

JOiINT TALKS

Robot quadrupedi: innovazione, applicazioni e sfide future



2 dicembre 2025

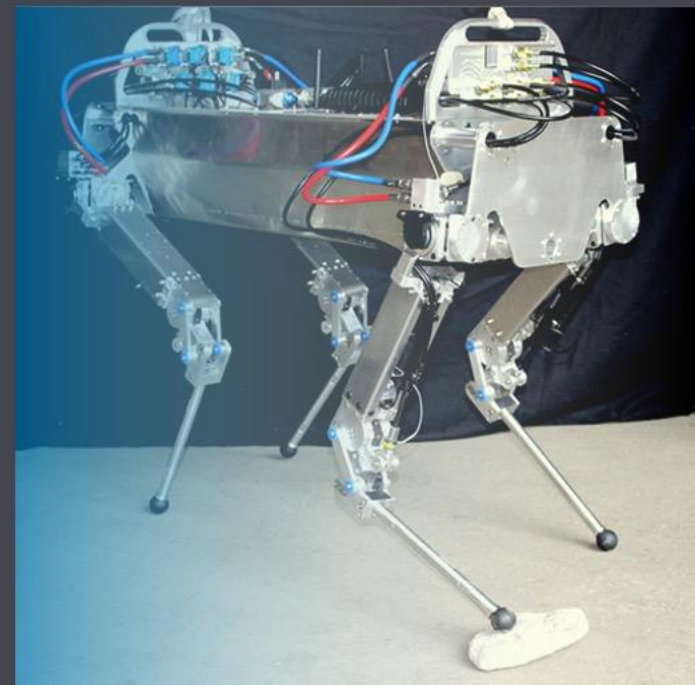
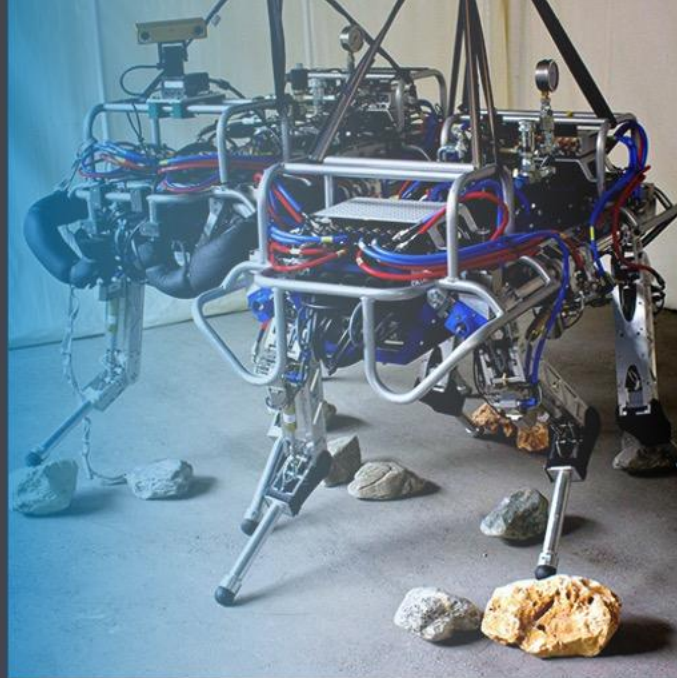


Ore 11.15

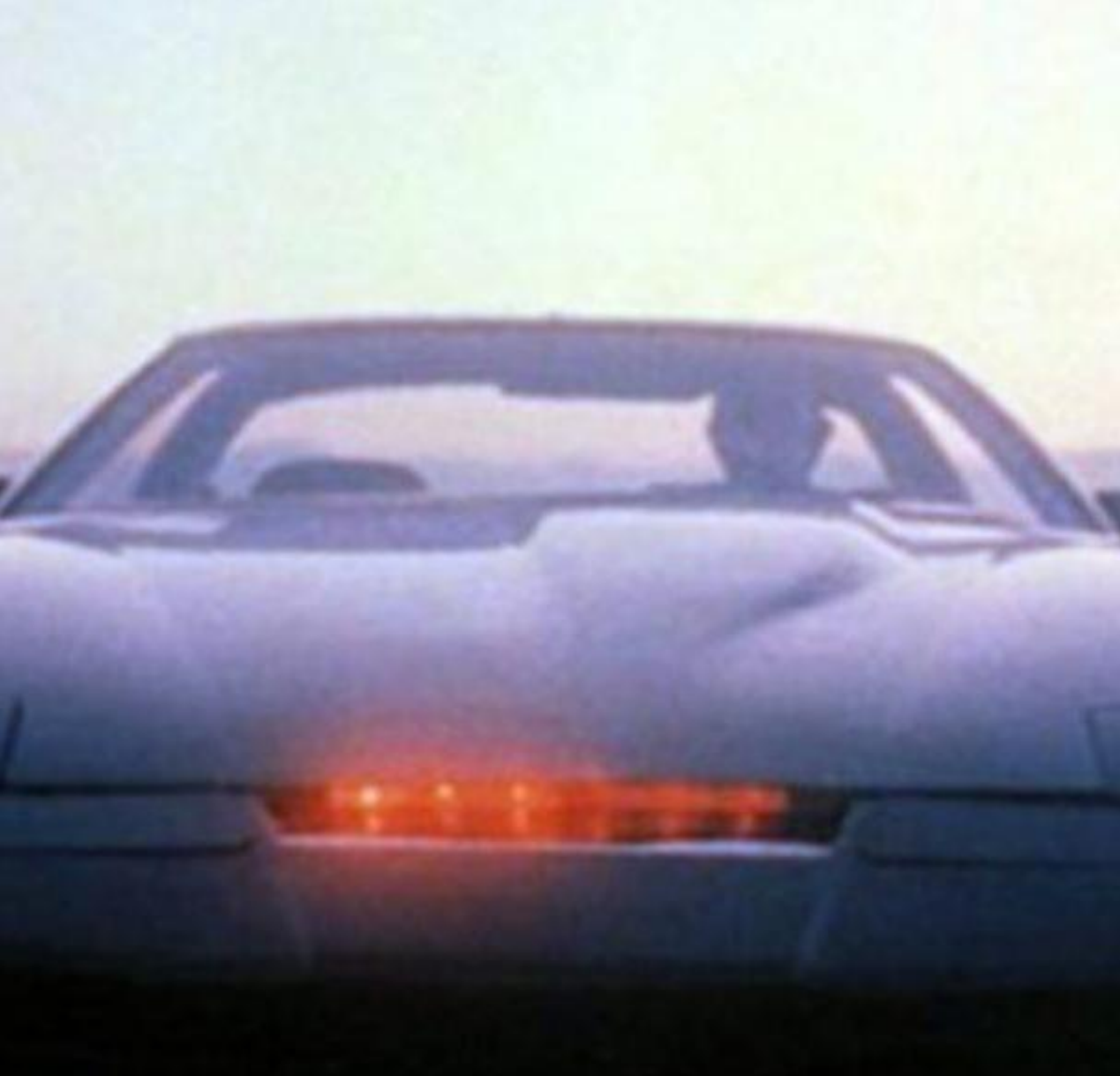


Sala Polivalente di Confindustria Bergamo

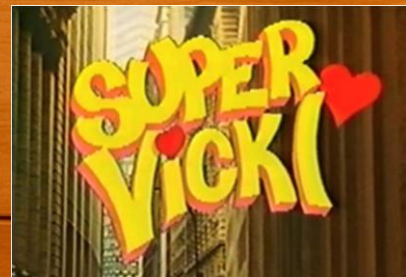
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ROBOTIC INTELLIGENCE LEAGUE BERGAMO



