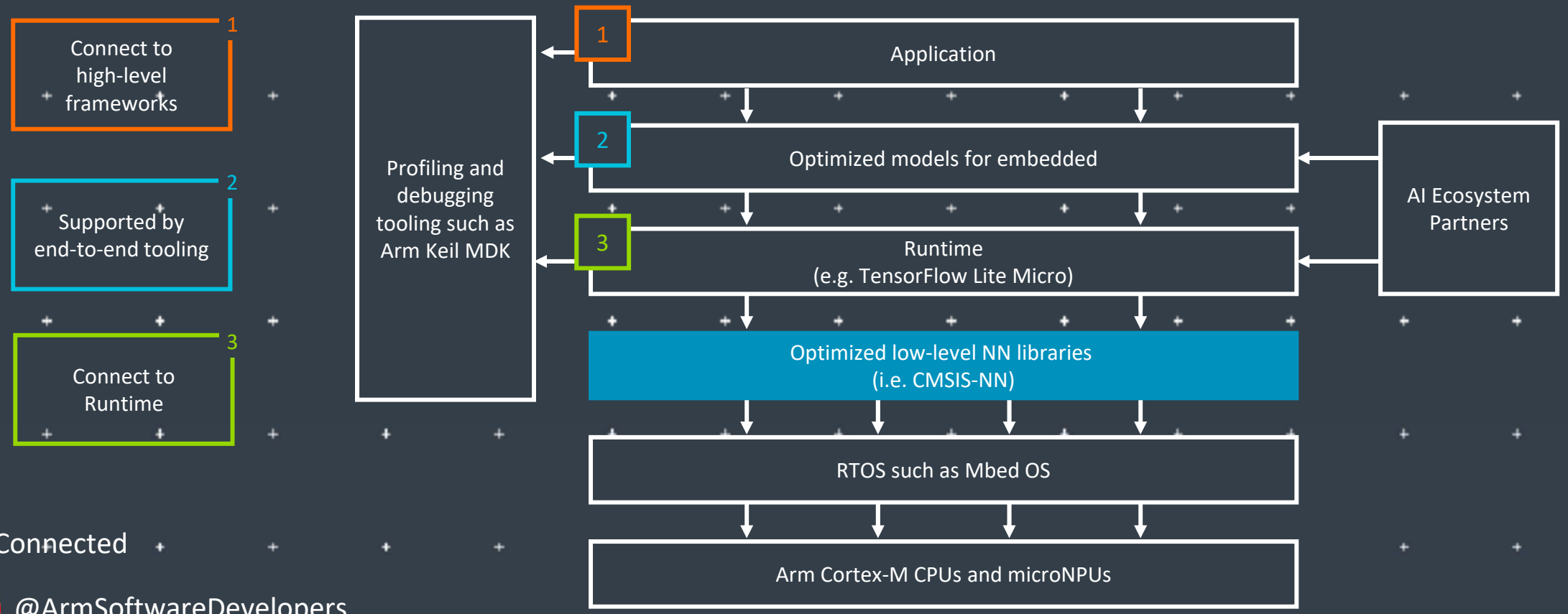

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Resources: developer.arm.com/solutions/machine-learning-on-arm

arm

TinyML for all developers

C++ library

Arduino library

WebAssembly

Dataset

Acquire valuable training data securely

Enrich data and train ML algorithms

Edge Device

Real sensors in real time

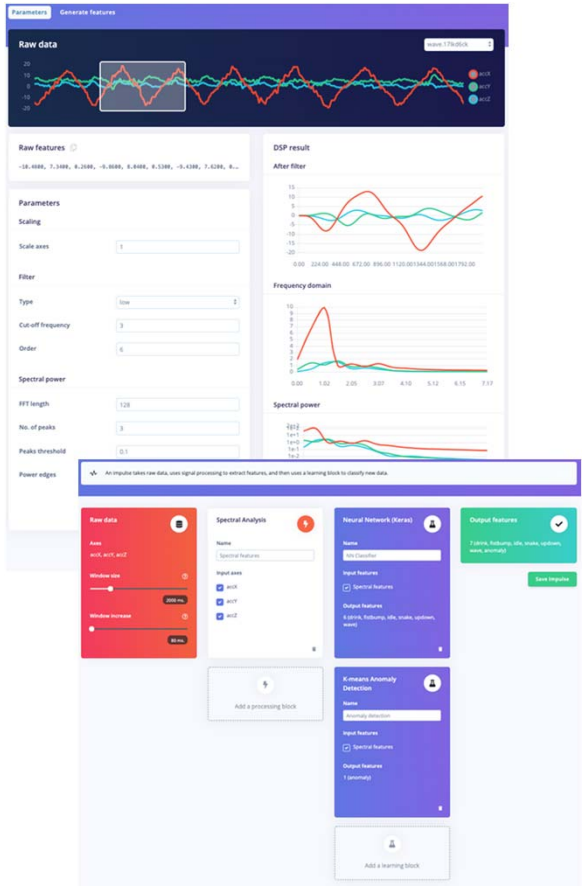
Open source SDK

Impulse

Embedded and edge compute deployment options

Test impulse with real-time device data flows

Test



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Object detection, speech recognition, contextual fusion

Reasoning

Scene understanding, language understanding, behavior prediction

Action

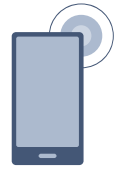
Reinforcement learning for decision making

Edge cloud

Cloud

IoT/IIoT

Automotive



Mobile

SYNTIANT

Syntiant Corp. is moving artificial intelligence and machine learning from the cloud to edge devices. Syntiant's chip solutions merge deep learning with semiconductor design to produce ultra-low-power, high performance, deep neural network processors. These network processors enable always-on applications in battery-powered devices, such as smartphones, smart speakers, earbuds, hearing aids, and laptops. Syntiant's Neural Decision Processors™ offer wake word, command word, and event detection in a chip for always-on voice and sensor applications.

