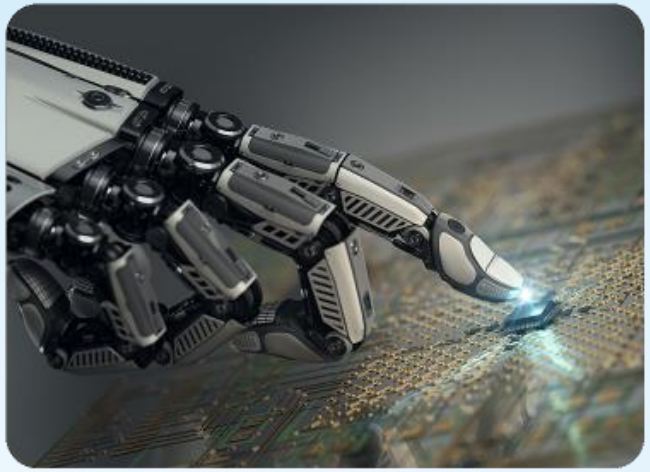
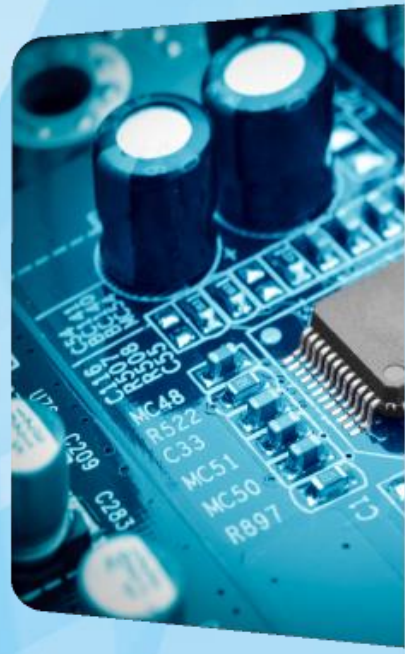
IEEE European Public Policy Webinar on Artificial Intelligence







Prof. Cecilia Metra

University of Bologna (Italy)