1980



DAVID HASSELHOFF
SUPERCAR



2025



Kawasaki- Unimate

1960

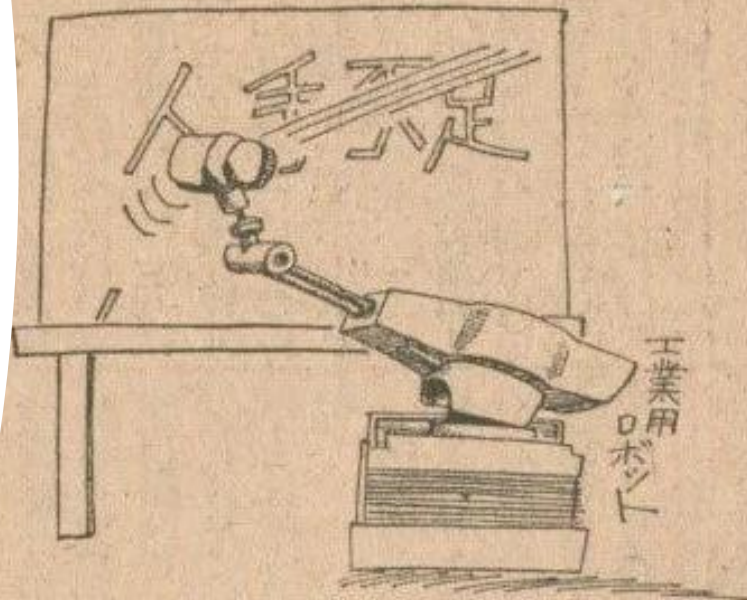


停視線

日本工業

93-12-7

179.95才



工業用
ロボット

やがて人手不足解消か

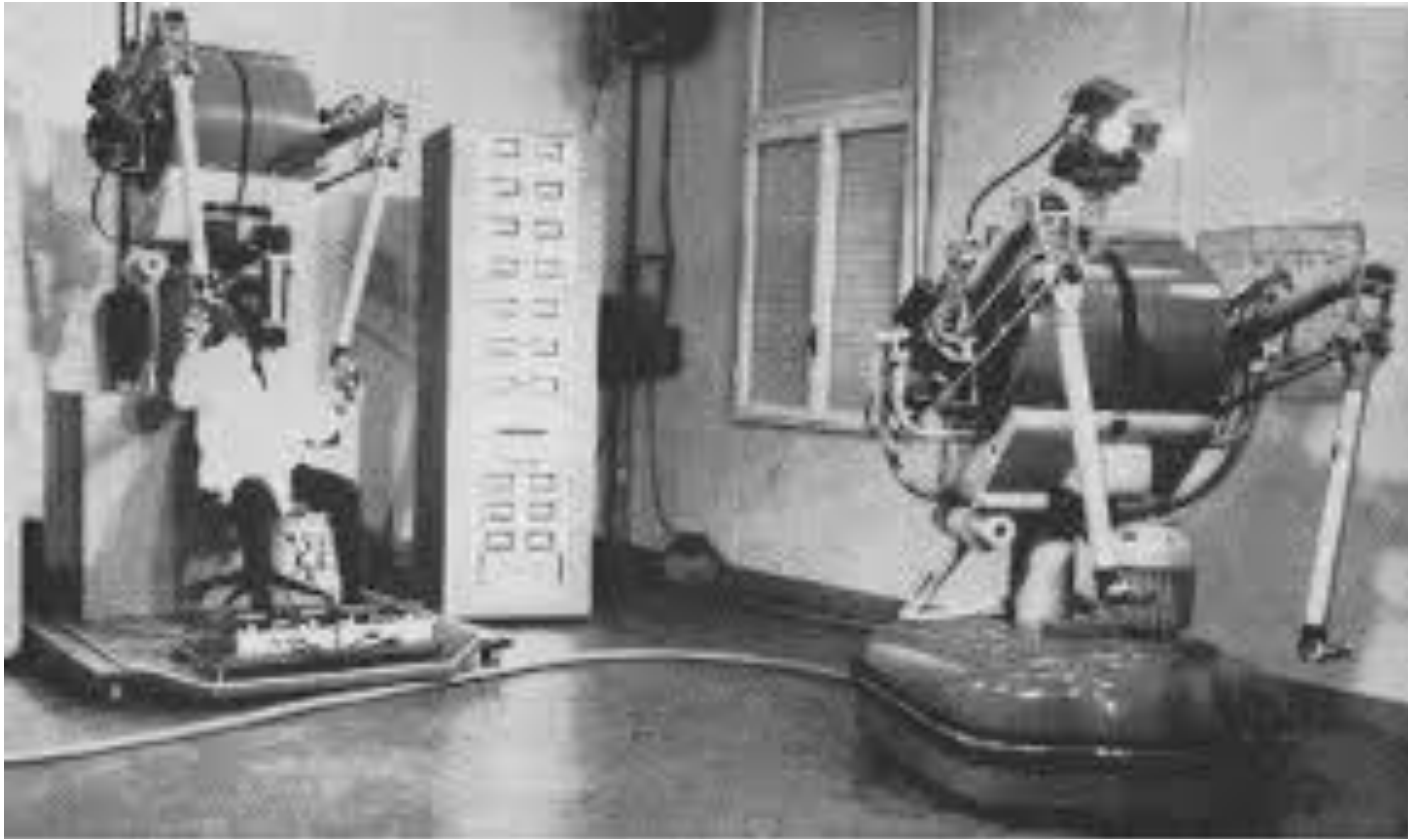
川崎航空がロボット国産化へ

Primati della Tecnologia RIM Italiana

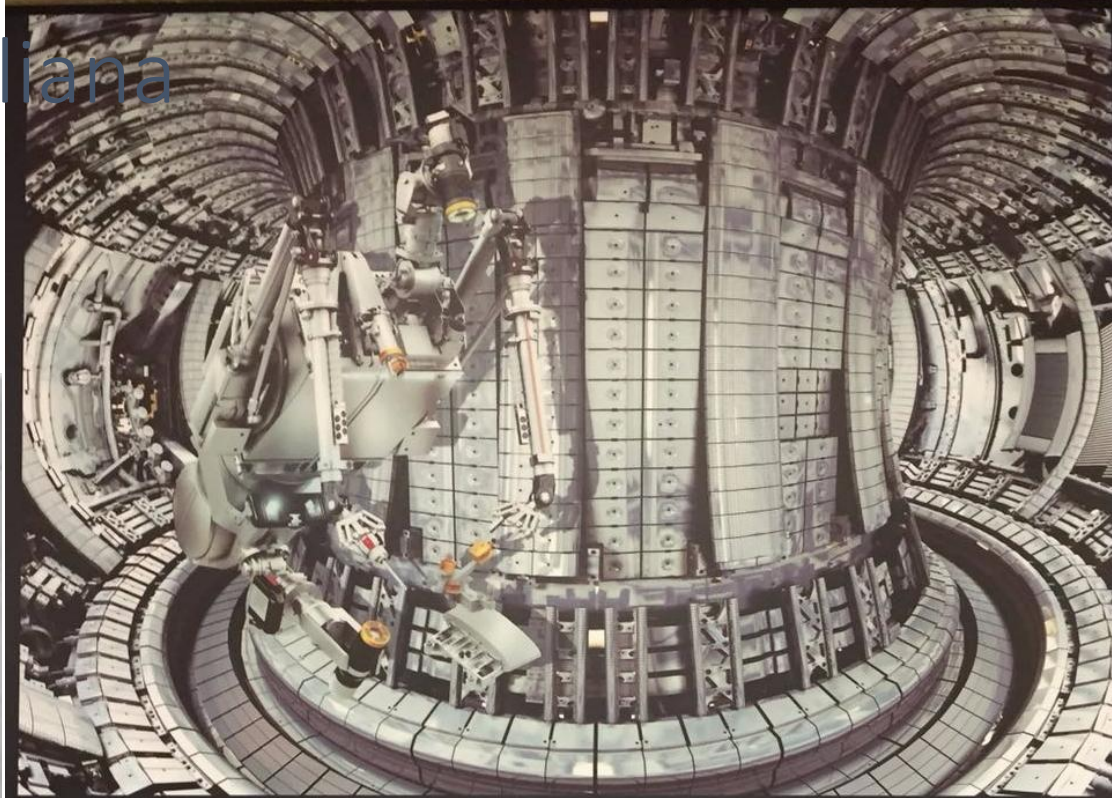
- ✓ Primo Manipolatore telecontrollato effettivamente usato in impianto nucleare (CNRN/ENEA)
- ✓ Primo robot di misura (DEA)
- ✓ Primo robot per assemblaggio (OLIVETTI)
- ✓ Primo robot per il taglio laser (PRIMA INDUSTRIE)

Primati della Tecnologia Robotica Italiana

Primo telemanipolatore realmente usato in ambiente operativo:
MASCOT



C. Mancini
CNRN (ENEA) - 1959



Tools in the Torus

Most modifications inside JET are carried out by engineers using the remote handling system. This system comprises of two articulated booms that can accept a variety of different end-effectors. The main end-effector used for the majority of the tasks is "MASCOT" (Manipolatore Servo Controllato Transistorizzato) – a force reflective servo manipulator.

