EDGE AI Academy

Summer School

7-8 July 2025, Pisa, Italy

Edge AI Academy Summer School

The intelligent edge - Navigating the frontiers of edge AI technology and applications

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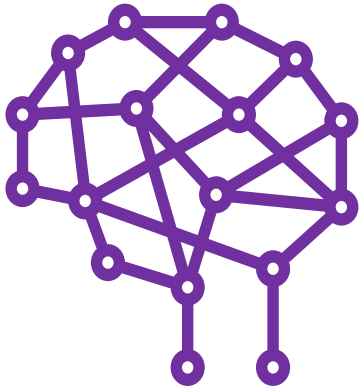
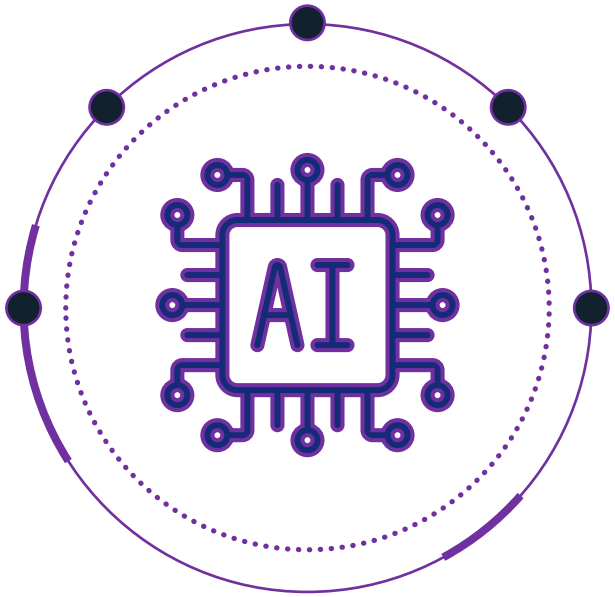
7-8 July 2025 Pisa, Italy

Types of AI





		Description
CAPABILITIES	1. Narrow AI	AI systems designed to perform a narrow task (e.g., facial recognition, internet searches, self-driving cars).
	2. General AI	AI systems with generalised human cognitive abilities. A strong AI system can find a solution without human intervention when presented with an unfamiliar task.
	3. Super AI	AI systems that compete with human intelligence in several aspects, including creativity, problem-solving and general wisdom.
FUNCTIONALITIES	4. Reactive Machines	AI systems with no memory and task-specific. The systems cannot use past experiences for future decisions.
	5. Limited Memory	AI systems that use past experiences to make future decisions to a limited extent. The systems have a short-term memory.
	6. Theory of Mind	AI systems understand human emotions, beliefs, thoughts, and expectations. They can interact more naturally and socially with humans. Bridge to sentient intelligence.
	7. Self-aware AI	AI systems that possess a sense of self, consciousness, and awareness. The systems can understand their state and predict others' emotions and reactions.

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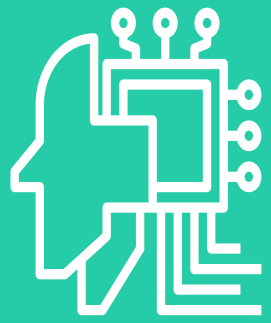
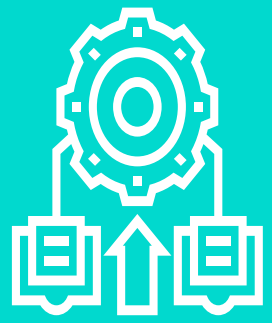
Edge AI Across the Intelligence Continuum

Artificial Intelligence



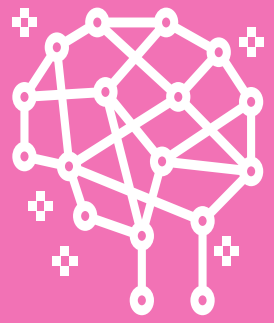
Engineering of making Intelligent Machines & Programs

Machine Learning



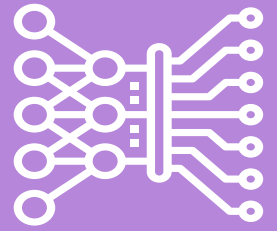
Ability to learn without being explicitly programmed

Deep Learning



Learning based on Deep Neural Network

Generative AI



Produce various types of content, including text, imagery, audio and synthetic data

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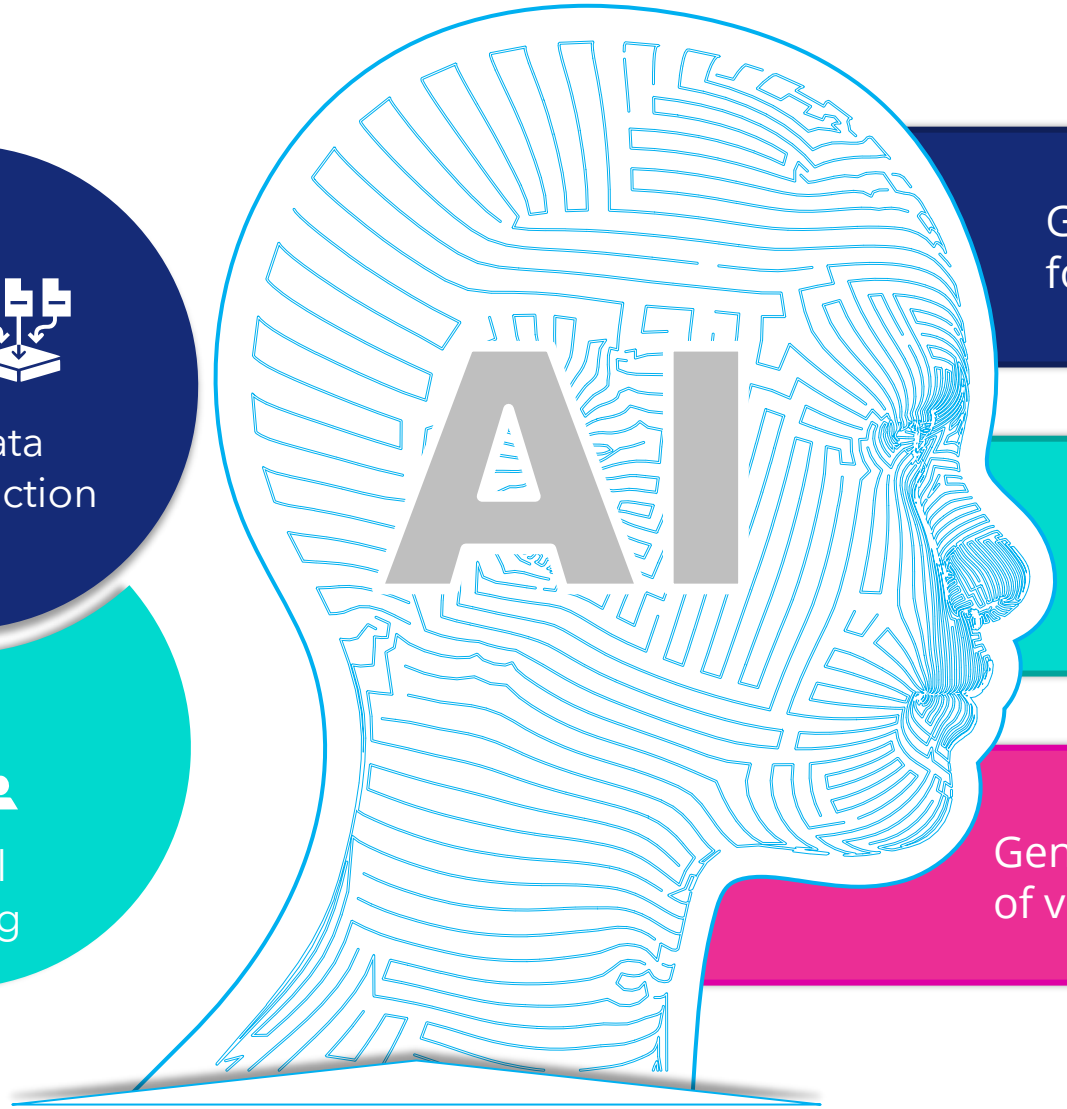
Generative Edge AI



