Natural Intelligence

for robotic monitoring of habitats

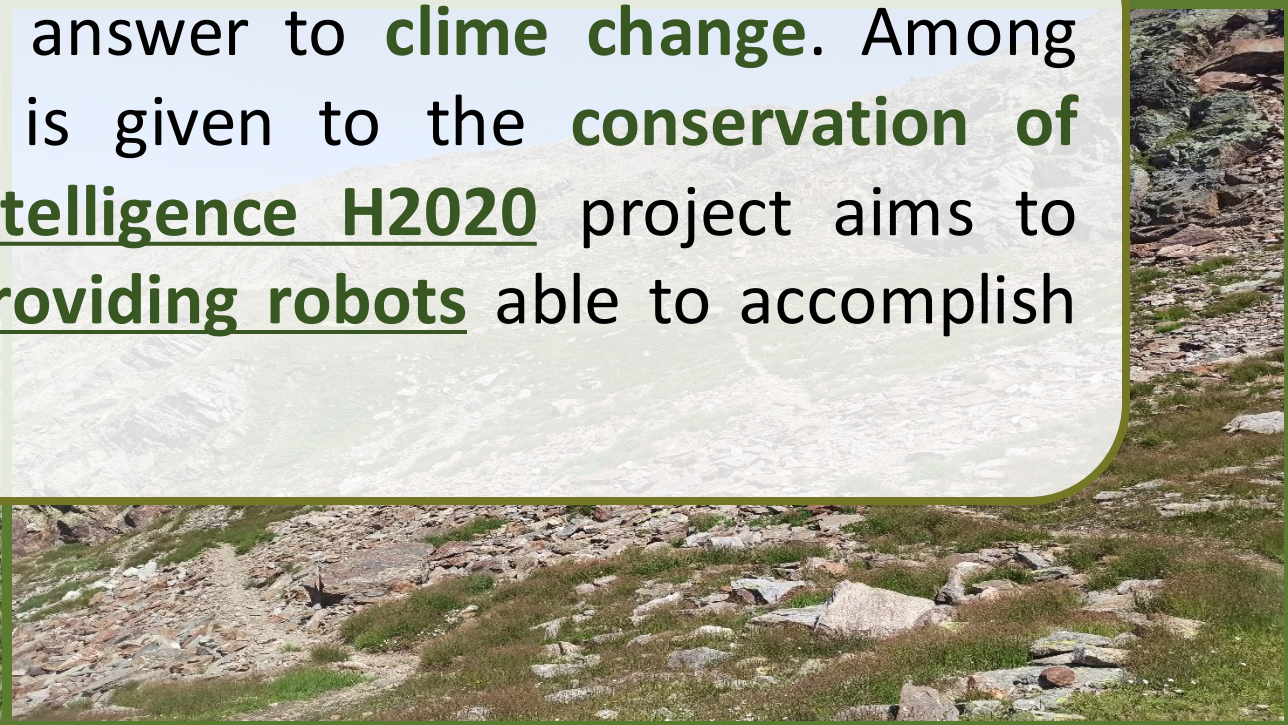
Robotic Monitoring of Habitats: The Natural Intelligence Approach

H2020-ICT2019-2
(GA 101016970)

Research Center E. Piaggio
University of Pisa

Habitat monitoring via robots

The **Green Deal** is the European answer to **clime change**. Among these policies a prominent role is given to the **conservation of habitats and species**. **Natural Intelligence H2020** project aims to serve the European Green Deal **providing robots** able to accomplish **monitoring of habitats**.