To handle the wide variety of components in the torus, tooling has to be developed to provide an interface between the component and the MASCOT's gripper that is used for the manipulation.

The operator guides and locates the component onto the vessel interface and fastens it via bolts or other fixing methods. The tooling is then removed, leaving the component in place.

FAST FACTS

Two articulated booms: 12.5m & 9.4m – able to access any part of torus
Lifting capability: 650 kg.

End-effectors: Ability to attach a number of different end-effectors, from "MASCOT" (force reflecting servo manipulator) to dedicated component handling tools.

MASCOT: Mass 250Kg, 7 degrees of freedom, designed payload of 20kg. Operational limits for safety and reliability: 5kg (single arm) and 10kg (two arms manipulation).

Still operational today at JET - Joint European
Thorus (UK) for nuclear fusion:
11 Megawatts of energy over 5 seconds in Feb. 2022

L'Italia nella Robotica Spaziale



TECNOSPAZIO S.p.A.



SPIDER ARM

SPace Inspector Device for Extra-vehiculaR activity Arm

1980 - : SPIDER was developed and qualified in the frame of a contract from Agenzia Spaziale Italiana (ASI).

The joint technology, developed in the frame of the SPIDER contract, has flown on MIR Space Station as part of the EUROMIR 95 Technology Experiment T7.

<http://www.spazio.galileoavionica.com>

L'eccellenza italiana

- Robotica collaborativa
- Biorobotica
- Interfacce aptiche
- Robotica *soft*
- Roboetica
- 200 progetti di ricerca finanziati dall'Europa > 120 M€ (16,5% dei finanziamenti totali vs contributo italiano 13%)

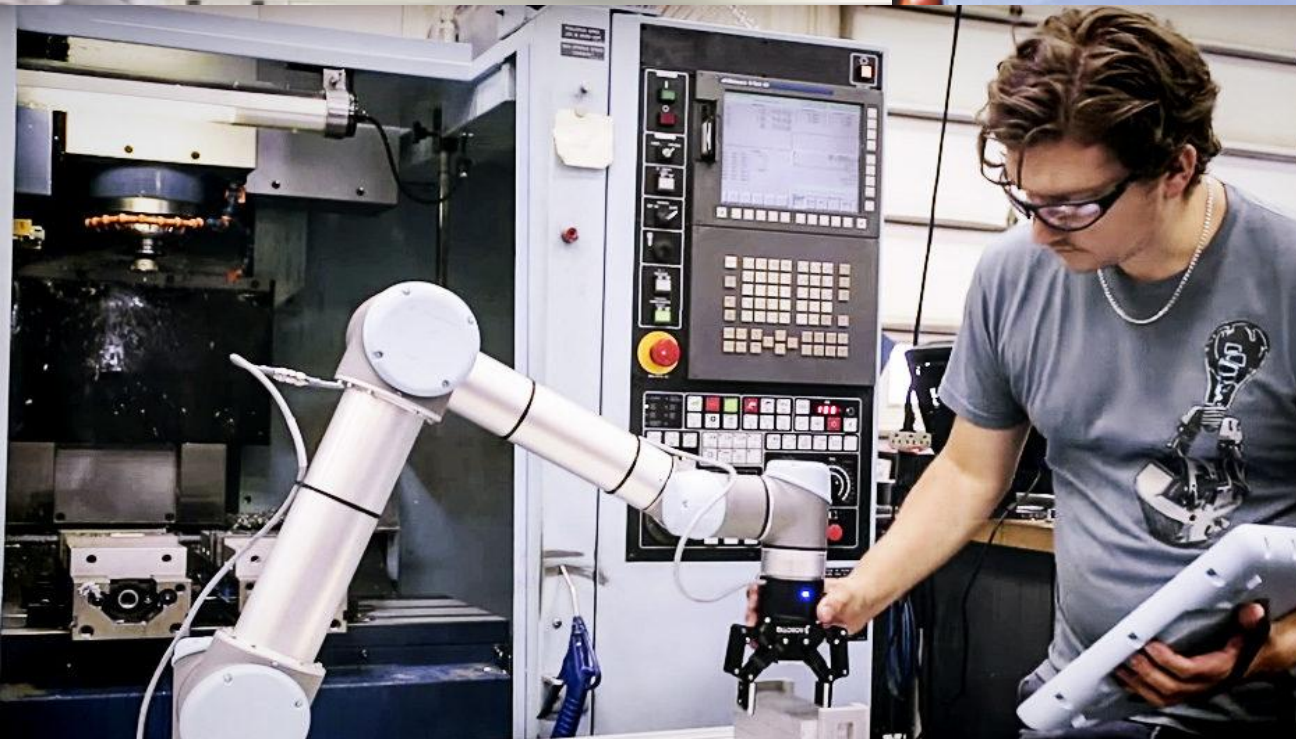
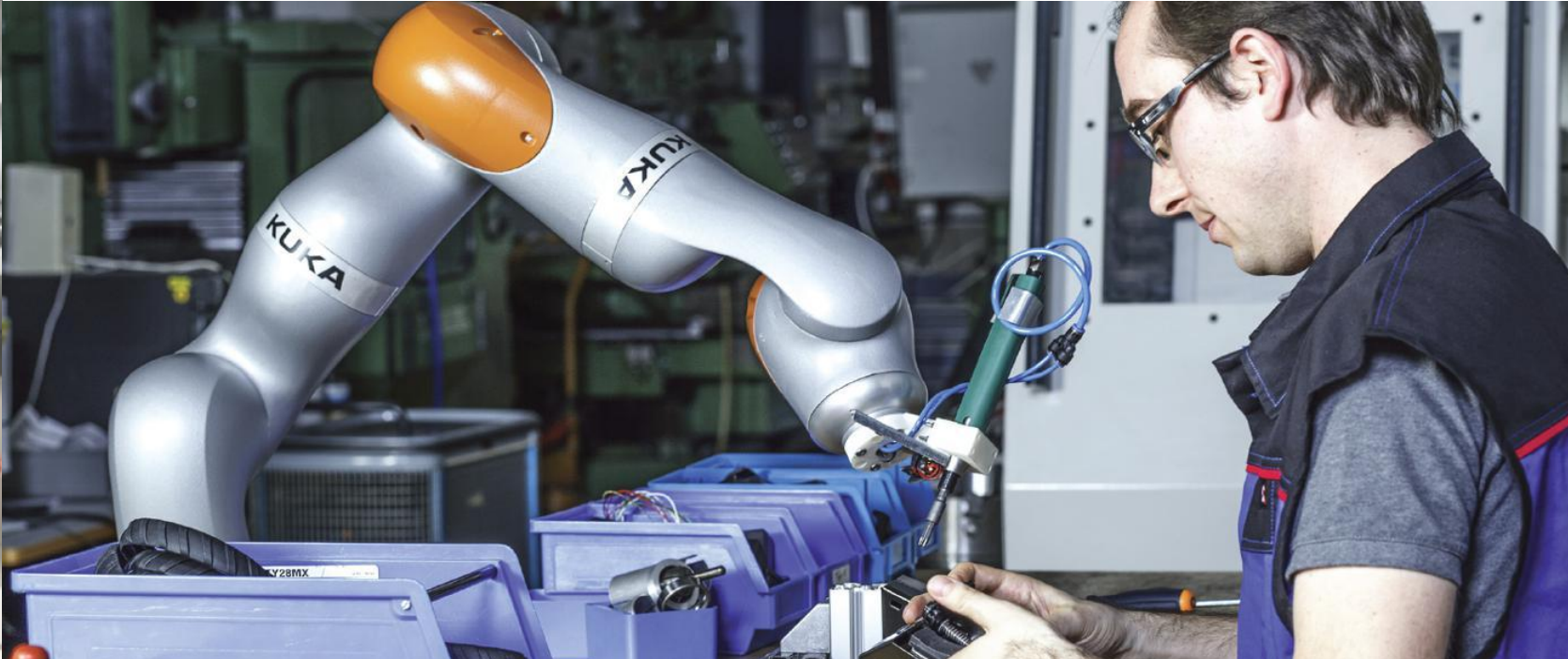
Mappa delle competenze di ricerca in Robotica