Generation of synthetic data for algorithmic training

Generation of scenarios for autonomous systems

Generation of requirements, generation of verification, validation and testing

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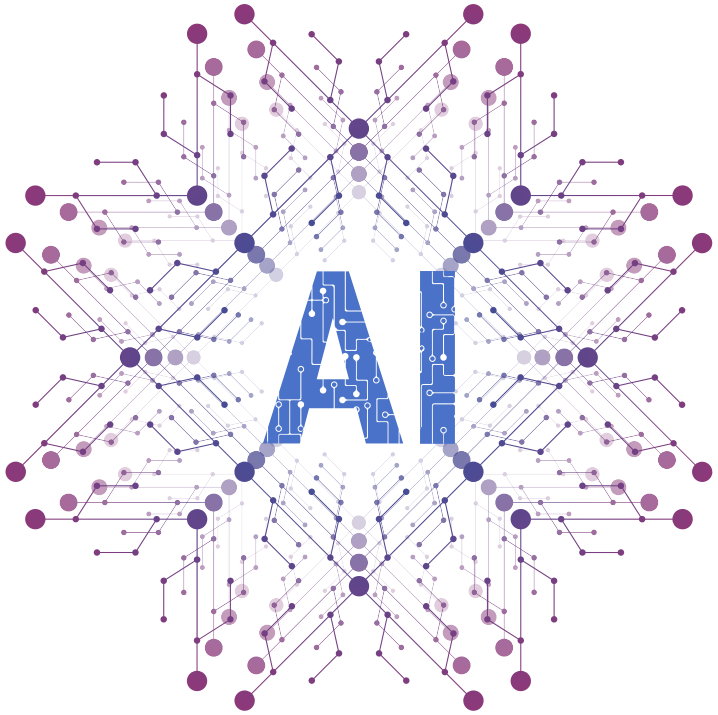
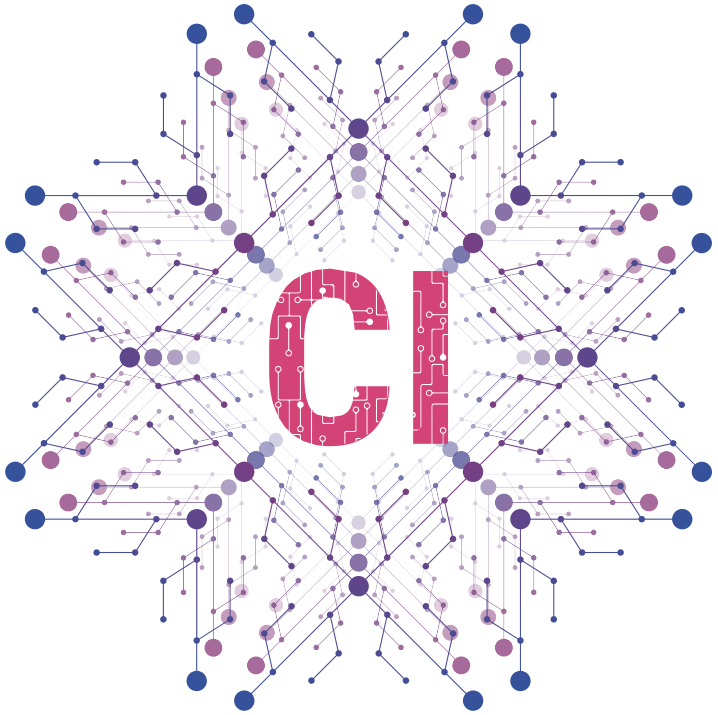
Artificial Intelligence vs Computational Intelligence



Artificial Intelligence

AI is the study of intelligent behaviour demonstrated by machines as opposed to the natural intelligence in human beings.



Computational Intelligence

CI is the study of adaptive mechanisms to enable or facilitate intelligent behaviour in complex and changing environments.

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AI vs CI

Artificial Intelligence

- Hard Computing Techniques
- Follows Binary Logic
- Based on Mathematical Models
- Relative Effective
- Deterministic Results

VS

Computational Intelligence

- Soft Computing Techniques
- Follows Fuzzy Logic
- Nature Inspired Models
- Work Inexact + Incomplete Data
- Probabilistic Results

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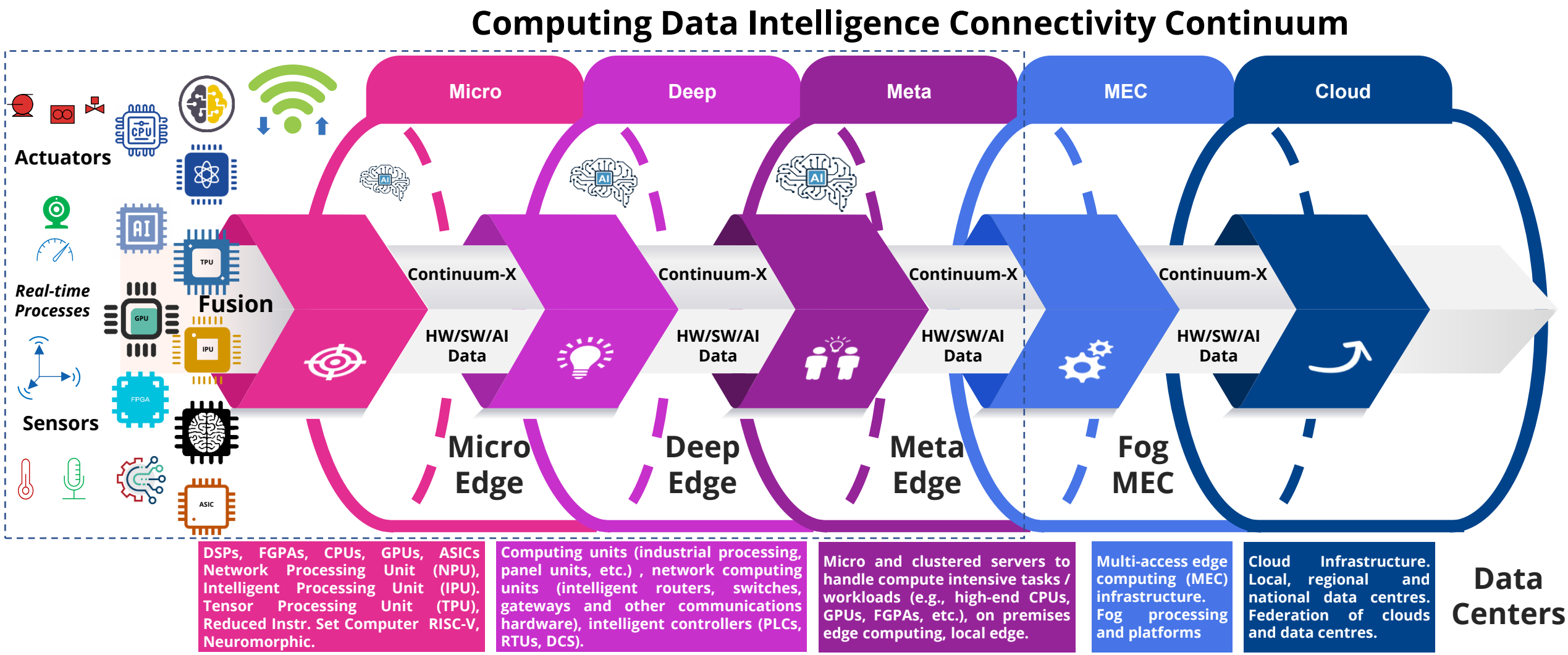
Edge Continuum Intelligence