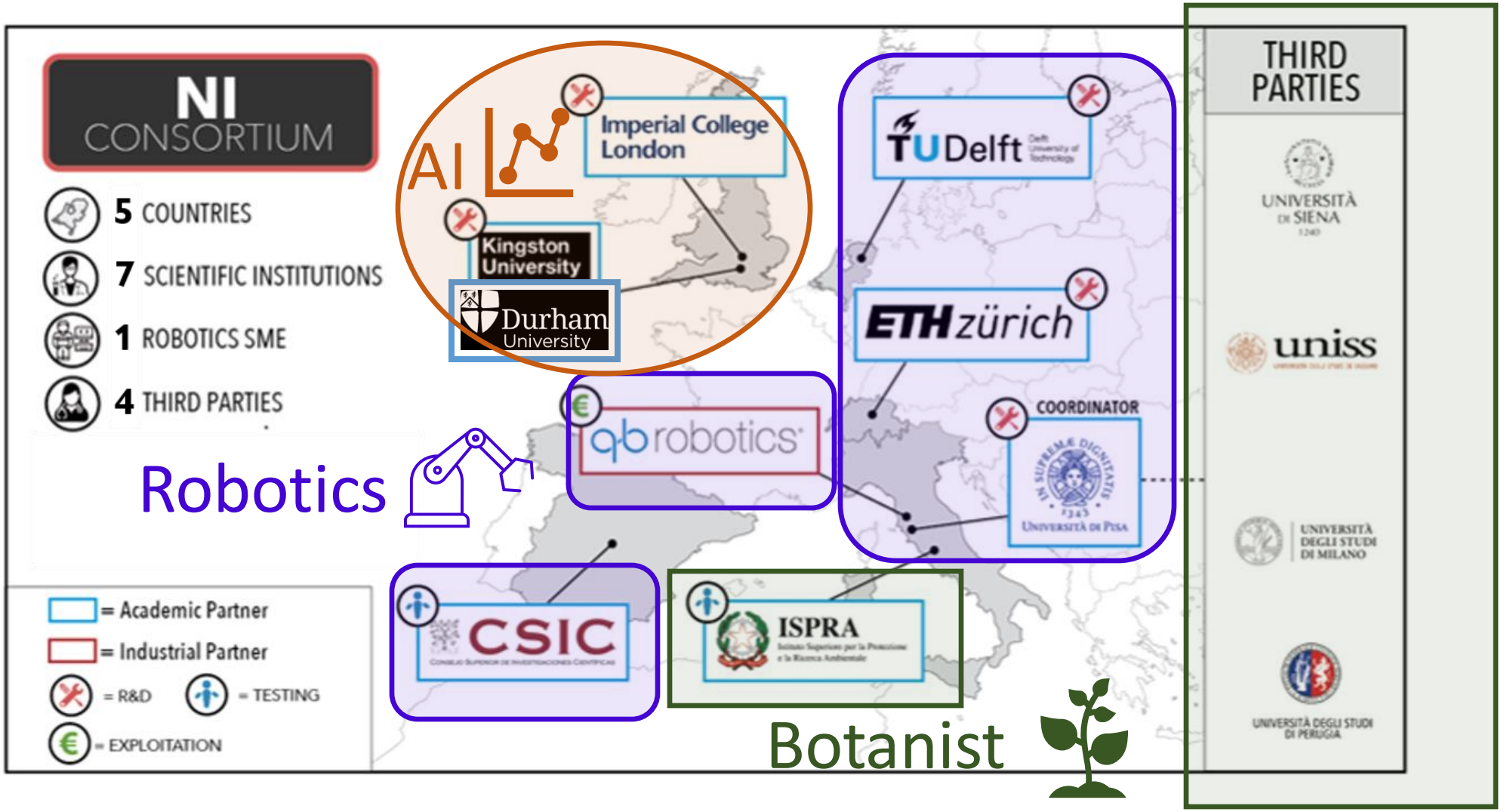


Scenarios

- Dunes
- Forests
- Grasslands
- Screes

Objective: Enhance human monitoring capabilities by collecting data using legged robots that are capable to operate in terrestrial habitats.

Team

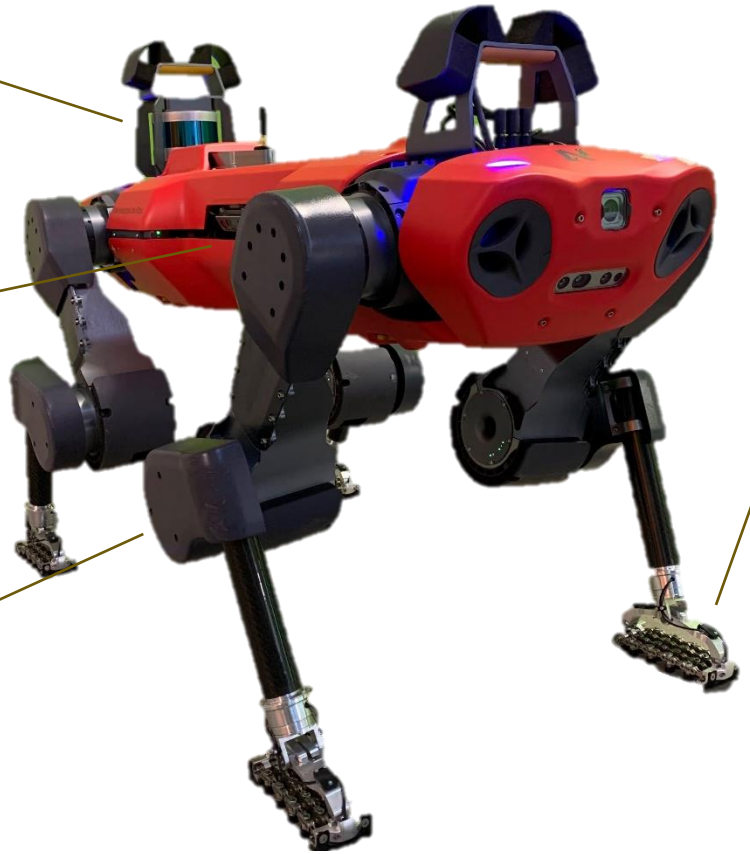

NI CONSORTIUM
5 COUNTRIES
7 SCIENTIFIC INSTITUTIONS
1 ROBOTICS SME
4 THIRD PARTIES
AI
Imperial College London
Kingston University
Durham University
TU Delft
ETH zürich
COORDINATOR
Università di Pisa
qb robotics
Robotics
CSIC
ISPRA
Botanist
THIRD PARTIES
Università di Siena
uniss
Università degli Studi di Milano
Università degli Studi di Perugia
= Academic Partner
= Industrial Partner
= R&D
= TESTING
= EXPLOITATION

