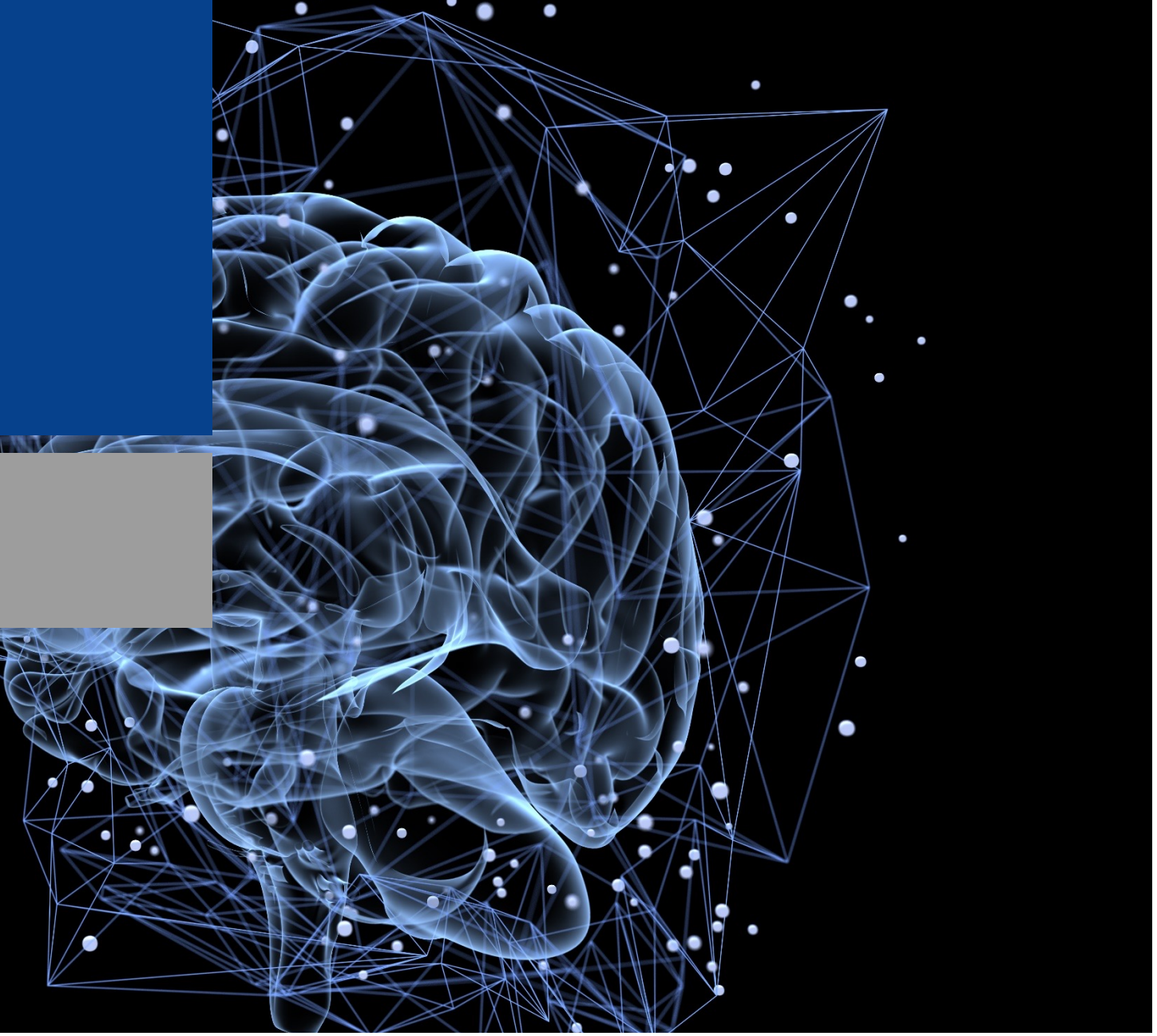
SEAMLESS TINYML DEVELOPMENT AND DEPLOYMENT OF AIOT

GEORGIOS FLAMIS
SR. STAFF SYSTEM DESIGN ENGINEER
RENESAS ELECTRONICS



DATA EXPLOSION

85%
CAGR
(2017-2025)