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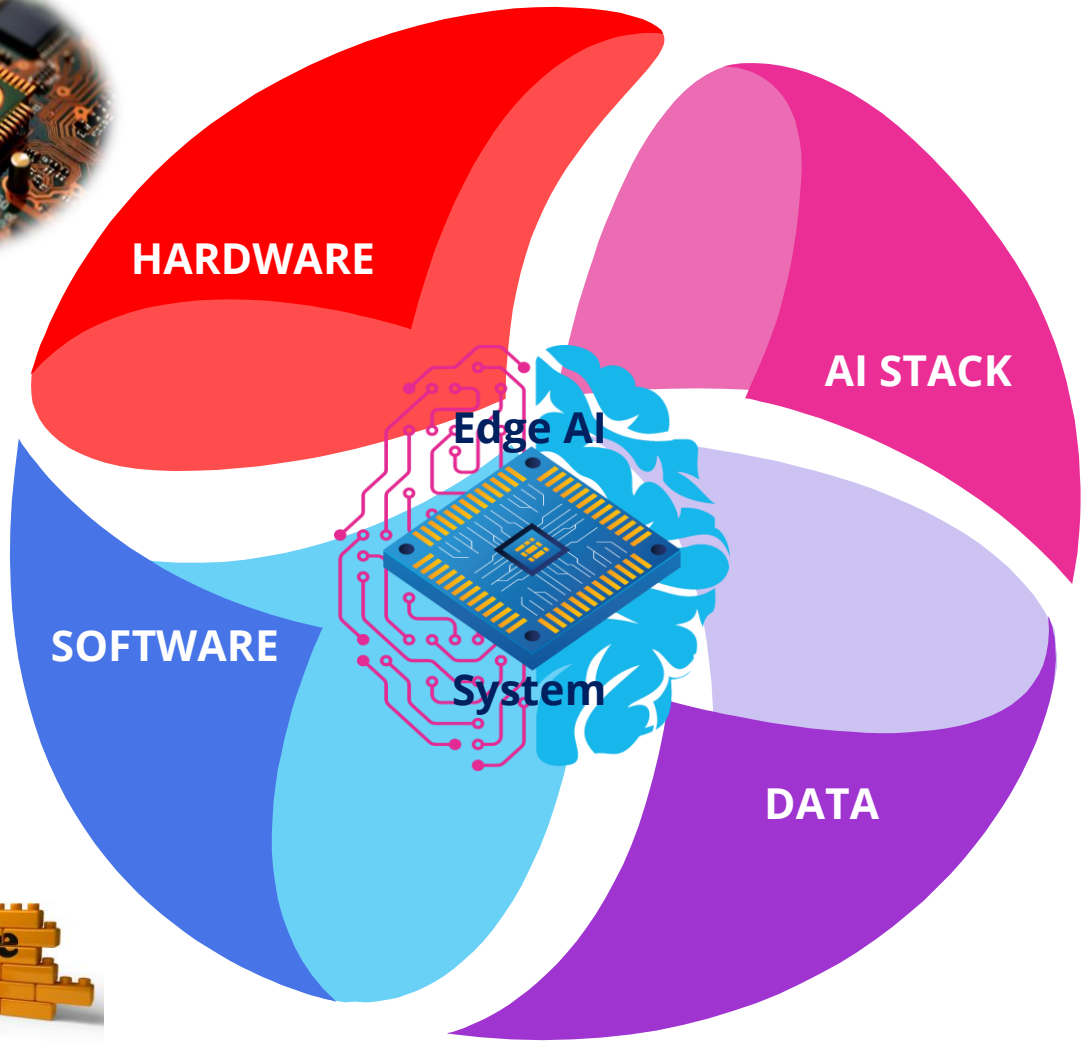
Edge AI System – Holistic View

- HW platforms.
- CPUs, GPUs, TPUs
- ASICs, FPGAs
- Neuromorphic



- AI Models
- Methods
- Algorithms
- Libraries
- Frameworks

- SW platforms
- Optimisation tools
- SDK tools
- Software engineering
- OSs

- Data collection
- Features extraction
- Data types
- Data sets
- Training data
- Validation data
- Test data
- Inference data