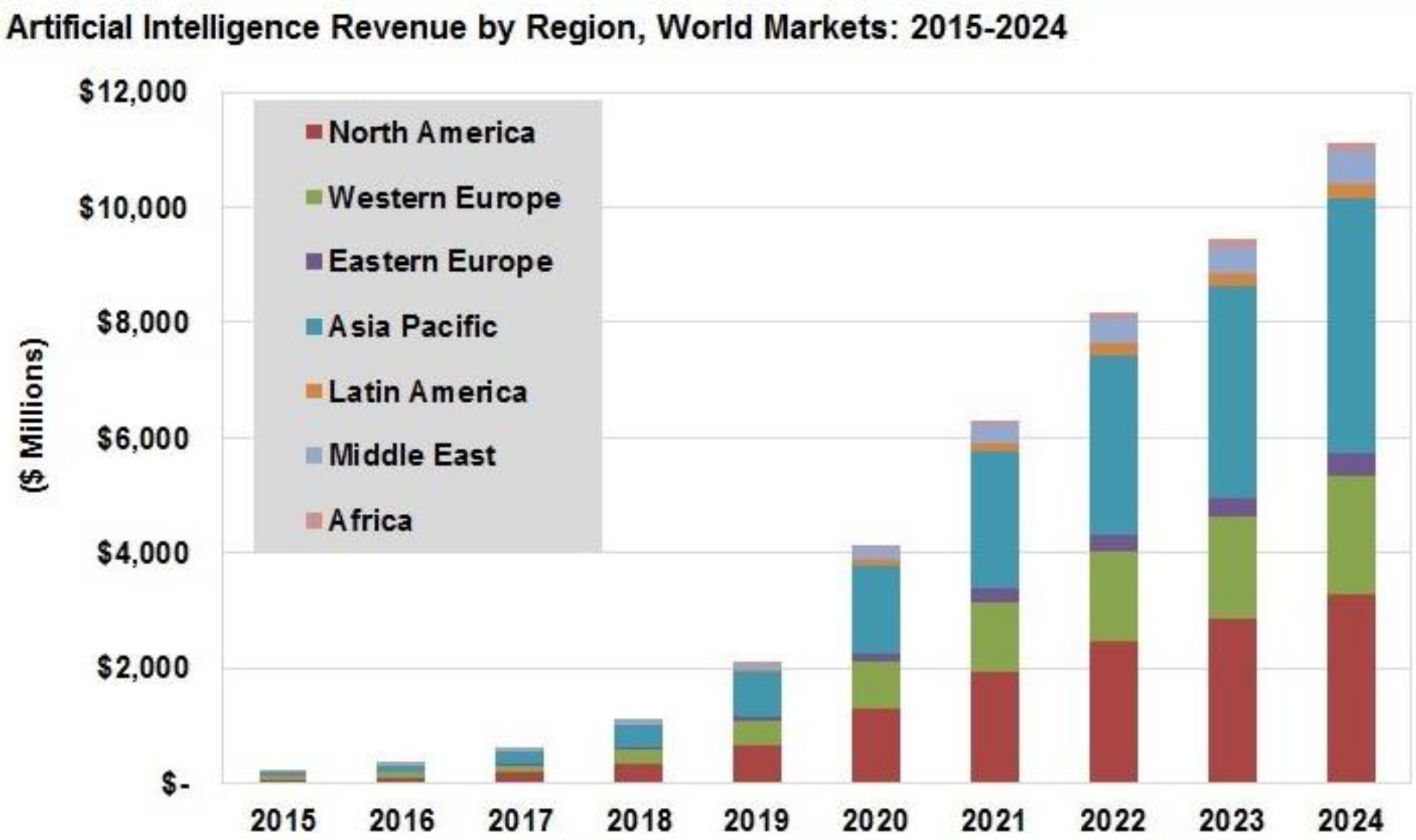
DEI, ARCES, Alma AI

IEEE EPPC WG on ICT Chair 2021

IEEE Director-Elect 2021 (IEEE Director 2022-2023)

IEEE Computer Society President 2019

AI Market Growth



https://emerj.com/ai-sector-overviews/valuing-the-artificial-intelligence-market-graphs-and-predictions/

AI Can Enable a Smarter World

Smart Things

A Smart Thing …

- Understands the environment
- Manages data & transforms to info
- Connects to the world
- Protects your data
- Is energy efficient

Smart Home & City

Smart City-Environment

- Smart city infrastructure to improve traffic and municipal services
- Smart Grid
- Intelligent, adaptive street lighting
- Smart Buildings
- Reducing waste

Smart Home

- Smart control of heating, air-con, appliances, locks & alarms
- Smart meters to connect homes to the smart grid
- More energy efficiency, convenience, comfort and security

Smart Driving

Smart Driving

- Making driving safer for the driver and car occupants, and for other road users
- Improving power and fuel efficiency
- Moving towards electric vehicles
- connected driving experience