Founded in 2017 and headquartered in Irvine, California, the company is backed by Amazon, Applied Materials, Atlantic Bridge Capital, Bosch, Intel Capital, Microsoft, Motorola, and others. Syntiant was recently named a CES® 2021 Best of Innovation Awards Honoree, shipped over 10M units worldwide, and unveiled the NDP120 part of the NDP10x family of inference engines for low-power applications.

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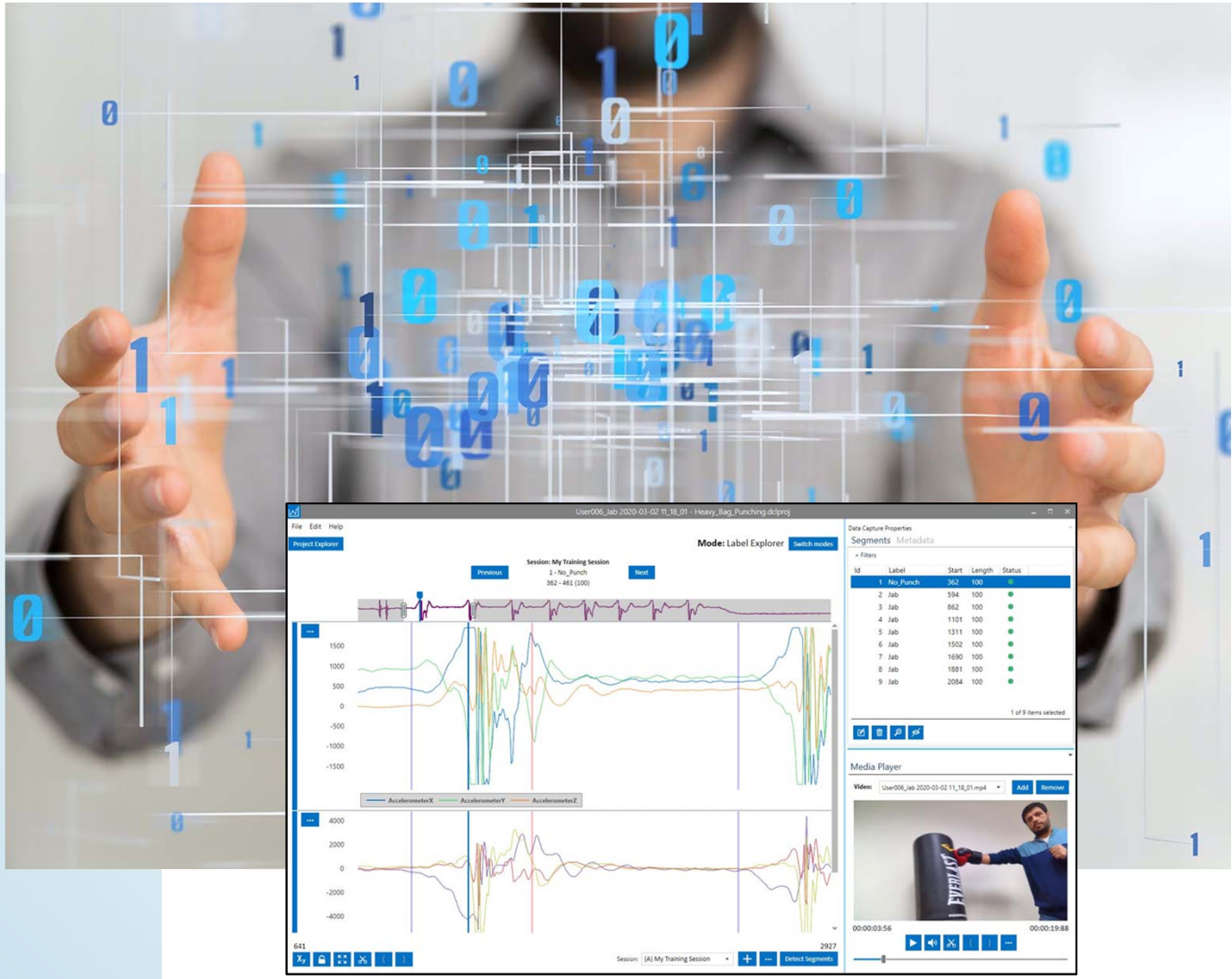

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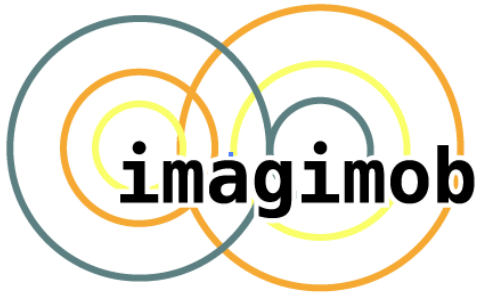

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