ENDPOINT DATA CREATION GROWTH

TOTAL DATA GENERATED BY IOT DEVICES

80
ZETTA BYTES
(IN 2025)

90%

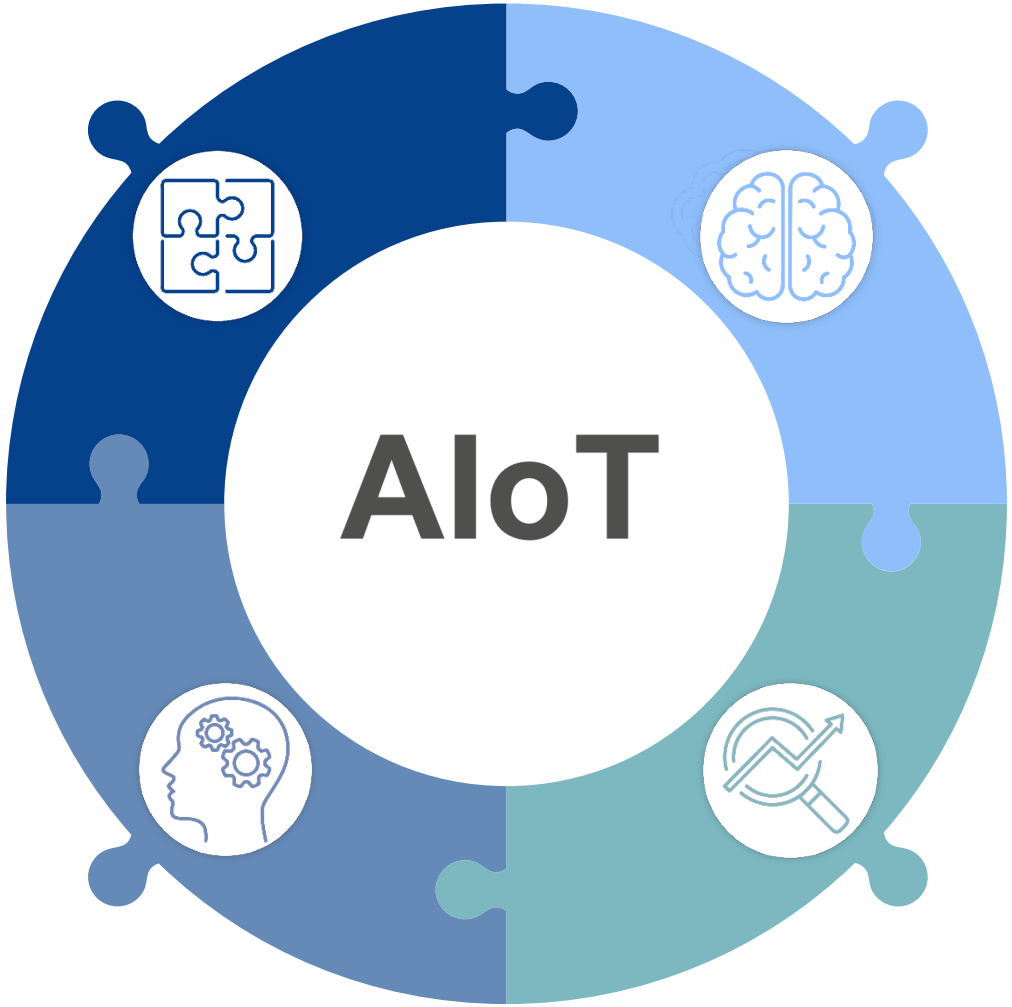
ENTERPRISE DATA IS NEVER USED

Source: IDC Research, Forbes

TECHNOLOGY ALIGNMENT IN AIOT

TECHNOLOGY CONVERGENCE

IOT, AI, 5G maturing roughly at the same time



DECENTRALIZED INTELLIGENCE

Tremendous benefits of a distributed intelligence model

NEW DESIGN MINDSET

AI transforms data to actionable insights

DATA EXPLOSION

Endpoint data creation to grow at 85% CAGR (2017-2025)

WHY DECENTRALIZE INTELLIGENCE?