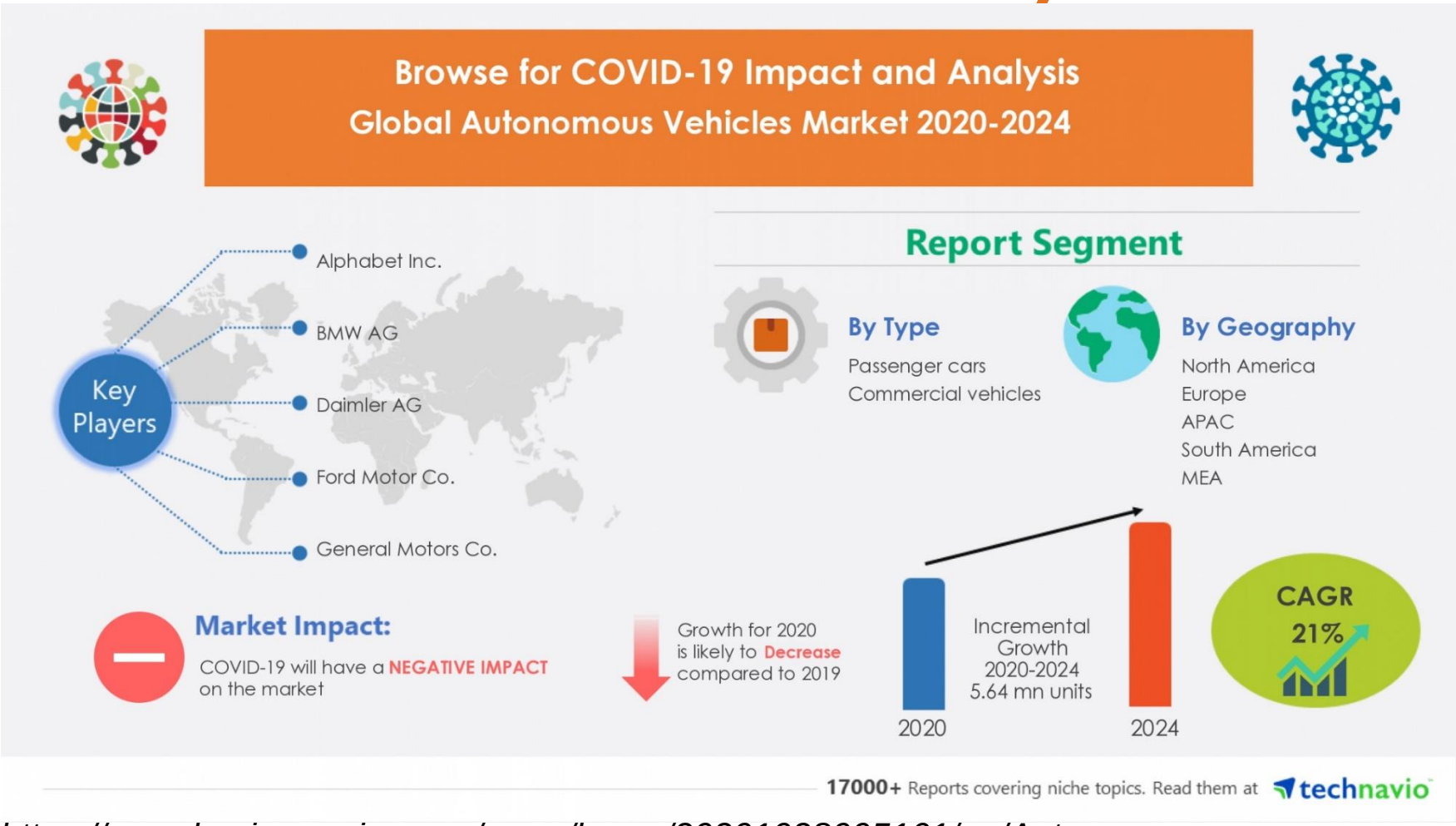
Smart Industry

Smart Industry

- More efficient factories
- More flexibility and customization
- More sustainable production
- Safer working environments
- Better man-machine cooperation

AI can enable Autonomous Vehicles (After-Covid19 Market Growth)