Technology

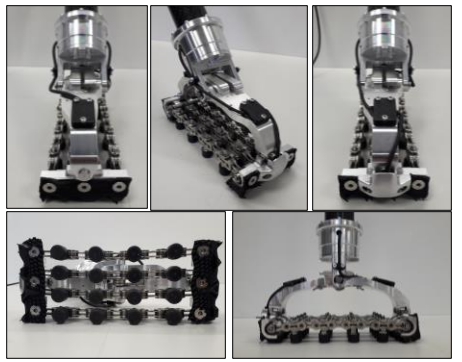
Lidar

Depth Cameras

ANYdrives



SoftFoot-Q



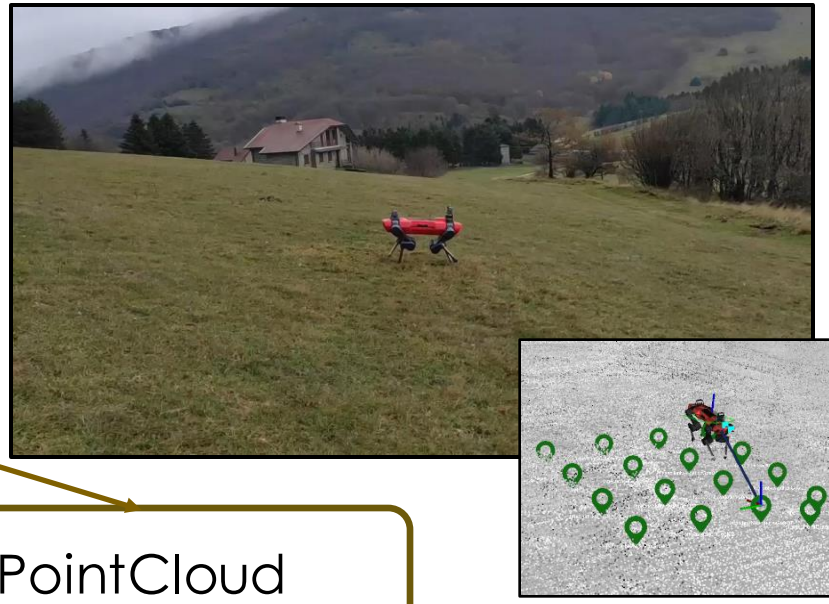
- Number of links per chain: 9
- Area of the footprint: 54 x 143 mm^2
- Roll Range of Motion: ±30 deg
- Pitch Range of Motion: ±45 deg

ANYbotics

[2] M. J. Pollayil *et al.*, "Adaptive Feet for Quadrupedal Walkers," in *IEEE TRO*