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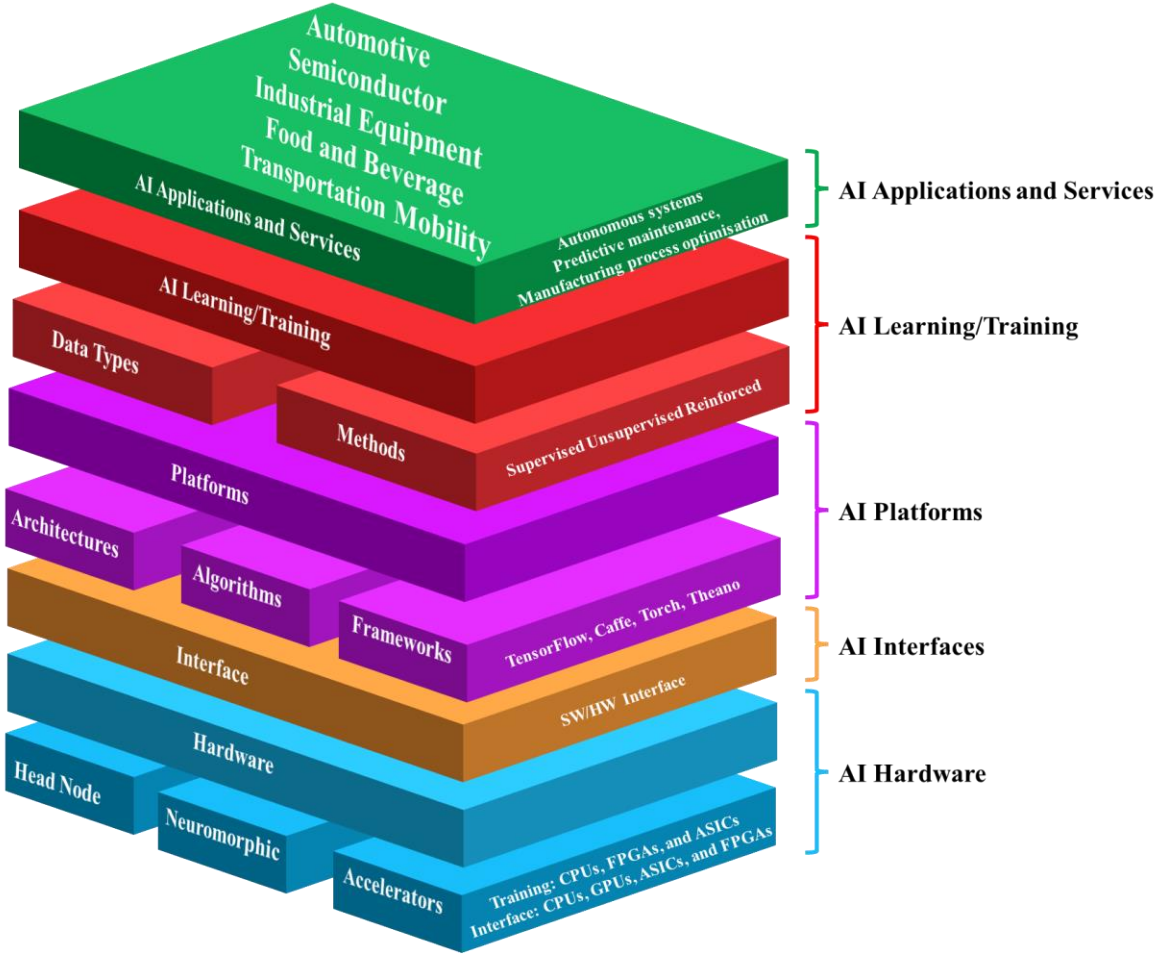
Edge AI Technology Stack

- Edge AI integrates open-source hardware, software, AI frameworks, and data to run AI models on edge devices.
- Open-source applied to each layer.



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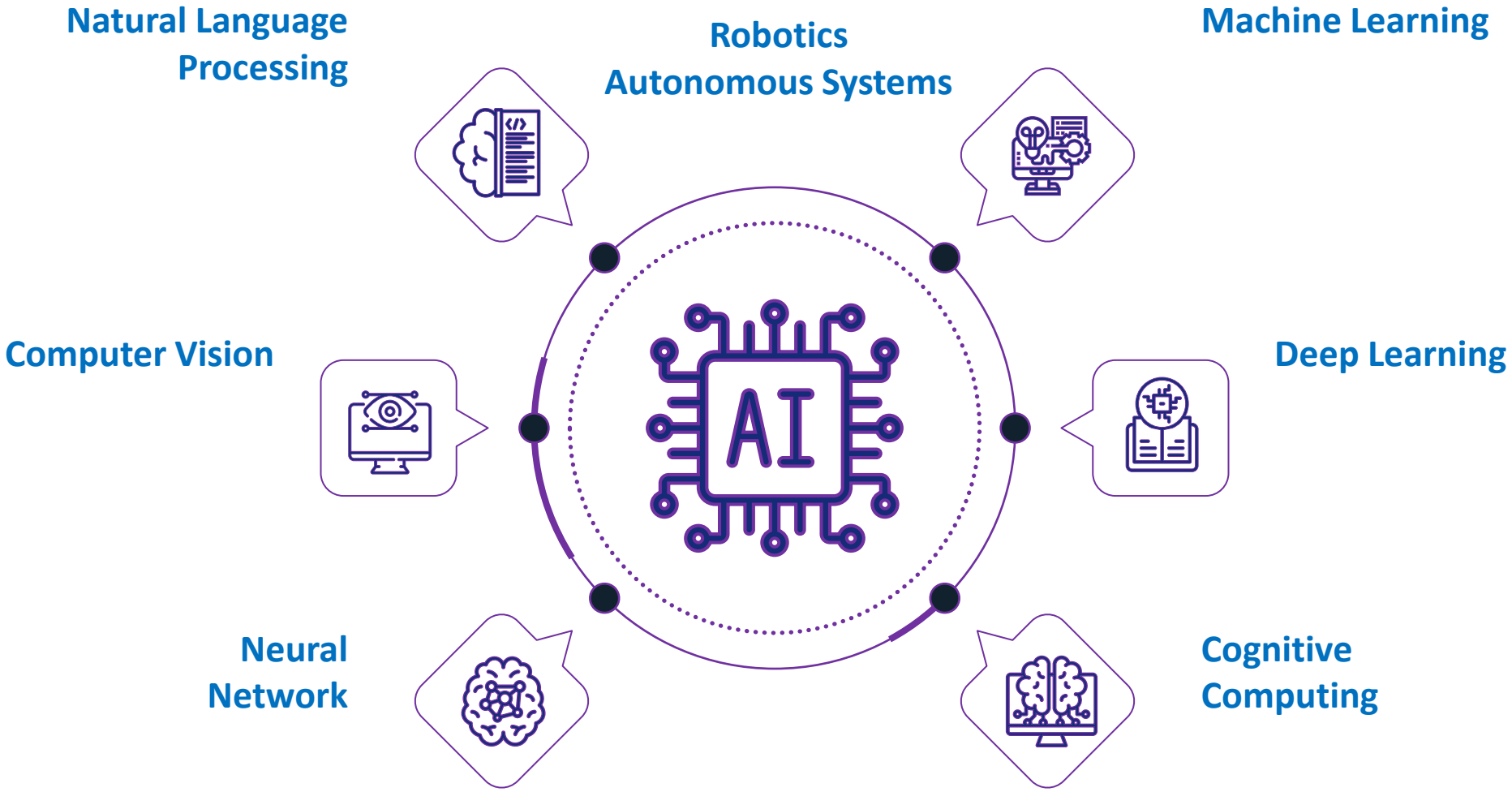
Components of Edge AI