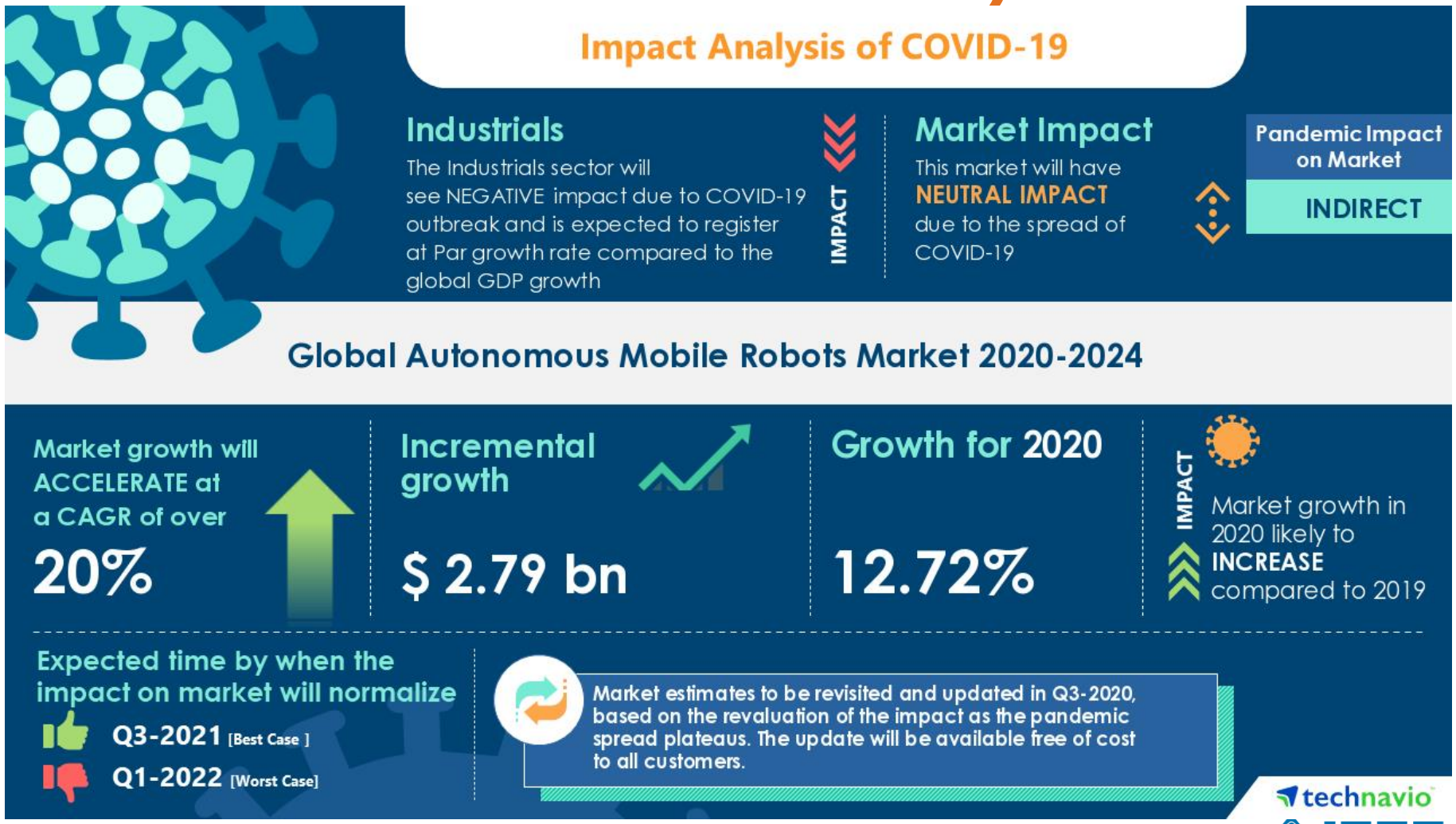
The autonomous vehicles market is expected to have a **Compound Annual Growth Rate (CAGR)** of **21% by 2024.**



https://www.businesswire.com/news/home/20201028005161/en/Autonomous-Vehicles-Market%C2%A0to-Reach-5.64-Million-Units-by-2024-Alphabet-Inc.-and%C2%A0BMW-AG-Emerge-as-Key-Contributors-to-Growth-Technavio

AI can enable Autonomous Mobile Robots (After-Covid19 Market Growth)