Monitoring Flow Chart



Autonomous Mission

Images

PointCloud

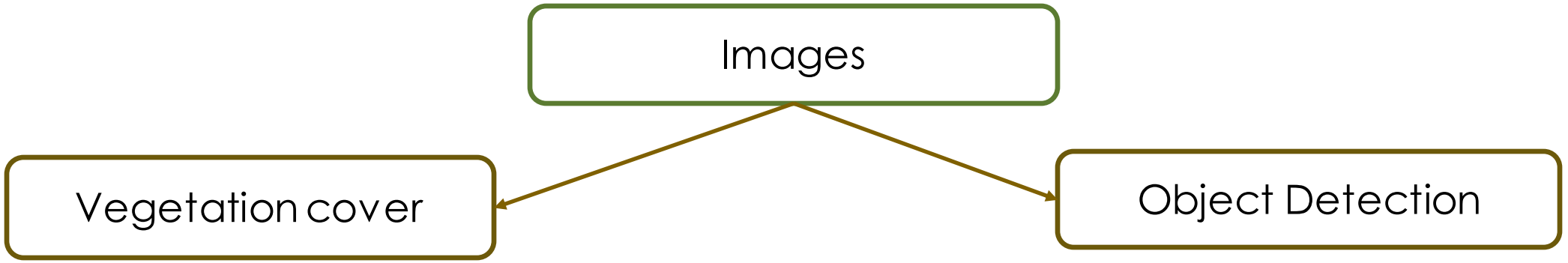
Vegetation cover

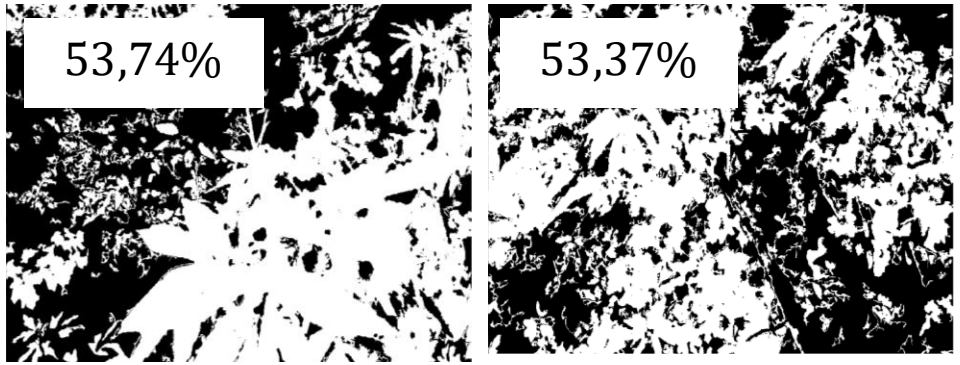
Object detection

Trees – number, features

Bush Identification

Monitoring Flow Chart



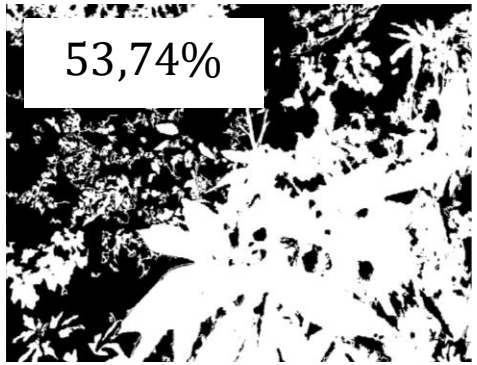


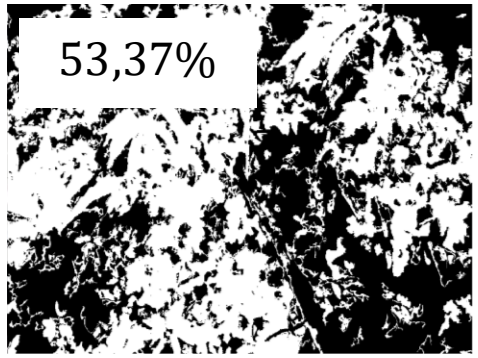
Monitoring Flow Chart

Images

Vegetation cover

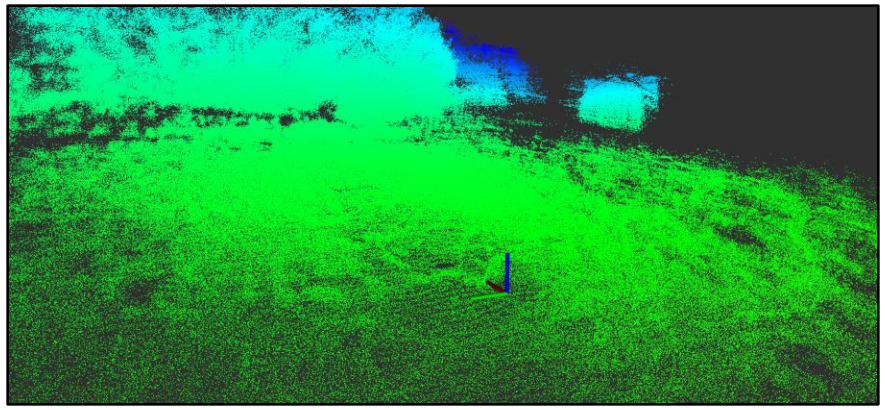
Object Detection





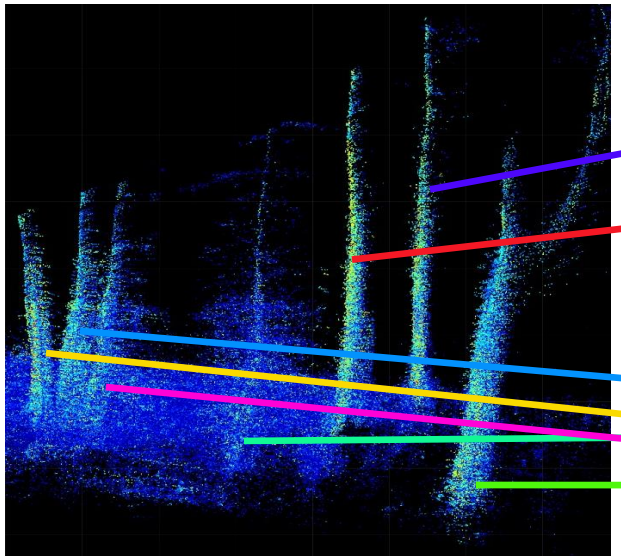
Monitoring Flow Chart

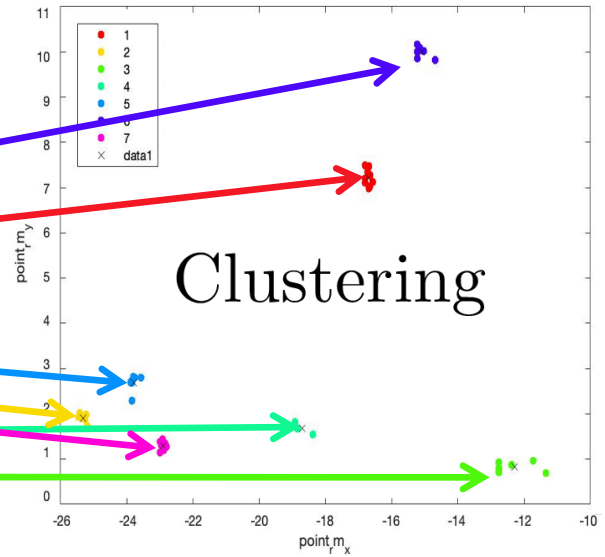