REAL-TIME RESPONSE

- ✓ Minimized latency by transforming data at source
- ✓ Optimized processing for time-critical applications

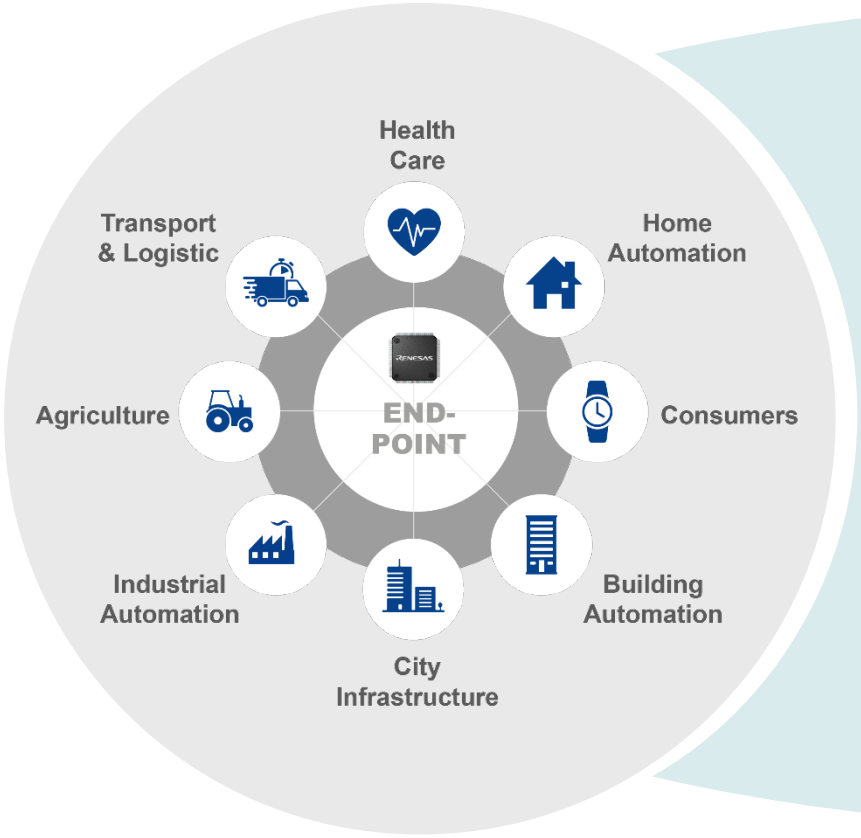
SECURITY & DATA PRIVACY

- ✓ Minimized security concerns related to transfer & flow of data
- ✓ On-device data handling tightly coupled to hardware root-of-trust

NETWORK AGILITY

- ✓ Maximizing data gravity by operating on data at the source
- ✓ Reduced data transport improves power & cost efficiencies

MCU / MPU CENTRIC AI/ML ON THE EDGE



AI/ML Pillars

- Voice
- Real Time Analytics
- Vision

KEY TECHNOLOGIES

- Sensor Fusion
- Motor Control
- HMI
- Wireless Communication
- Capacitive Touch
- Cloud Connectivity
- Functional Safety
- Robotics
- IoT Security

AI/ ML can solve-for or enhance aspects of IOT systems related to maintenance, effectiveness, liability, personalization, service, safety, security, and more

MCU / MPU CENTRIC AI/ML ON THE EDGE

Real Time Analytics | Vision | Voice

RA6M3/Asset Movement
AI/ML – Realtime Analytics

Asset Tracking

AI based asset movement detection

This demo showcases AI based asset motion tracking solution developed using Reality AI Tools and deployed on AIK-RA6M3.

Key Features

- On-board accelerometer-based tracking.
- Resource efficient model.

Key Benefits

- Easy to generate models using Reality AI Tools.

Key Applications

- Consumer
- IoT devices
- Industrial.

To be launched later Q4 2023

Renesas Electronics
www.renesas.com
2023.10

People Detection
AI/ML - Vision

People Detection

Complete software solution for camera-based people detection. The AI software solution is readily available for the RA family of MCUs and runs on Arm Cortex-M33, Cortex-M4, and Cortex-M85 microcontrollers.