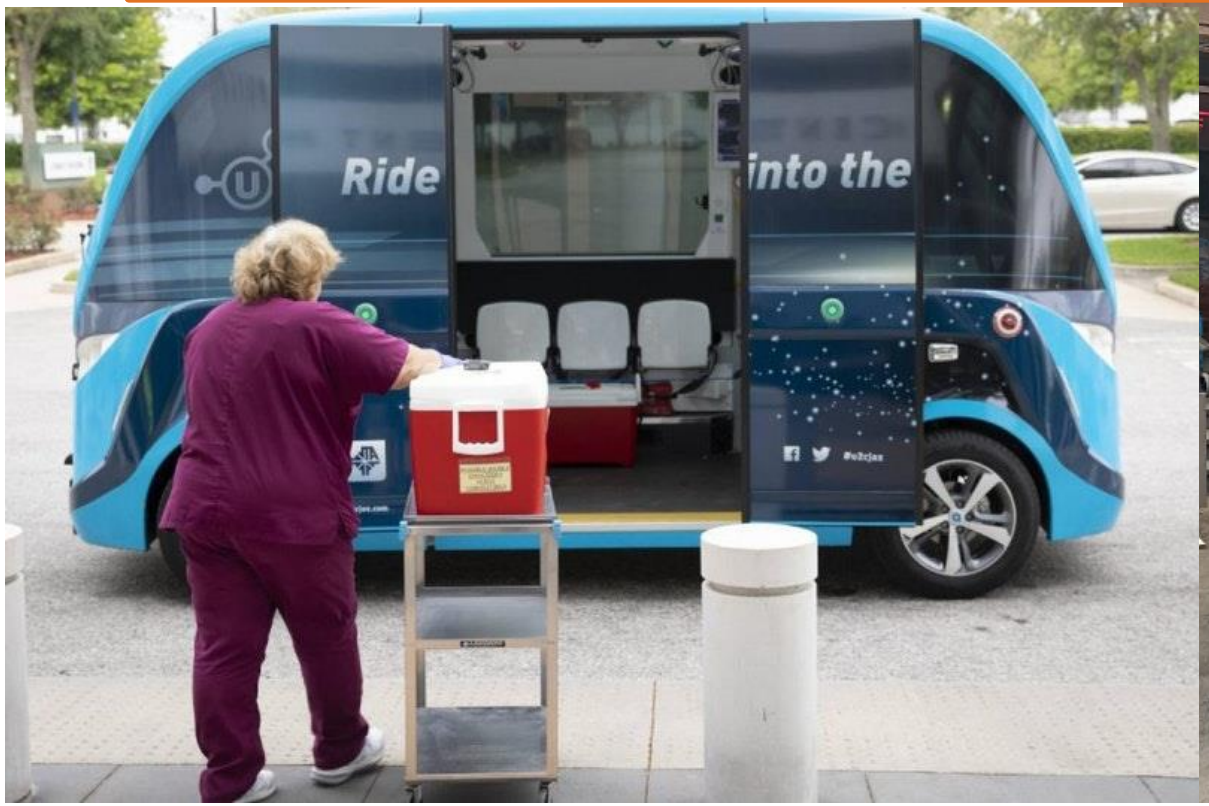
The autonomous mobile robot market is expected to have a **Compound Annual Growth Rate (CAGR)** of **over 20% by 2024.**



https://www.businesswire.com/news/home/20201019005561/en/Autonomous-Mobile-Robots-Market-Better-ROI-of-Autonomous-Mobile-Robots-to-Boost-Market-Growth-Technavio

Autonomous Vehicles' Usage during Pandemic

Autonomous vehicles have been used to transport COVID-19 tests from a drive-thru testing site to a processing laboratory, to deliver food and medical supplies to infected areas, etc.



https://www.roboticsresear.ch/articles/20383/autonomous-shuttles-help-transport-covid-19-tests

https://www.therobotreport.com/autonomous-vehicles-vital-role-solving-future-pandemics/