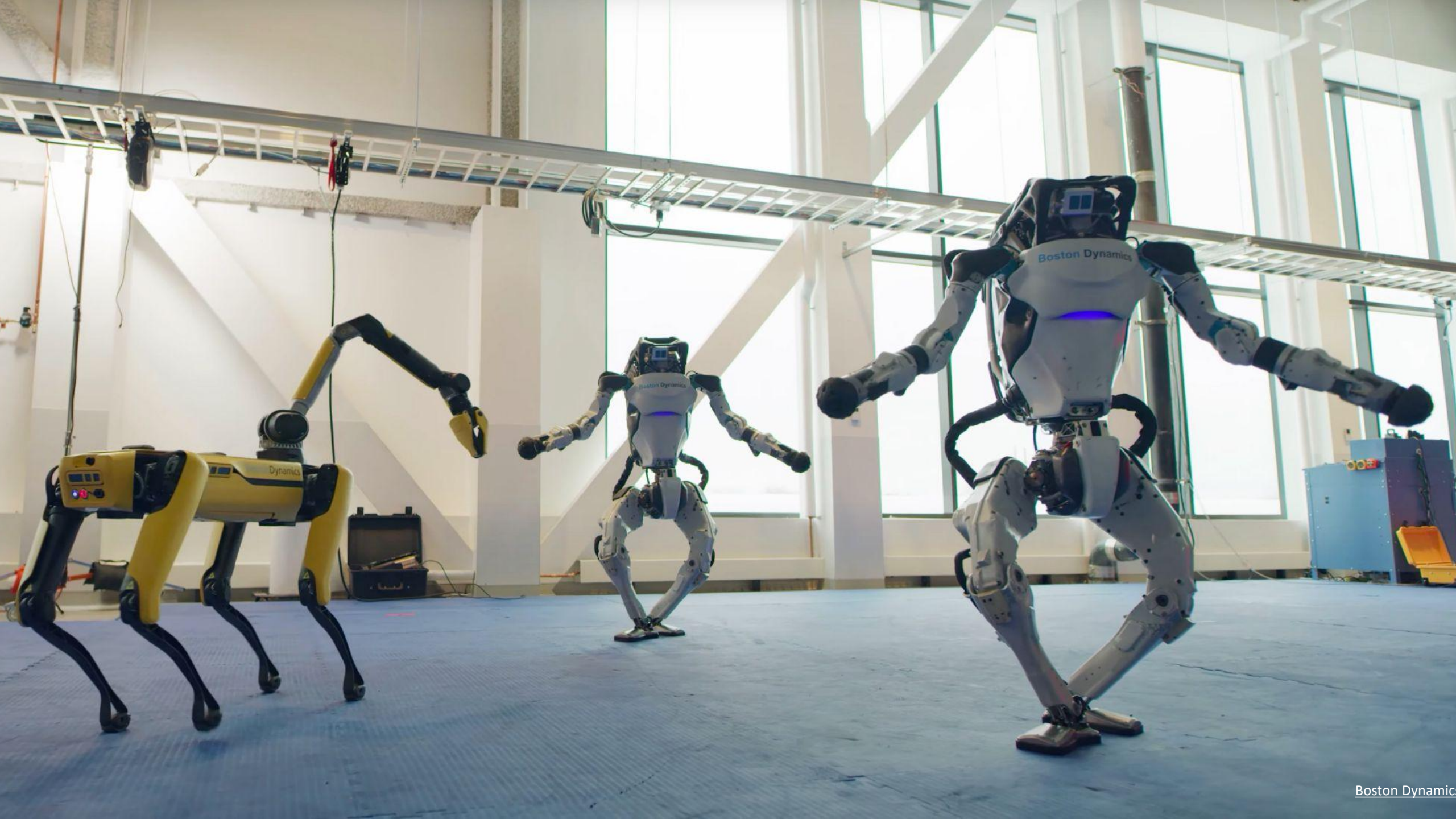


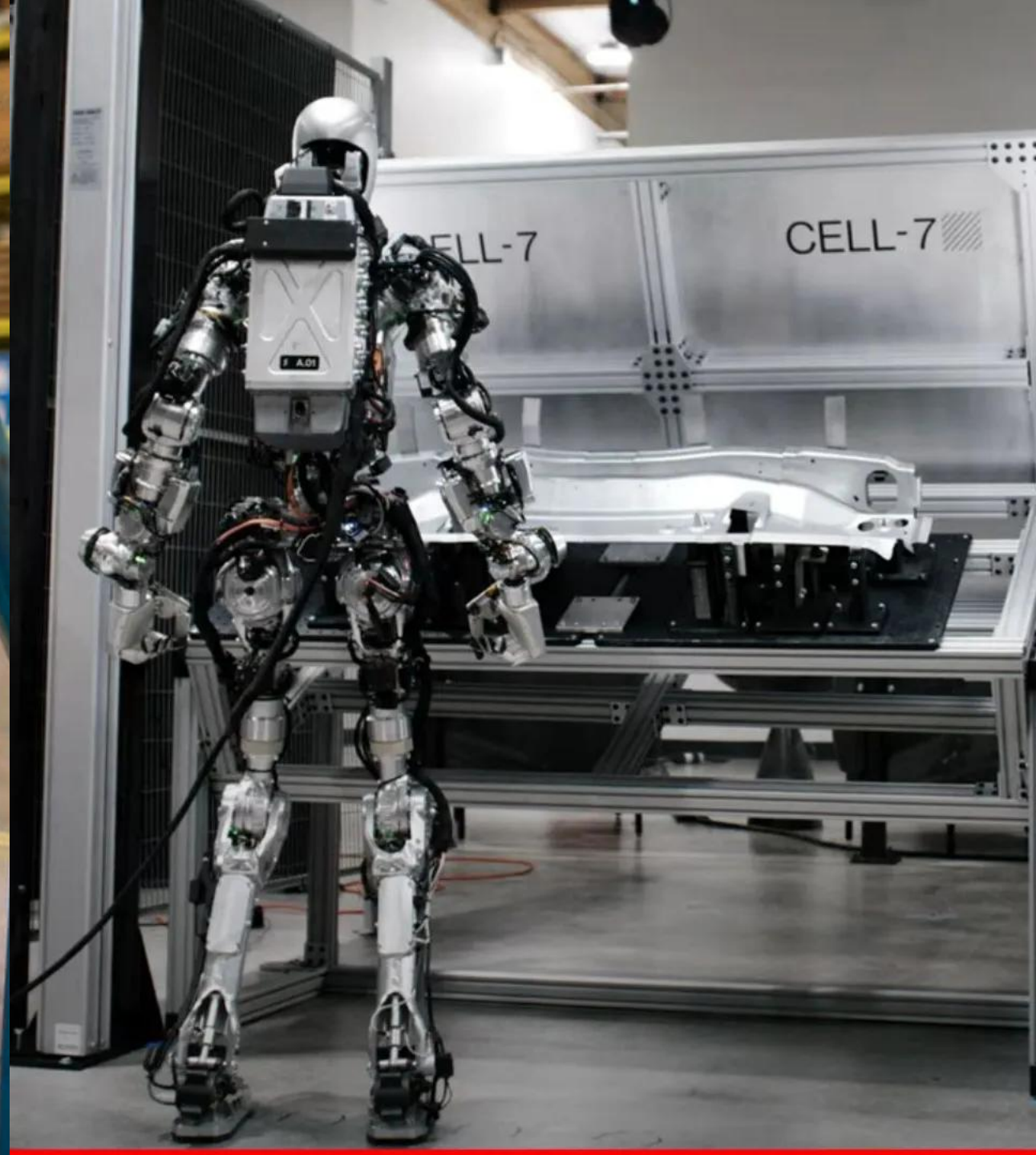


**Physical Human-Robot Interaction:
DepENDability and Safety**









Since 2020

JOINT LAB[®]