Key Features & Benefits

- Detects each person in view, even if partially occluded
- Tracks people and assigns up to 20 unique IDs
- Detection distance of more than 20m / 65ft
- Trained with over 32 million labeled images
- Extensively validated on diverse people and scenarios
- Supports lenses up to 180 FOV

Plumerai

Key Applications

- Intelligent people detection sensors
- Security cameras and video analytics
- Video conferencing and webcams
- Video doorbells and smart home cameras

Plumerai People Detection | Renesas

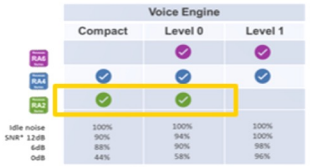
Renesas Electronics
www.renesas.com
2023.10

RA2L1/Voice Recognition
AI/ML - Voice

Voice Control

World-wide first VUI on CM23 – 48MHz

Palm size Voice kit platform, ready with RA2 for low power requirements of an application matter most for these device definitions. Realizes with ecosystem partner: Cyberon.



Key Features

- Endpoint voice recognition algorithm
- No latency, perform real time control
- Friendly voice modeling tool: DSMT
- Global 44+ language support:
- High Robustness and Accuracy
- Maximum three main points

Key Benefits

- One hand solution provider
- Simplify Design
- Fully System Cost Reduction
- Accelerate to Revenue
- Faster Go-To-Market

Cyberon Leading Speech Solution Provider

Key Applications

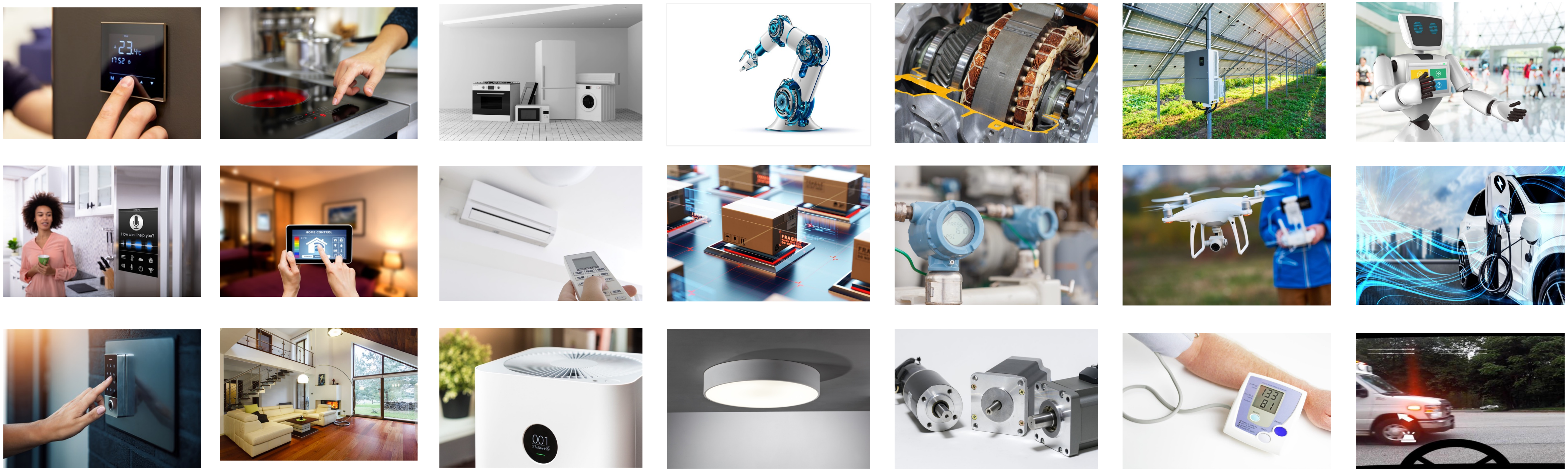
- IoT Devices
- Home Appliances
- Wearable/Hearable Devices

TW001-VUIA2L1POCZ - RA2L1 Voice User Reference Kit | Renesas

Renesas Electronics
www.renesas.com
2023.10

AI IS DISRUPTING EVERYTHING

The impact of AI in our lives is more visible than ever!