Autonomous Mobile Robots' Usage during Pandemic

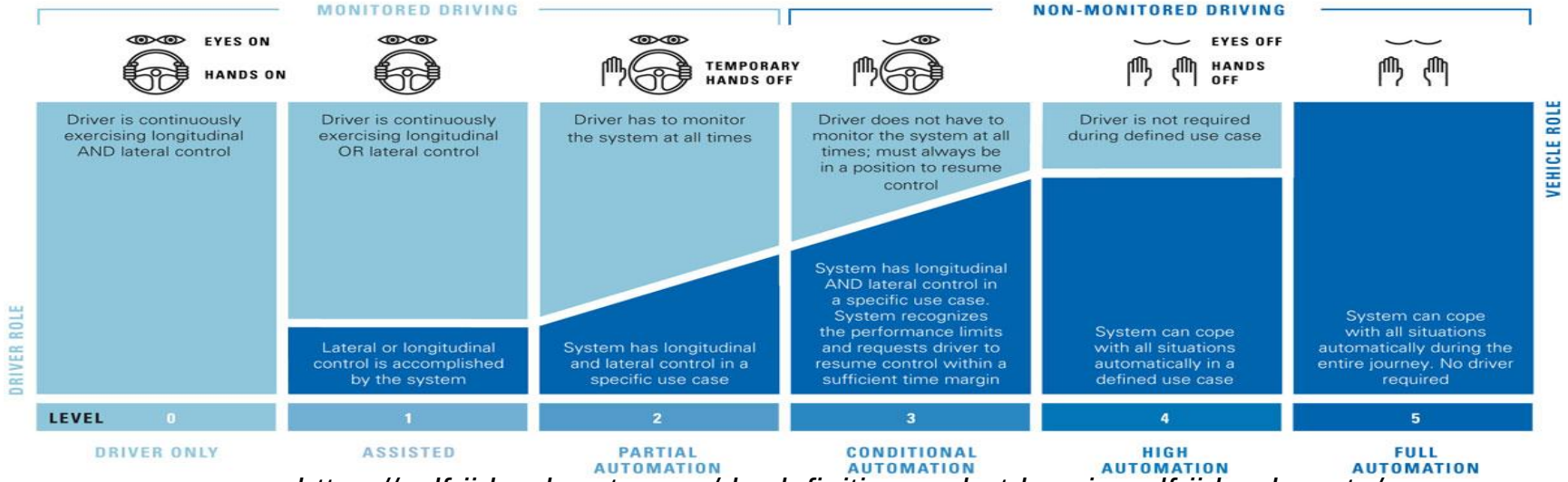
Autonomous robots have been used to disinfect infected areas, to aid hospital personnel, etc.

https://www.roboticsresear.ch/articles/20153/robots-helping-to-fight-coronavirus

https://www.roboticsbusinessreview.com/manufacturing/march-2020-robotics-transactions-slow-covid-19-crisis/

Autonomous Vehicles and Robots

- **The level of autonomy of autonomous vehicles** has been formalized by the **Society of Automotive Engineers (SAE),** as ranking **from 0 to 5.**



https://zelfrijdendeauto.com/de-definitie-van-het-begrip-zelfrijdende-auto/

- **Similarly for the level of autonomy of autonomous mobile robots**

https://stanley-robotics.com/blog/the-different-autonomous-level-for-industrial-robotics-you-need-to-know/

AI Challenges for Highly Autonomous Intelligent Systems

- **The higher the level of autonomy** of autonomous intelligent systems, the **stronger are the requirements** in terms of their **reliable, safe and secure** operation → **need for highly reliable, safe and secure AI**, that constitutes the core of such systems
  - **Reliability:** ability to guarantee the **continuous delivery of the intended (correct) service for a given amount of time**

    → ***Need to guarantee the AI correct inference, despite the occurrence of faults possibly affecting the AI implementing hardware***
  - **Safety:** ability to guarantee the **absence of catastrophic consequences on the environment and users**

    → ***Need to guarantee a safe inference in case of inconsistencies, unexpected and hazardous conditions***
  - **Security:** ability to protect **data from unauthorized access, corruption, misuse**