ROBOTIC INTELLIGENCE LEAGUE BERGAMO



- Advanced Robotic and HRI Know-how
- Research Units



- Advanced Automation



Technology Transfer
Innovation
Advanced Training

FLEXIBLE ROBOTIC WORKSTATION

LOGISTIC 4.0

ROBOTIC ASSISTANT

ROBOT AVATAR FOR REMOTE PHYSICAL ACTIVITIES

- Cross-fertilization



- Leaders in manufacturing and mechatronics
- Champions

ABB **brembo**

cosberg innovation

ELETTROCABLAGGI SISTEMI ELETTRICI PER L'AUTOMAZIONE

FASSI **SDF** Farming Technology. Since 1927

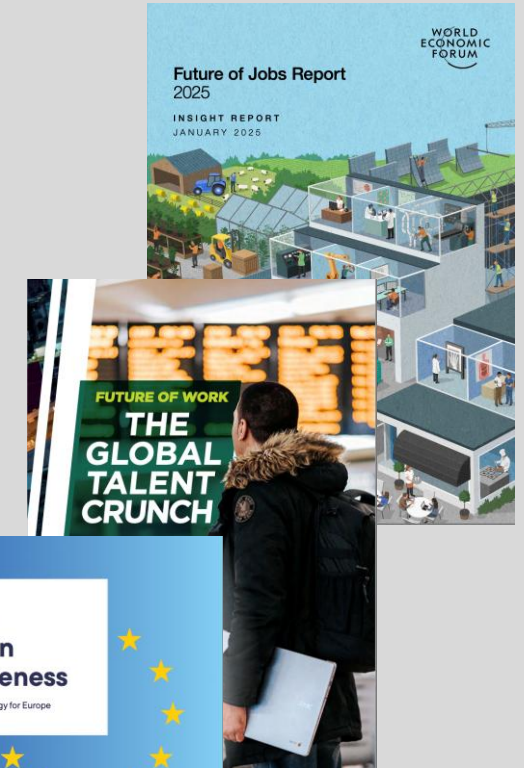
SIAD **VALTELLINA**

- Large Industrial Network



European Manufacturing Challenges

- **Negative Demographic Trend & Aging**
- **Skill gap**
- **Labour shortage**
- **Improve workers health, well-being and inclusivity**
- **Low attractivity of classical manufacturing jobs**
- **Innovation gap**
- **Raise Industrial European Competitivity**
- **Prepare workers for dynamic job transitions**



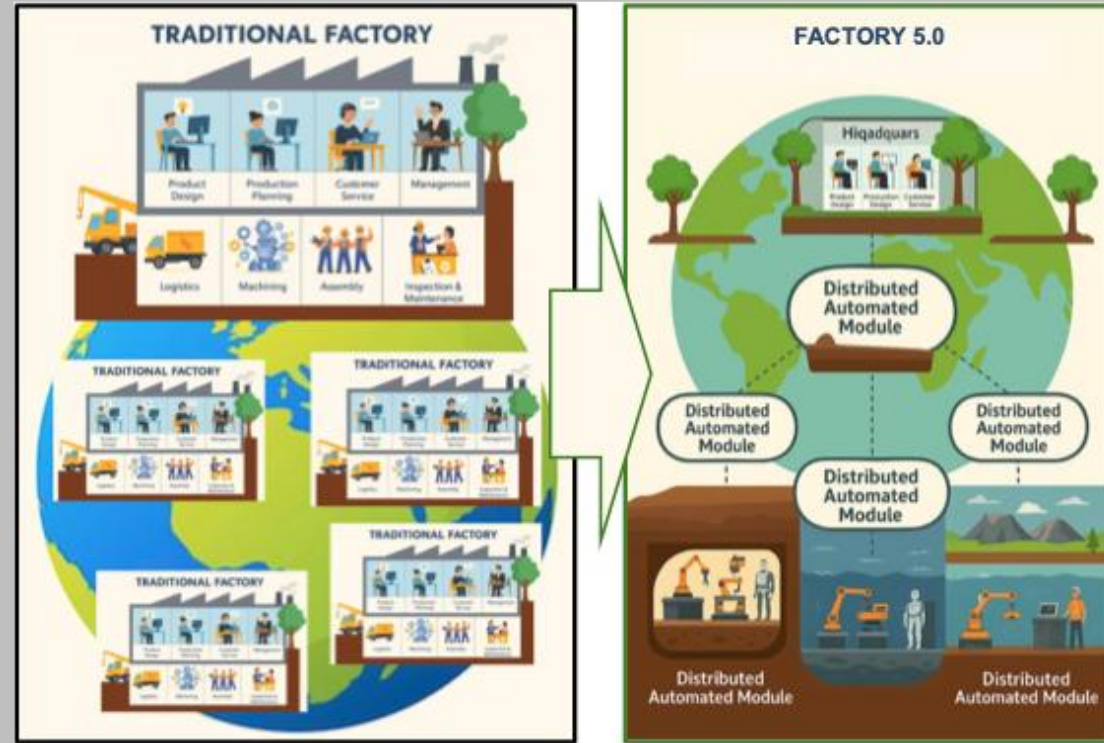
"Future of Work: The Global Talent Crunch" report, Korn Ferry, 2018

"The future of European competitiveness», M.Draghi, 2024

"The Future of Jobs Report 2025", World Economic Forum, 2025

ISTITUTO ITALIANO DI TECNOLOGIA

STRATEGIC PLAN 2024-2029



From the Lab Bench to the Factory
Wilderness:
A Human-Robot Integrated Approach

Domain: Robotics

Opportunities

- Emerging paradigms (soft robotics)
- More industrial applications

Action Plan

Further invest i) soft robotics, ii) human-robot interaction, iii) bio-inspired approaches
Invest neuroscience & robotics to advance embodied AI
Invest in humanoid robot design.
Invest in maintaining a technological edge via industrial partnerships

Flagship Program

- Technologies for Sustainability
- Brain and Machines
- Teaching Science to Computers
- Technologies for Healthy Living