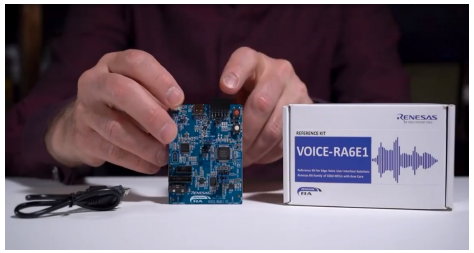
AI @ RENESAS

Comprehensive portfolio of AI/ ML tools and solutions

STARTING WITH	SENSOR/SIGNAL DATA	USE CASE REQUIREMENTS	TRAINED MODEL OR MODEL FROM RENESAS APPLICATION ZOO		VOICE COMMANDS
AVAILABLE TOOLS	RealityAI Tools® RealityCheck™ AD RealityCheck™ Motor	RealityCheck™ HVAC Automotive SWS	RZ/V AI SDK DRP-AI TVM DRP-AI Translator	e-AI Translator	Dspotter Tool
SUPPORTED COMPUTE ARCHITECTURES	RA, RX, RL78, RZ		RZ	RA, RX, RL78	RA, RX

AI @ RENESAS

VOICE PLATFORM SUPPORTING 44 LANGUAGES

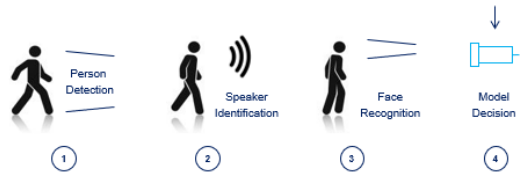


Comprehensive & intuitive toolchain
Support for 44+ languages
Scalable + smart software features
Runs on Cortex M23/ M33 devices
License free development

Home Appliances, Wearables, IoT Devices

MULTI-MODAL MACHINE ACCESS/ PERSONALIZATION

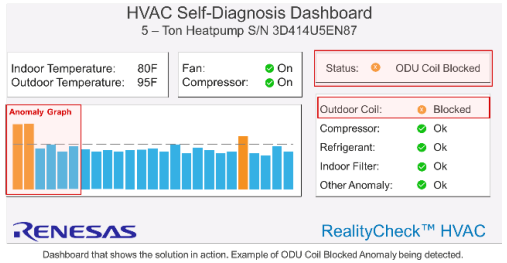
Enhances user safety or personalizes operation
User facial & voice signatures for authentication
Multi-modal design runs on M33 devices



Smart Appliances, Machines, etc.

AI/ ML SOLUTIONS

HVAC, Refrigeration

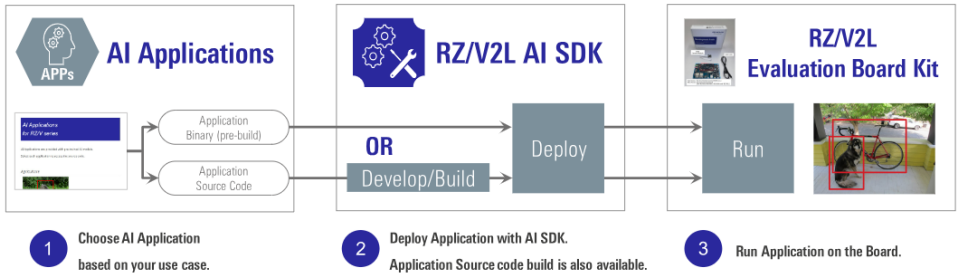


Dashboard that shows the solution in action. Example of ODU Coil Blocked Anomaly being detected.

Complete end-to-end service
H/W, S/W reference design
AI-enabled anomaly detection
Predicting operating conditions

REALITYCHECK HVAC SOLUTION SUITE

Multiple IoT verticals.



20+ PRE-TRAINED MACHINE VISION APPLICATIONS

SUMMARY & KEY TAKEAWAYS

- The convergence of AI & IoT is a megatrend that cannot be ignored
- With explosive growth in endpoint data creation a decentralized intelligence architecture will unlock tremendous potential
- Renesas with its comprehensive offering of hardware, software, tools & ecosystem provides all the building blocks for you to unleash your creativity
- Join Renesas and experts & through-leaders from across the industry at Renesas AI, where we present the latest innovations in this space.
- Come talk to us about your next AIoT challenge!

renesas.com/ai


RENESAS

TINY ML ASIA
Seoul, South Korea
November 16, 2023

Copyright Notice

www.tinyml.org