PointCloud



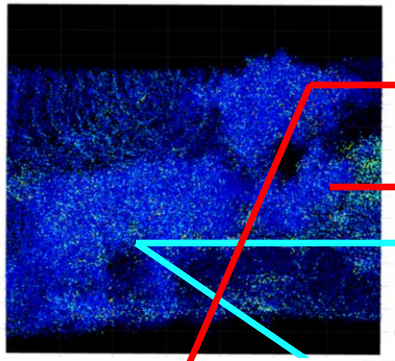
Trees – number and features

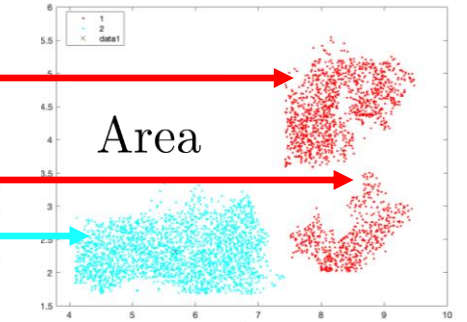
Bushes identifcation

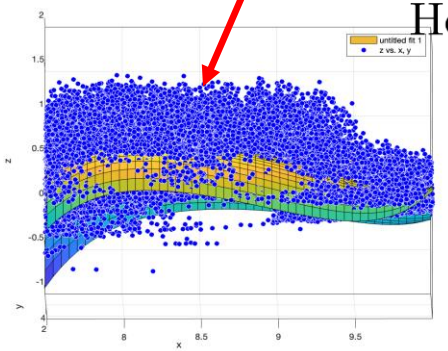


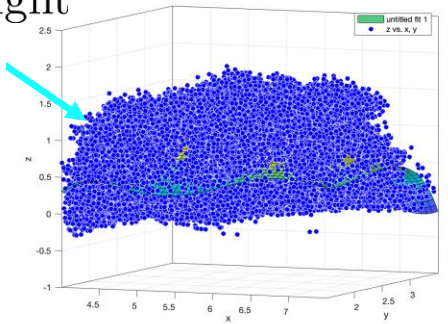


D. #	1	2	3	4	5	6	7
[m]	0.36	0.28	0.85	0.40	0.41	0.43	0.24

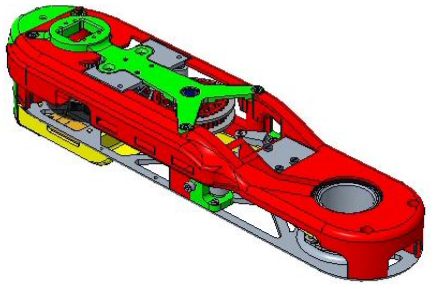








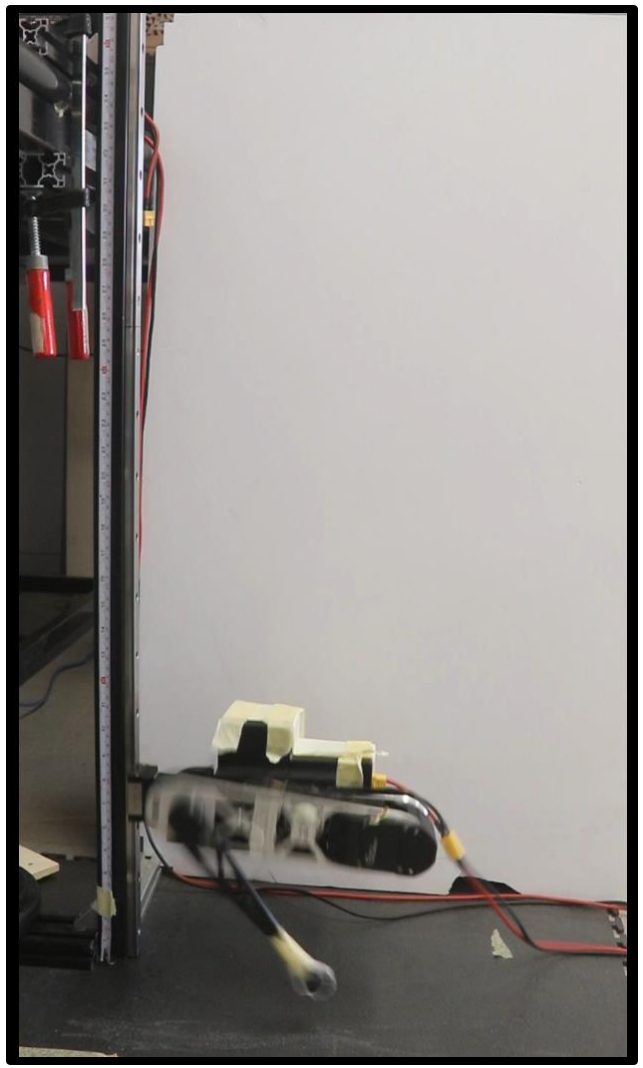
EM-Act: Modular Servo Elastic Actuator

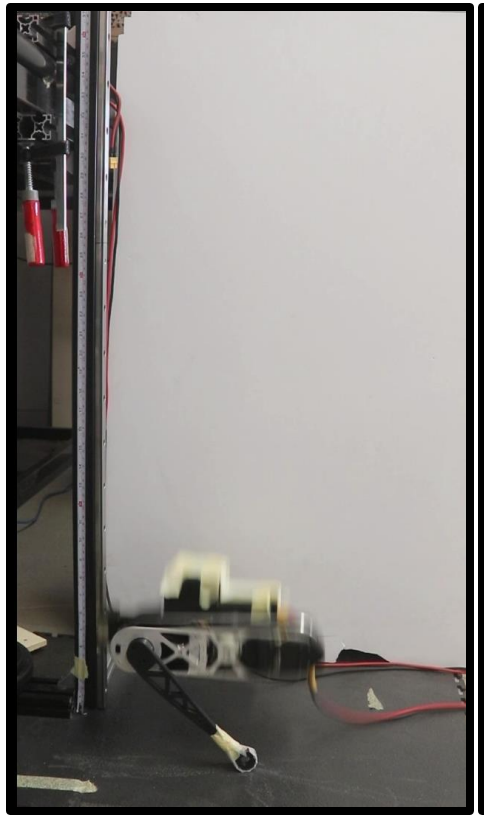


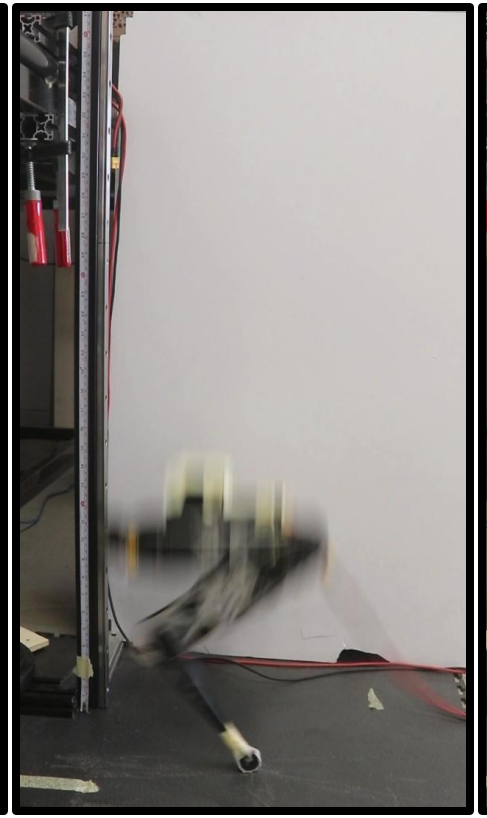
Operating data		
(quantity)	(unit)	(value)