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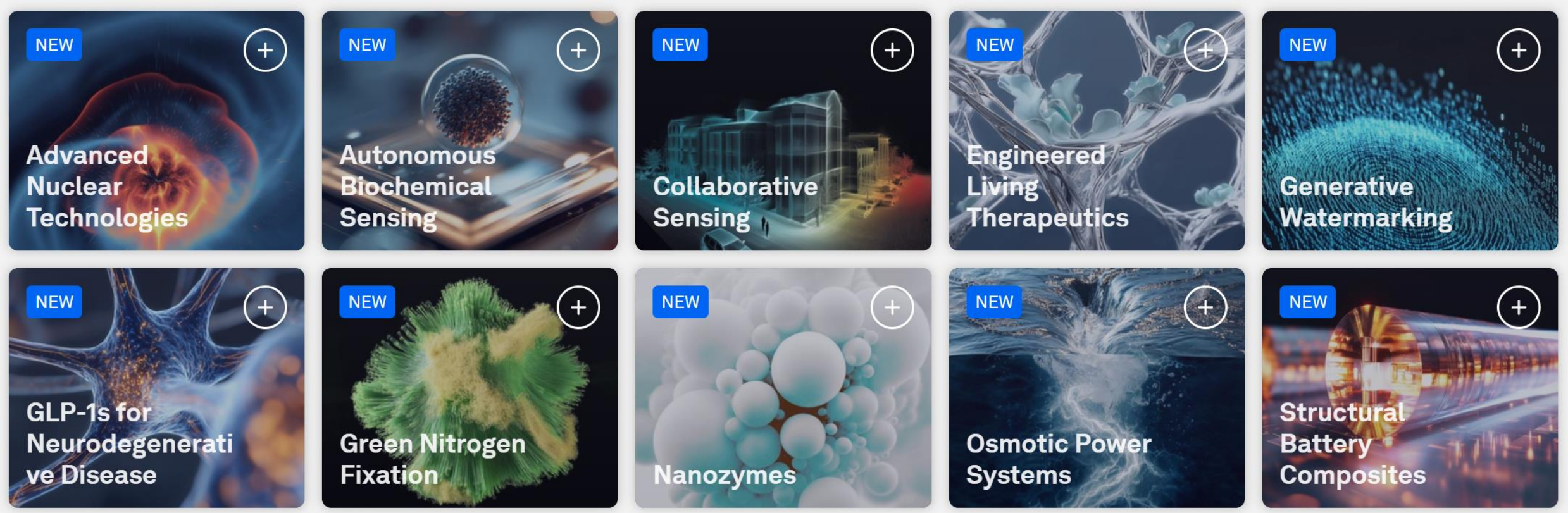
Top 10 Emerging Technologies of 2025



Source: OECD - Flagship Report June 2025

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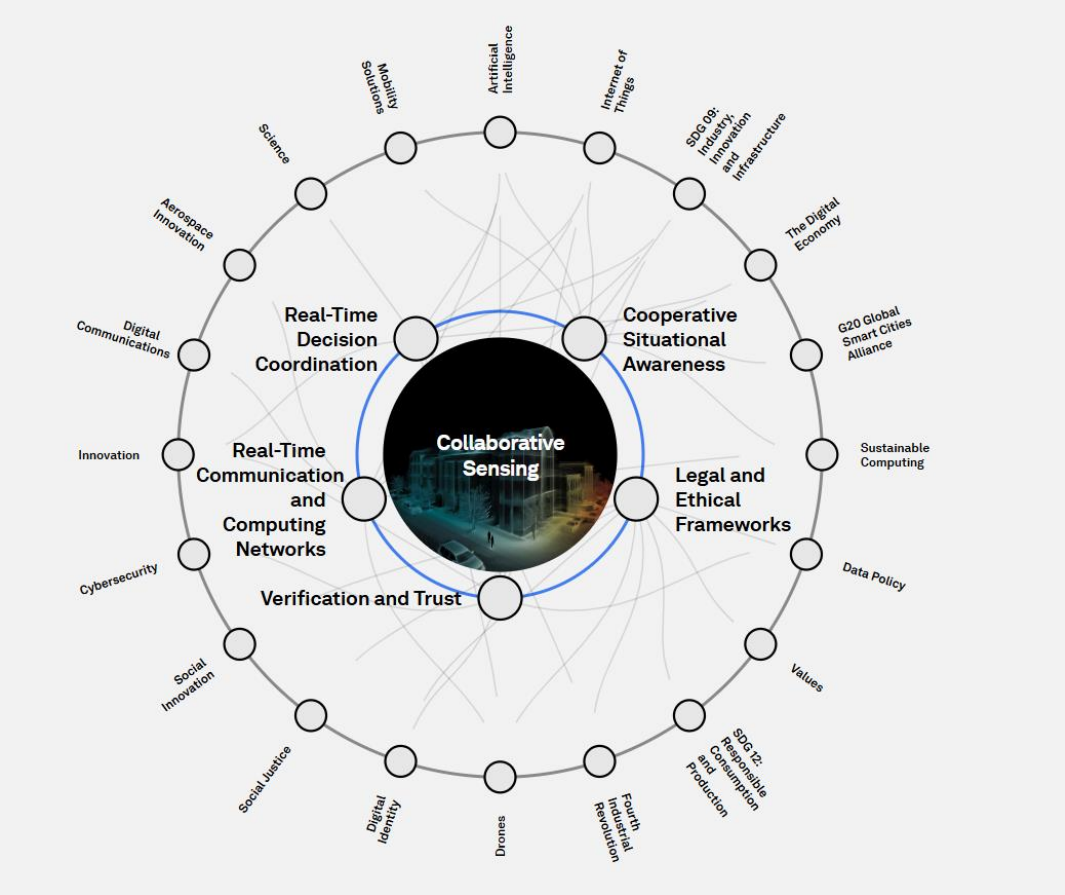
Collaborative Sensing

❖Empowering connected systems to make context-aware decisions.

- Collaborative sensing allows machines and devices to work together by sharing contexed data sensed.
- Collaborative sensing generates shared situational awareness across systems by combining networks of sensors, IoT devices, real-time communication and edge AI.
- Collaborative sensing enables autonomous agents (e.g., vehicles, drones and robots) to pool data for better decision-making, even in unfamiliar or rapidly changing environments.
- Collaborative sensing is feasible at scale by implementing advances in wireless connectivity, localised data processing, edge AI and sensor integration.
- Collaborative sensing offers the potential to improve safety, efficiency and resilience across multiple sectors.
- Collaborative sensing applications: traffic management, environmental monitoring, industrial automation, etc.