Product Design



Process Design



Service & Customer Care



Management & Business development



Logistics



Machining



Assembly



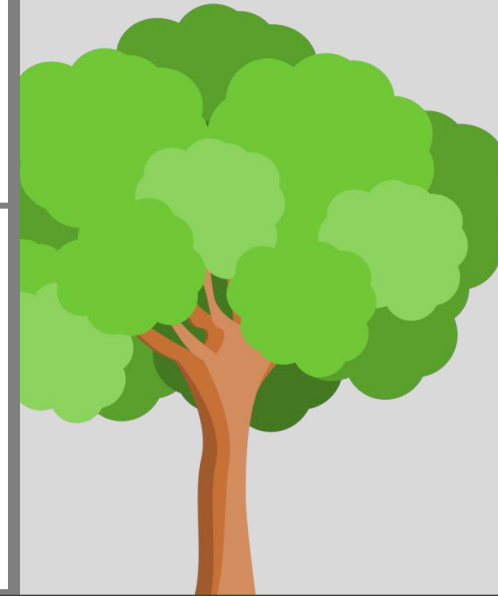
Quality



Inspection & Maintenance

Production Line

Logistics Input/Output



Factory 5.0

HEADQUARTER



Product Design



Process Design



Service



Logistics I&O
Assembly & Manufacturing



Quality



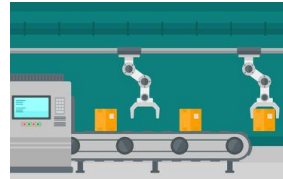
Inspection & Maintenance



Management



Logistics
Input/Output



Intra-Logistics



Machining



Assembly



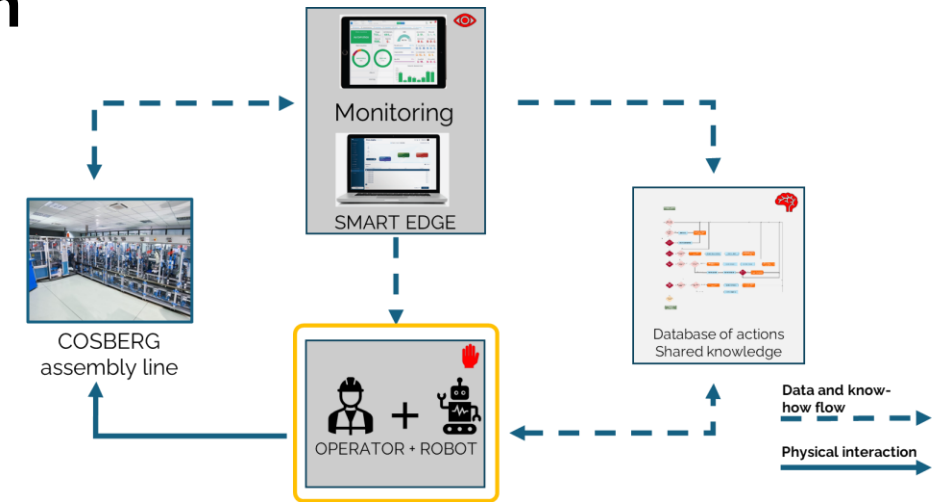
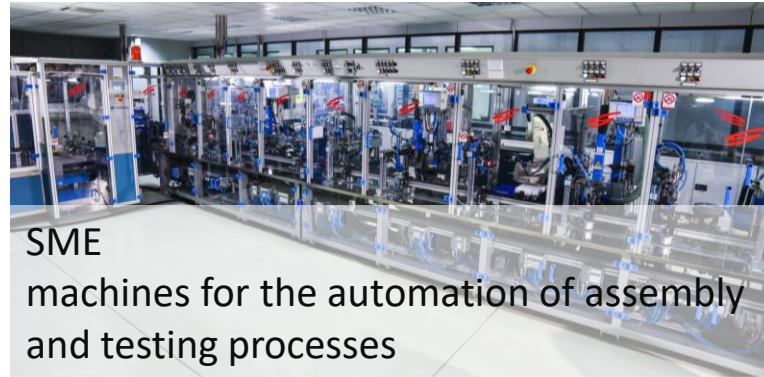
Quality



Inspection & Maintenance

PRODUCTION PLANT

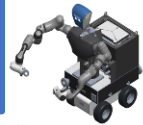
Inspection & Maintenance Process Transformation



Operator/supervisor
Cosberg, Italy



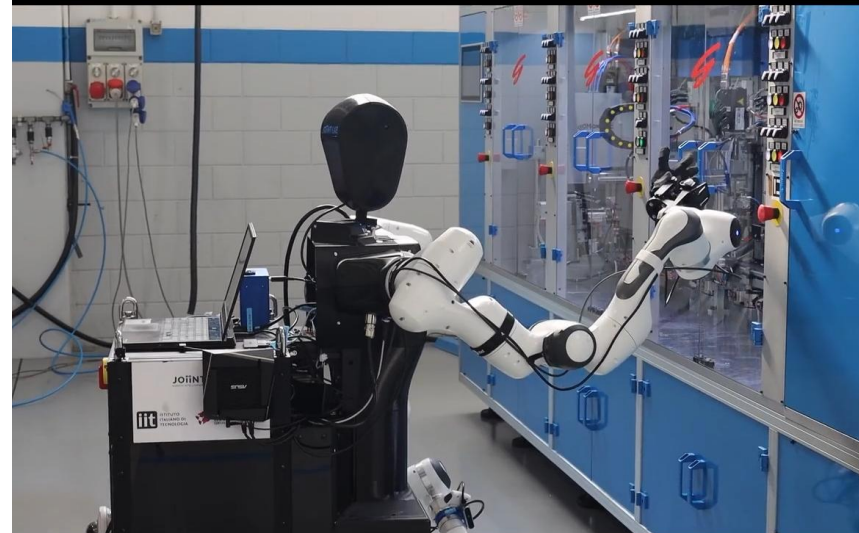
Robot avatar, India



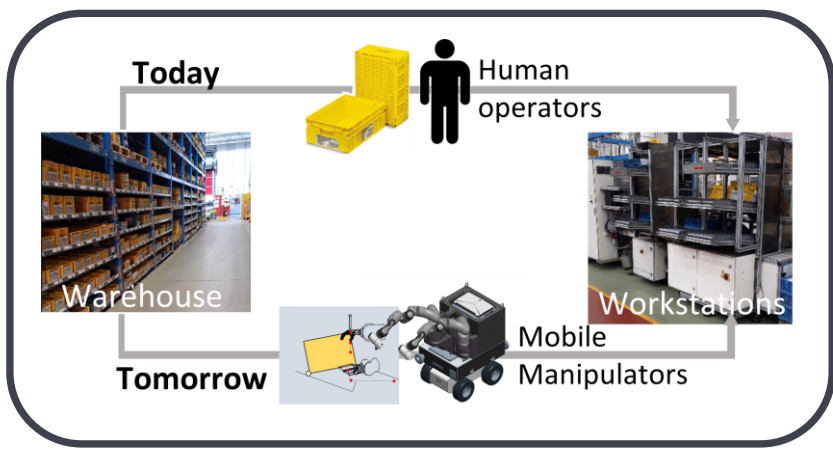
Robot avatar,
Brazil

SOLUTION AWARD 1°Place
Best industrial robotic application 2023

MECSPE
TECNOLOGIE PER L'INNOVAZIONE



F. Negrello, ... **M.G. Catalano** "Towards Robot Avatars in Industrial Applications", I-RIM 3D @ RobotHeart, Milan, 2022.