Mechanical		
Continuos Output Power	[W]	450
Ratio		9:1
Nominal Torque	[Nm]	2,5
Nominal Speed	[rad/s]	180
Peak Torque	[Nm]	20
Stiffness	[Nm/rad]	45,5
Angular Resolution	[°]	360/16384
Weight	[kg]	0,560
Fatigue test		
Peak Torque = 4 Nm	cycles	>100k
Peak Torque = 6 Nm	cycles	>100k
Peak Torque = 8 Nm	cycles	≈25k
Electrical		
Nominal Voltage	[V]	24
Addictional sensor data		
Ang Res Second Encoder	[°]	360/16384

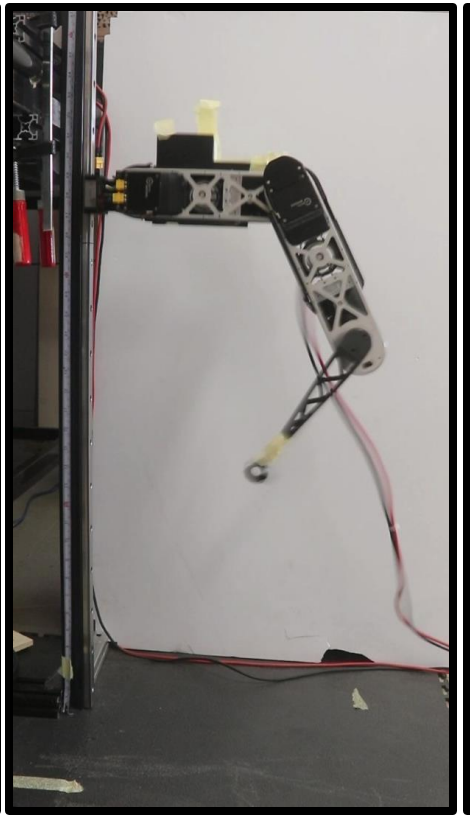
[4] Krishmanmg Ramesh *et al*., “EM-Act A modular SEA for dynamic robot , " in *IEEE T-MEC (Under Review)*