Source: OECD

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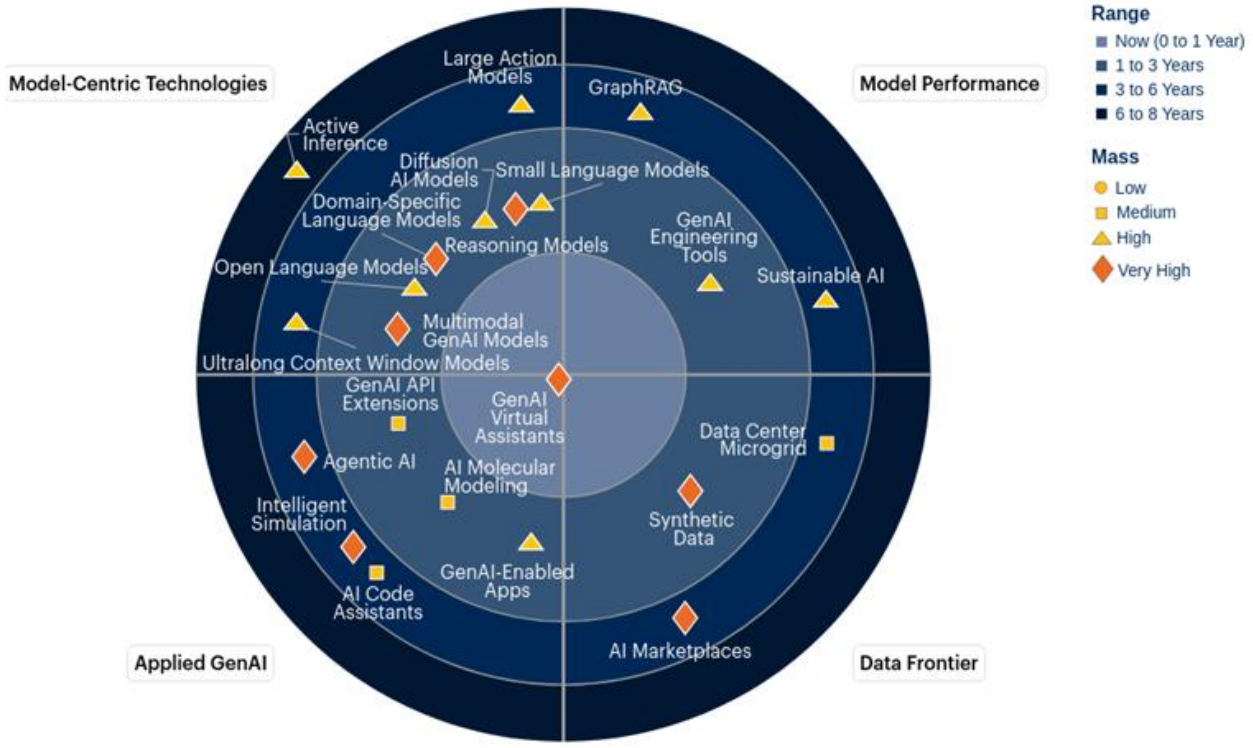
Generative AI

❖AI agents and reasoning models.



Source: Gartner – Emerging Tech Impact Radar: Generative AI. February 2025

❖ Key Findings

- The development of reasoning models can offer a significant advancement for businesses due to their ability to solve complex problems with high accuracy. The models use a chain-of-thought approach that allows them to analyse and articulate the necessary steps to reach a solution.
- Agentic AI can create significant opportunities to improve productivity, customer experience and decision making, but it will require user trust to gain sustained adoption.
- Multimodal GenAI can transform enterprise applications by enabling the addition of new user interfaces, features and functionalities.
- Synthetic data can revolutionise multiple industries and use cases in the next three years as it removes reliance on real-world data and enables endless opportunities for simulations and data-generation techniques.

❖ Recommendations

- Identify high-value applications for reasoning models, particularly agents requiring multistep actions, models serving as coordinators to orchestrate multiagent systems, and improving small-model reasoning performance through distillation and fine-tuning.
- Establish the basis for agentic AI adoption by starting with agents that carry out simple actions reliably and consistently, such as completing expense claim fills or parsing patient intake data in healthcare.
- Accelerate to high-quality multimodal experiences by first exploring acquiring curated text, image, video and audio datasets from AI marketplaces instead of developing in house.
- Create a strategic roadmap prioritising short-term synthetic data use cases focused on augmenting model training, especially for domain-specific tasks where real data is hard to acquire and noisy, while using simulations to understand and improve business processes in the long term.

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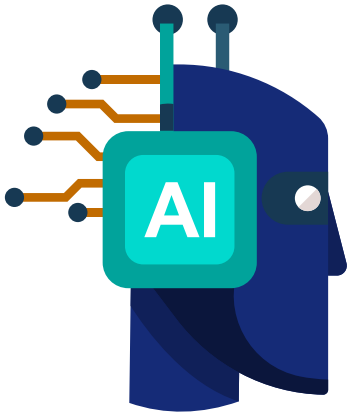
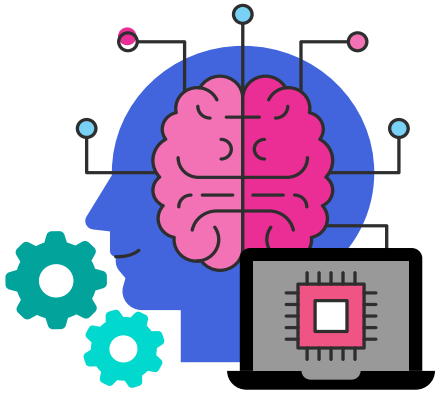
Edge Agentic AI vs Edge AI Agents



Edge Agentic AI

- Edge agentic AI refers to goal-driven software entities that autonomously make decisions and take action. These entities use AI techniques combined with components such as memory, planning, sensing, tooling and guardrails to complete tasks and achieve objectives. Agentic AI doesn't require explicit inputs and doesn't produce predetermined outputs.
- Agentic AI entities can receive goal instructions, iterate and delegate tasks, plus output variables and dynamic information, often augmenting the user's work.
- Examples include edge AI multi-agentic systems (MAGs) and mesh edge agentic AI

VS



Edge AI Agents

- An edge AI agent is a processing enity/software program that can perceive its environment, reason about available information, and perform actions to achieve specific goals.
- Specialised systems designed to tackle well-defined tasks.