Adriano's Temple, Rome

9 Months Running

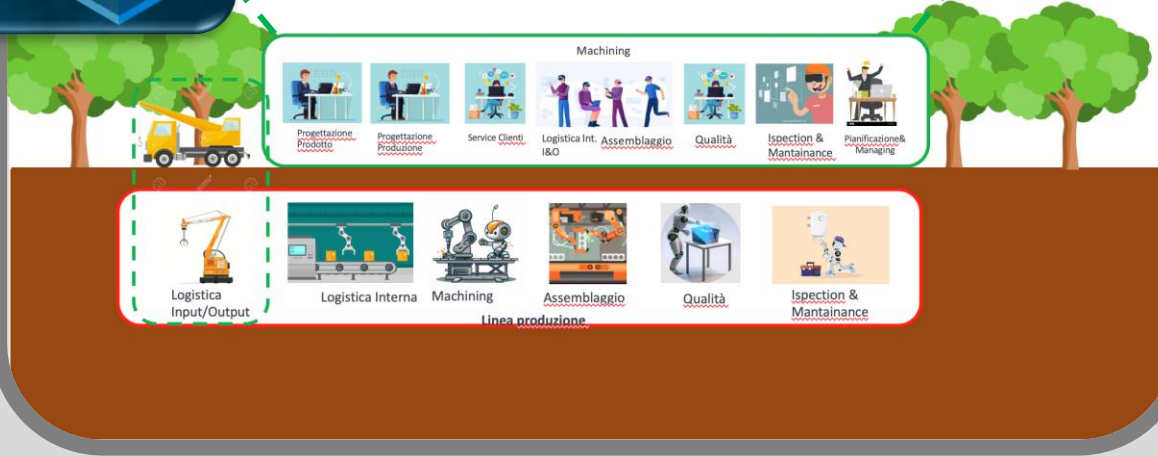
6 hours/day



Camera di Commercio
Roma

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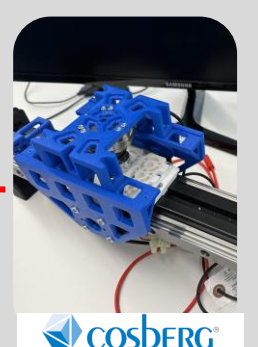
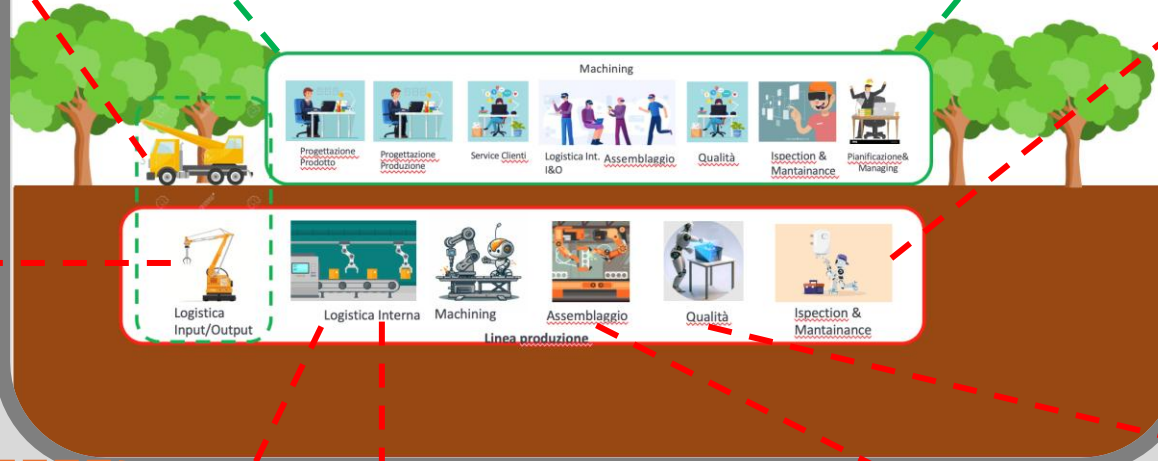
Factory 5.0



HARMONY
Human-Assisted Robotic Manufacturing for Optimized New Yield
bando Collabora & Innova



Inspection & Maintenance



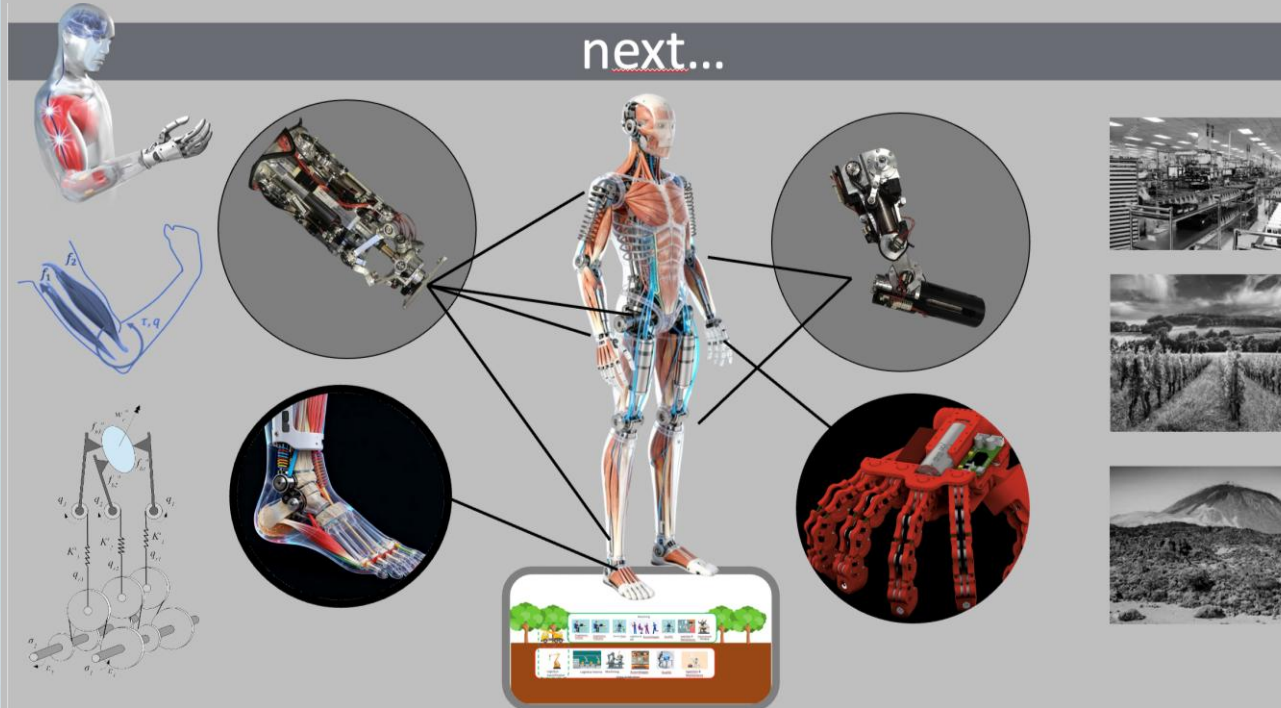
Robotic Agents

Collaborative Machining & Assembly Processes

Quality Control

ISTITUTO ITALIANO DI TECNOLOGIA

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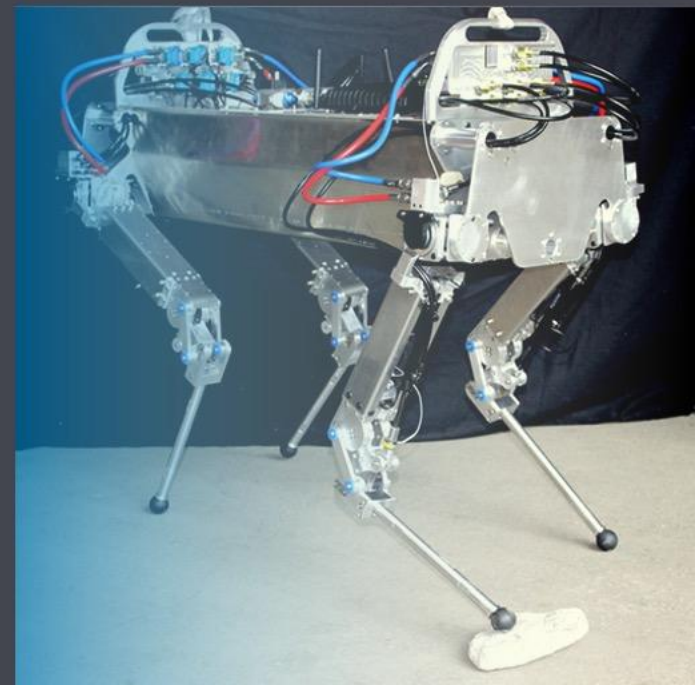
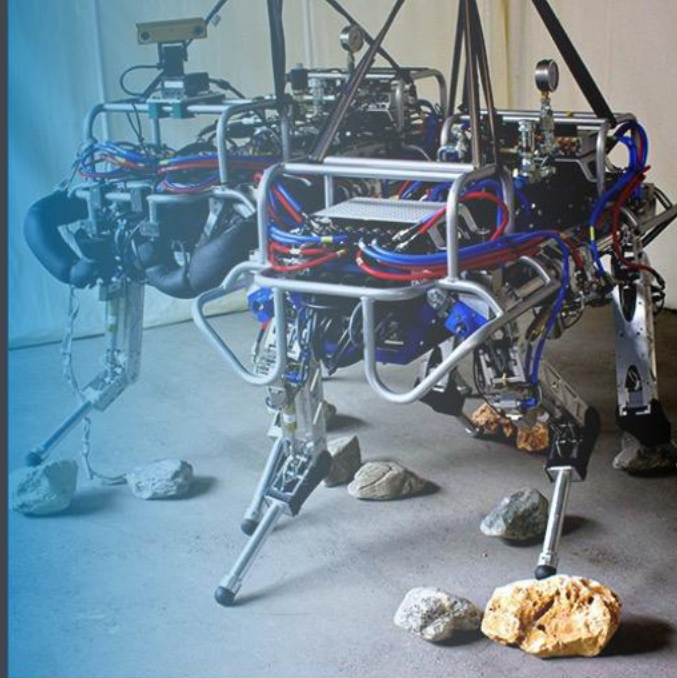