    → ***Need to guarantee the security of the data used by AI, with respect to malicious manipulations*** *(e.g., to lead to wrong AI decisions, or data misuse).*

Highly Reliable and Safe AI

- **Reliability:** ability to guarantee the **continuous delivery of the intended (correct) service for a given amount of time**

  → ***Need to guarantee the AI correct inference, despite the occurrence of faults possibly affecting the AI implementing hardware***

  → ***Possible adoption of Fault Tolerance and Robust design for the hardware implementing AI (e.g., ECCs (robust design) for memory (elements), self-checking circuits and recovery for data-paths, etc.), but capable of:***

  → ***Guaranteeing tolerance of (robustness wrt.) all possible faults included unlikely ones*** *(challenging)*, ***at sustainable costs*** *(challenging)*

- **Safety:** ability to guarantee the **absence of catastrophic consequences on the environment and users**

  → ***Need to guarantee a safe inference in case of inconsistencies, unexpected and hazardous conditions***

  → ***Include safety risk analysis in the AI decision process to force a safe inference, that will make the system move to a safe state***

  → ***High reliability of the hardware driving the system to a safe state***

AI Challenges for Highly Autonomous Intelligent Systems: IEEE Computer Society Community and IEEE Project

- To address **Reliability, Safety and Security challenges for intelligent systems,** as well as the interaction among such features:
  - A **community of technical experts** in the field has been created, as a **Special Technical Community (STC) within the IEEE Computer Society**
  - **IEEE Standards:**
    - **IEEE P2851**- *Exchange/Interoperability Format for Safety Analysis and Safety Verification of IP, SoC and Mixed Signal ICs*
    - **P2846** - *Assumptions for Models in Safety-Related Automated Vehicle Behavior* – approved PAR
    - **P1228** - *Standard for Software Safety* - approved PAR
    - **P982.1** - *Standard for Measures of the Software Aspects of Dependability* - approved PAR
  - An **IEEE Project within the IEEE Digital Reality Initiative** has been funded.

IEEE COMPUTER SOCIETY
RELIABLE, SAFE, SECURE, AND TIME DETERMINISTIC INTELLIGENT SYSTEMS
Special Technical Community

If you are interested in these technical fields, please join us at: www.computer.org/rsstdis-join

IEEE DigitalReality

IEEE

Ai Challenges: IEEE EPPC ICT WG Activity

❑ In addition to AI reliability, safety and security, **wide spectra of AI technical, ethical, societal, governance, sustainability challenges** → **Sub-Working Group in the IEEE European Public Policy Working Group on ICT:**

- **IEEE EPPC AI Concept note** (to result in an IEEE AI policy document) addressing AI general challenges (for its widespread application fields), taking into account:
  - recent EC developments;
  - IEEE EPPC activities on AI **initiated in 2017,** which led to the **IEEE response to the 2020 European Commission AI Public Consultation**.

Please contribute to the IEEE EPPC AI activities
by replying to the call for engagement on AI at:
https://www.ieee.org/about/ieee-europe/index.html

IEEE EPPC ICT WG Members/ AI Sub-WG Members

- **Cecilia Metra (Chair)**
- Adrian Ionescu
- Andreas Neumeier
- Cyril Onwubiko
- Enrico Del Re
- Giambattista Gruosso
- Javier Alonso
- Joao Azevedo
- Jorge Soares (EPPC Liason)
- **Joao Quintas (Coordinating Editor)**
- John Anderson
- Panagiota Karadimitriou
- Valentina Balas
- Francisco Medeiros (EPPC Liason)
- Stefano Zanero (EPPC Liason)
- Vasilis Kalogirou (EPPC Liason)

Conclusions

- **Widespread adoption of AI to enable a smarter world.**

- **Several AI technical, ethical, societal, governance, sustainability challenges** to be faced

- The **IEEE and the IEEE European Public Policy Committee** are taking the lead to face such challenges

Please join us on the IEEE and IEEE EPPC activities on AI!