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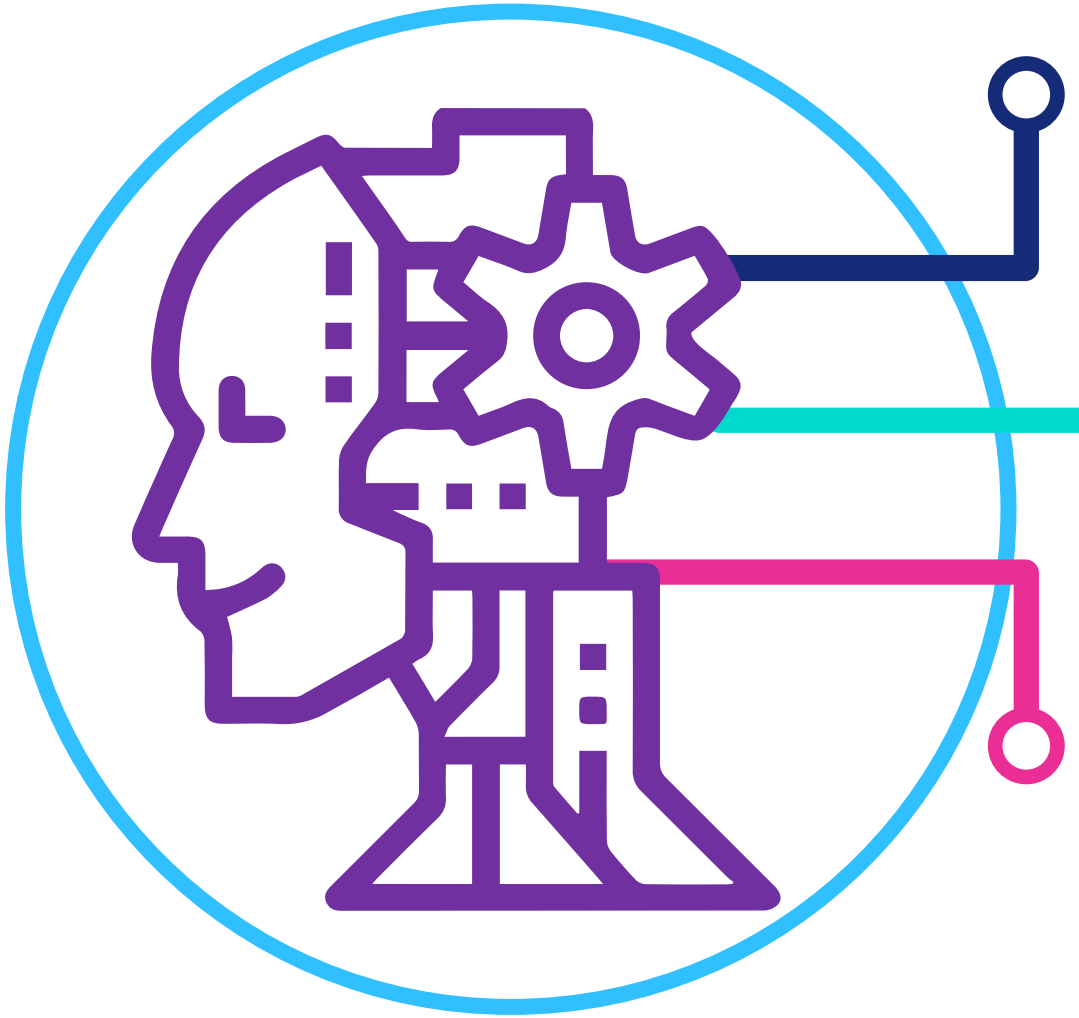
Edge AI with AI Explaining Interface



Dataset

Training and learning datasets.

Explainable Model
Edge AI Model

Explainable Edge AI
XAI Outputs
An Interactive Interface

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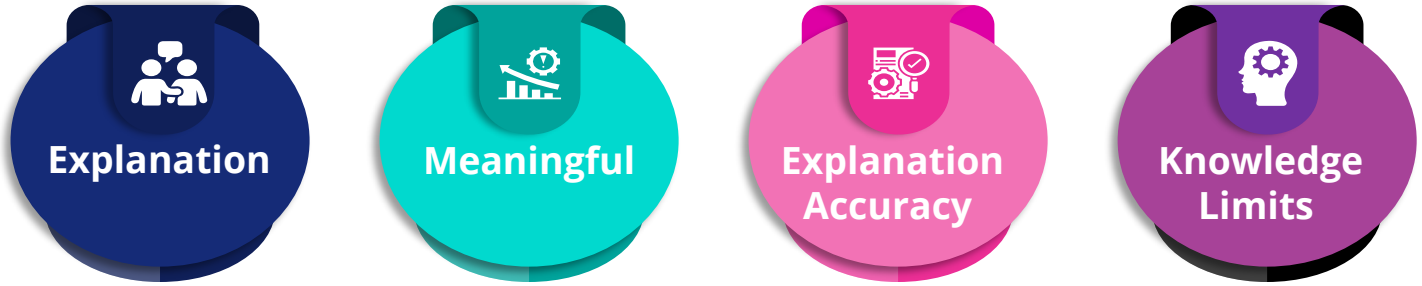
Principles of Explainable Edge AI



XAI

Training Data

New Machine Learning Process

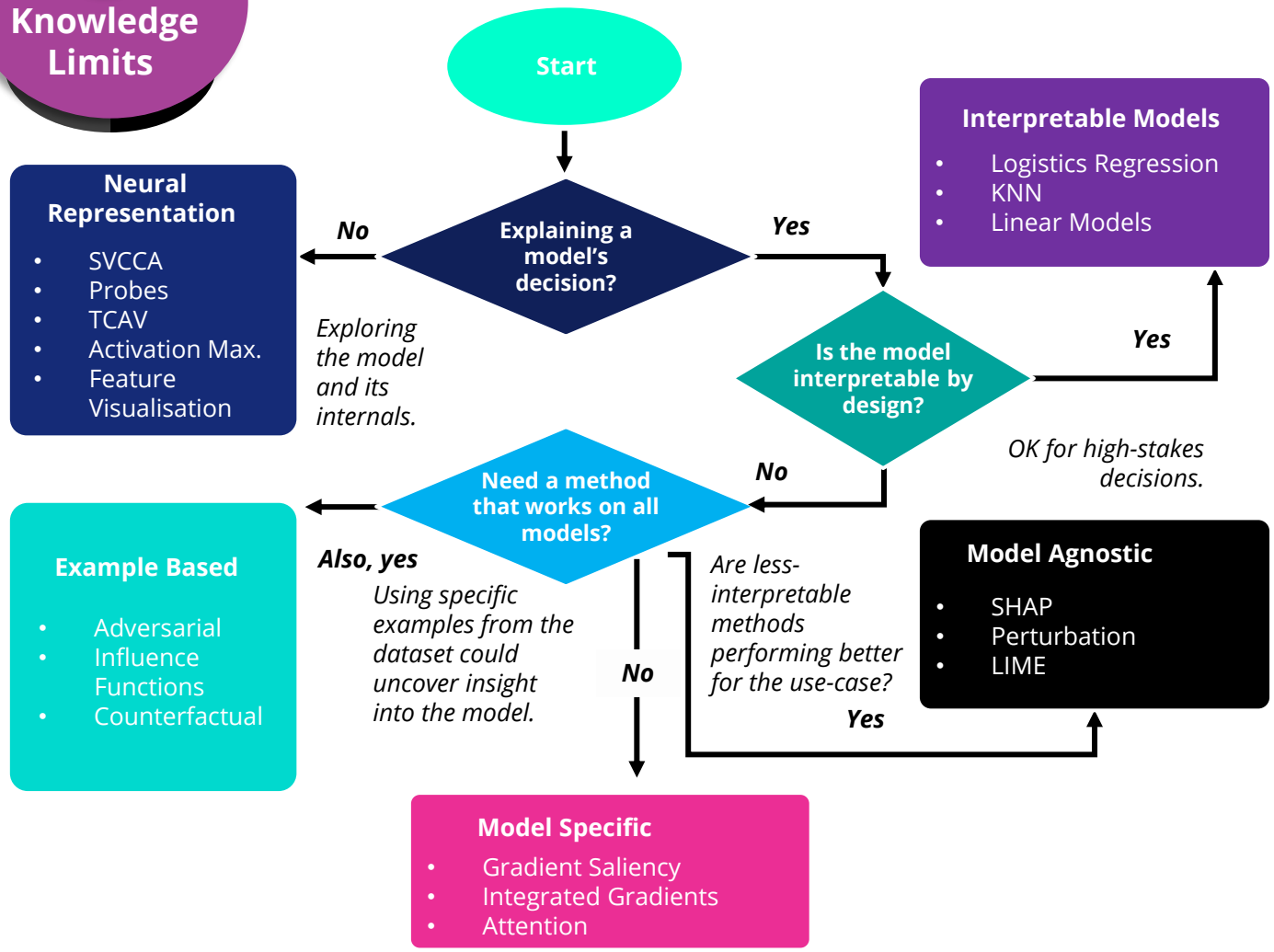
Explainable Model

Explanation Interface

User

Task

- *Understand Why*
- *Understand Why Not*
- *Know When You Succeed*
- *Know When Fail*
- *Know When To Trust*
- *know Why Erred*