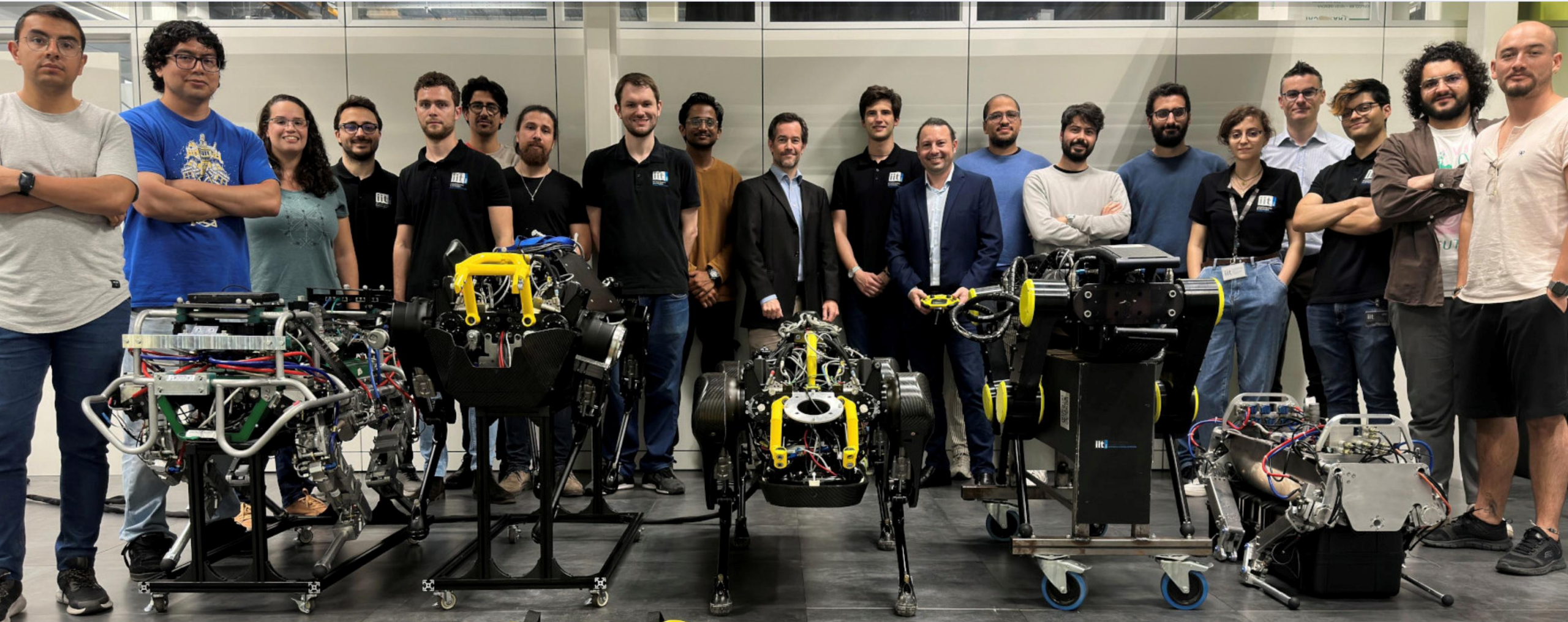
Ore 11.15



Sala Polivalente di Confindustria Bergamo

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iit

DLS

DYNAMIC LEGGED SYSTEMS

Principal Investigator
Claudio Semini

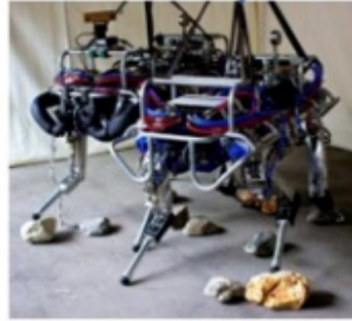
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023



HyQ leg prototype



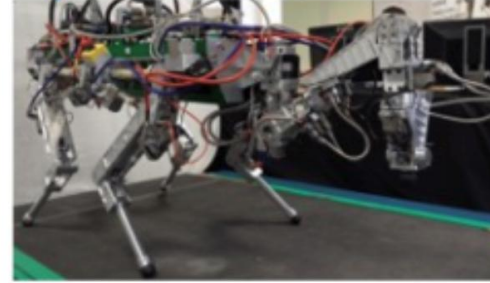
HyQ robot (90kg)



HyQ robot copies sold



HyQ2Max (80kg)

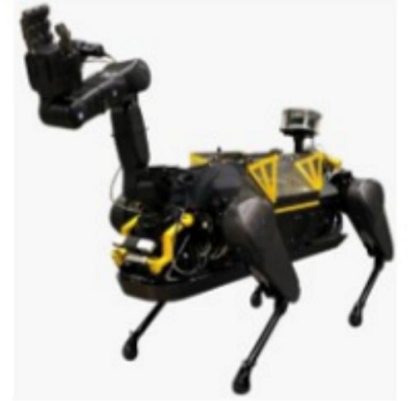


HyQ-centaur

MiniHyQ



HyQReal (140kg)



HyQReal with INAIL-IIT arm



DYNAMIC LEGGED SYSTEMS

MATTEO VILLA

Chief Technician

Dynamic Legged Systems



Chief Engineer IIT – Dynamic Legged Systems Lab

Formazione

MSc in ingegneria meccanica (Università di Bologna)

PhD in materiali e metallurgia (University of Birmingham, UK)

Esperienze

ENEA (Faenza, Italia)

Manufacturing Technology Centre (Coventry, UK)

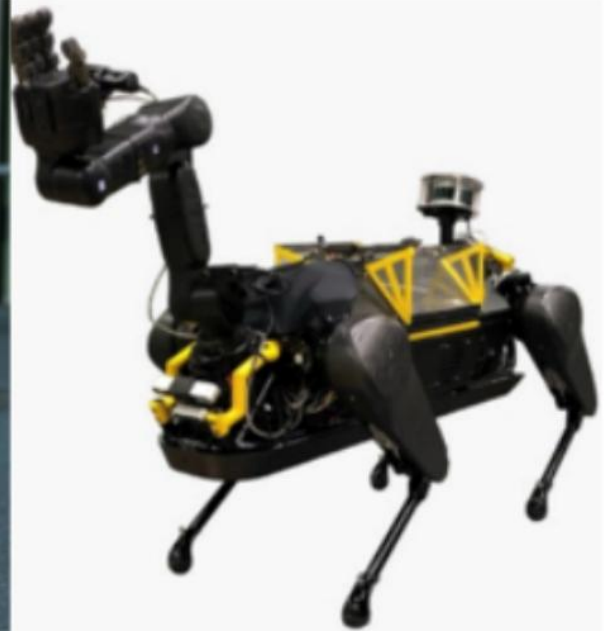
Technogym

Oggi

Sviluppo di nuovi robot quadrupedi presso il Dynamic Legged Systems Lab



DYNAMIC LEGGED SYSTEMS



Quadrupedal Robots: Traiettorie di ricerca e sfide future

Matteo Villa, PhD



DYNAMIC LEGGED SYSTEMS

JOiINT TALKS

Robot quadrupedi: innovazione, applicazioni e sfide future



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