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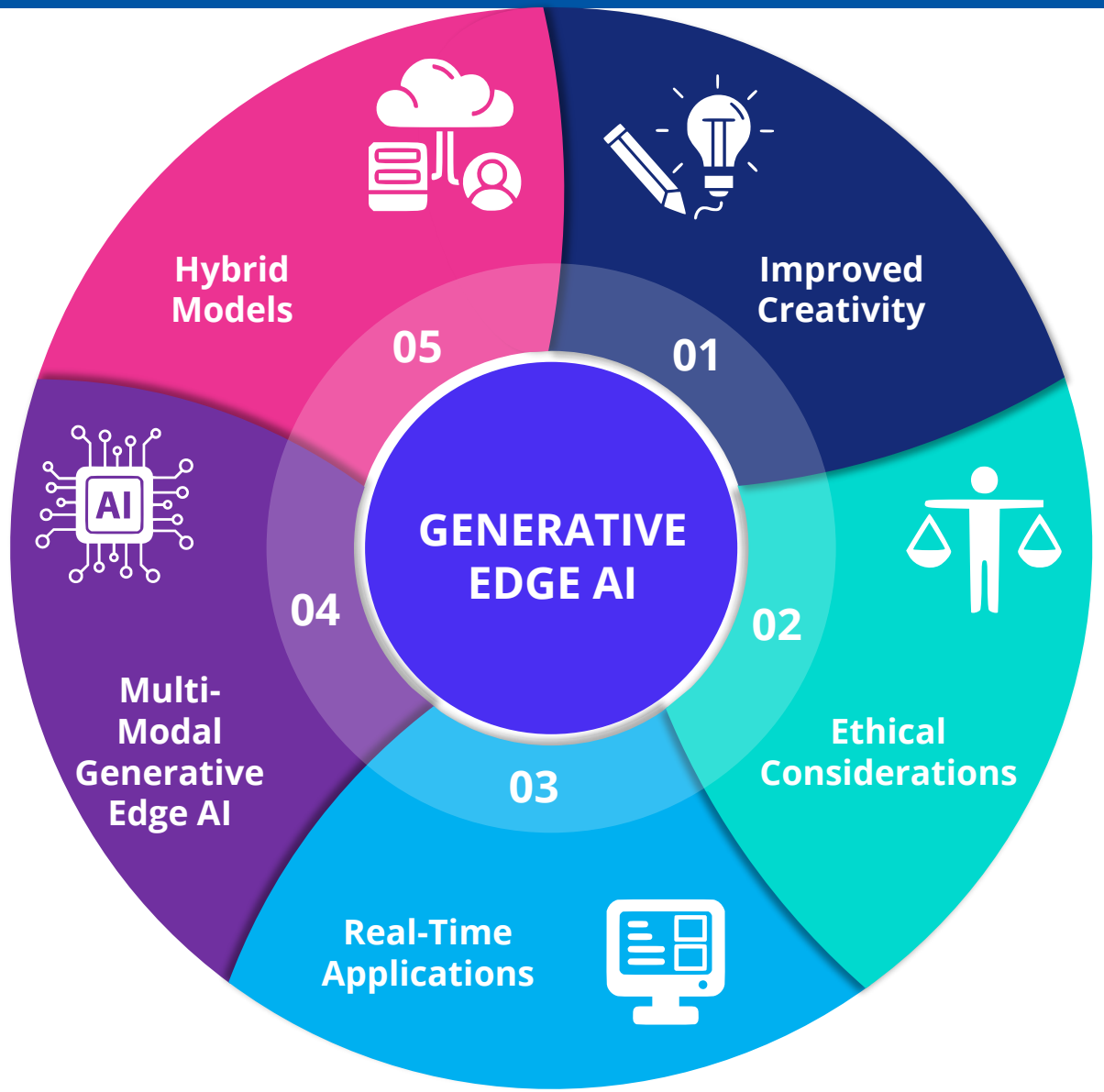
Challenges Generative Edge AI

- Edge AI integrated generative AI - edge AI models are integrated into most edge devices, and the evolution is addressing scalability, performance energy efficiency.
- Generative AI models are seeing significant advancements and limitations to be integrated in edge devices.
- Significant advances in the integration in deep-edge devices (e.g. smartphones)
- Generative AI for edge AI – used for supporting the edge AI system development life-cycle.



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Generative Edge AI - Risks

- Misinformation
- Hallucinations
- Abusiveness Changes
- Biased Outputs

- Unintended Consequences
- Manipulation and Impersonation
- Privacy Concerns
- Intellectual Property Infringement

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Conclusion

- Edge AI is rapidly shifting artificial intelligence from centralised cloud data centres to the very devices you use every day.
- In 2025, smaller, highly optimised models often called Small or Super Tiny Language Models (SLMs/STLMs) empower the smartphones, smart watches, and home appliances to process data locally. This means instant, real-time decisions without waiting on network responses.
- By end of 2025, 50% of enterprises are predicted to adopt edge computing, up from 20% in 2024. Adoption already seen in Apple Intelligence to enable smoother user interactions with less latency than cloud-based alternatives.
- With data processed locally rather than transmitted to remote servers, the personal information be it from photos, messages, or health data remains secure on the edge device. This on-device approach is a cornerstone of edge Intelligence, which is designed to minimise data exposure.
- **The question now is: What are the future trends in edge AI and what edge AI technologies and applications will emerge in the next 3-5 years?**

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Thank You

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EAI

https://edge-ai-tech.eu/

The two-day innovative educational initiative is designed for students, young researchers, and professionals eager to expand their understanding and skills in these cutting-edge technologies.

Participants will engage in interactive discussions, hands-on sessions, and lectures covering foundational concepts and innovative applications of edge AI across various domains with leading experts, gain insights into real-world applications, and work on team-based projects to foster collaboration and innovation.

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EDGE AI Academy 2025

Summer School Objectives

- The EDGE AI Academy Summer School aims to empower participants with advanced knowledge, hands-on experience and an in-depth understanding of edge AI, which combines Artificial Intelligence (AI) with edge computing and the Internet of Things (IoT) to process data closer to its source.
- Edge AI technology is gaining prominence due to its ability to enhance real-time decision-making, reduce latency, improve data privacy, and diminish reliance on continuous internet connectivity.
- The topics will extend to RISC-V architectures as ultra-low-power high-performance RISC-V-based processors and ultra-low-power vector-based accelerators are advancing smart IoT and edge AI computing capabilities.

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