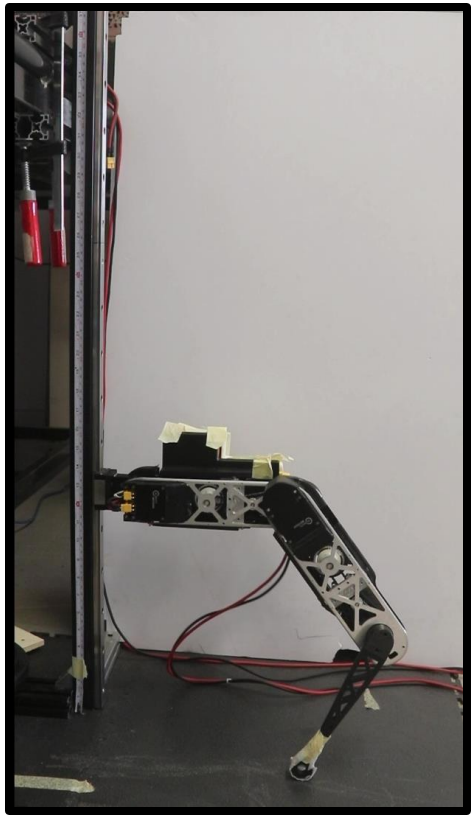
Jumping Soft Leg





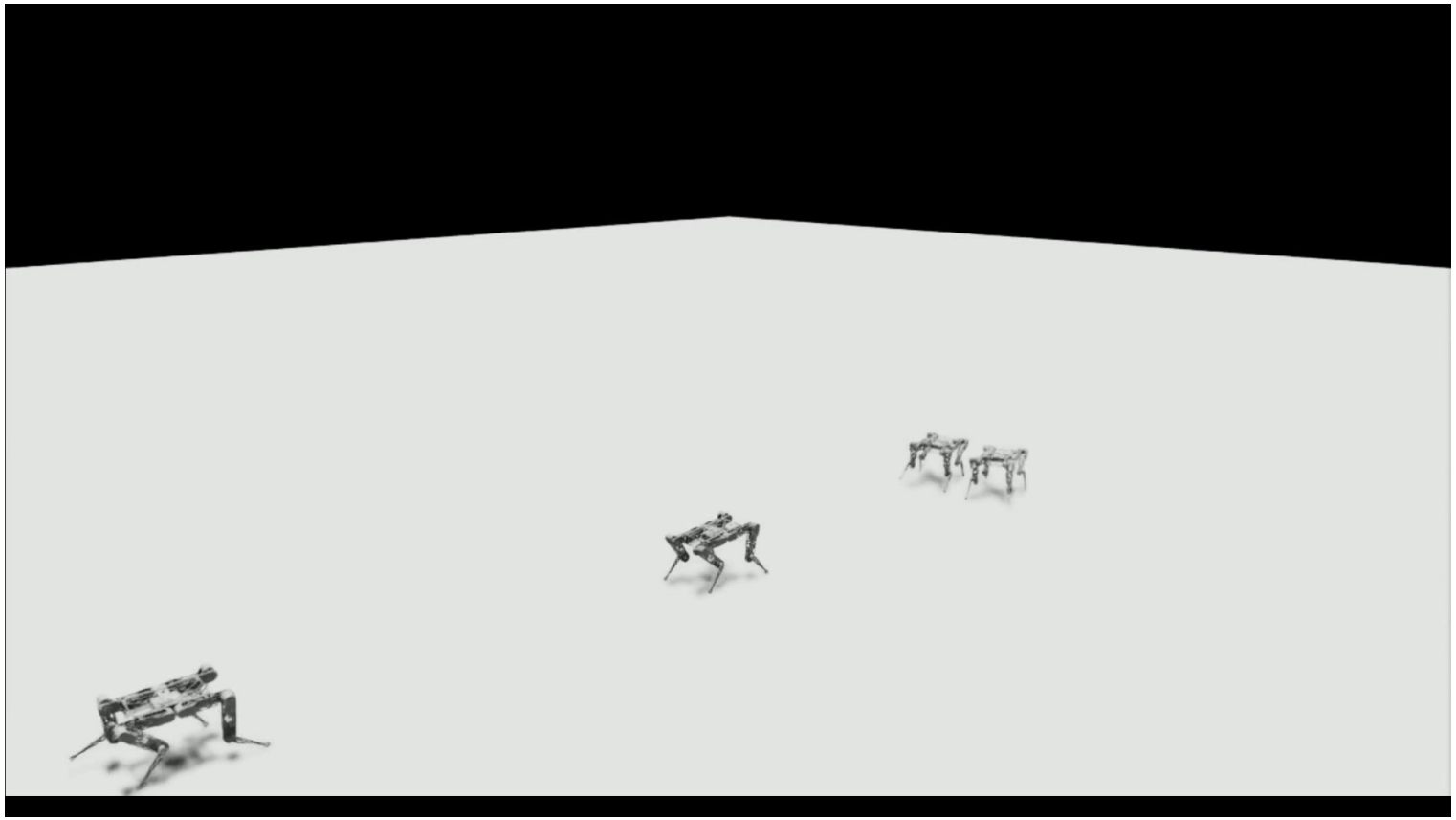




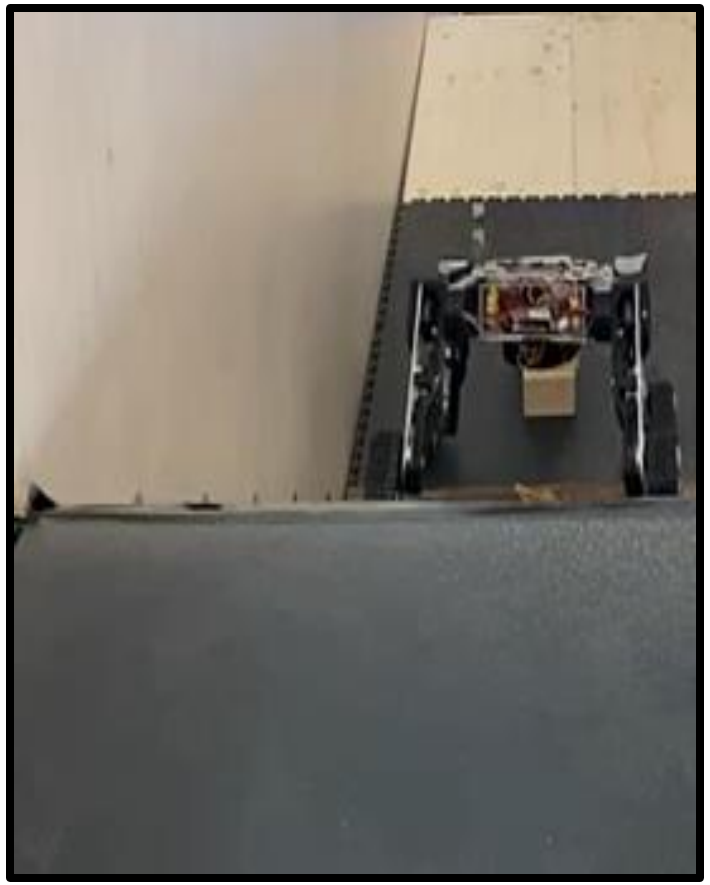


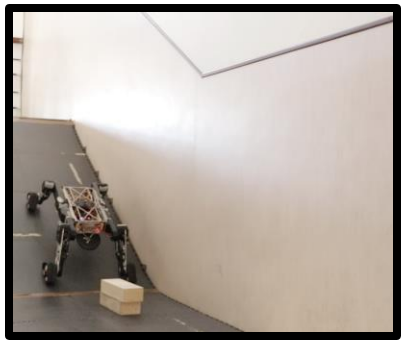
Quadruped

Simulation

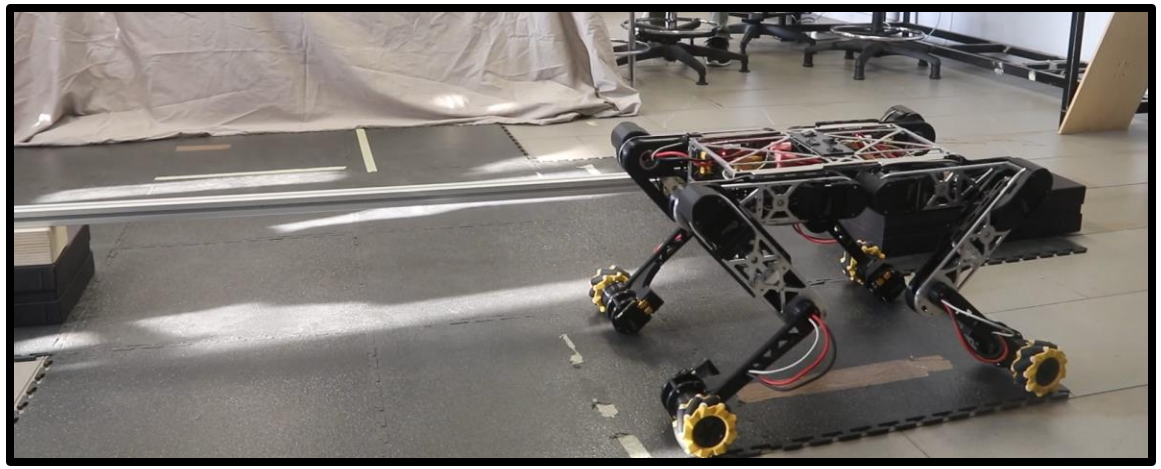


Quadruped with Tracks





Quadruped with Omniweels



Conclusion

Natural Intelligence will provide a reliable framework to enhance habitat monitoring through the use of legged robots leading to an improved biodiversity preservation.

This framework could also be a fruitfully exploited in other applications areas such as agri-tech, inspection and maintenance, and search&rescue.

[3] Angelini, Franco, et al. "Robotic monitoring of grasslands: a dataset from the EU Natura2000 habitat 6210* in the central Apennines (Italy)." *Scientific Data* 10.1 (2023): 418.

Natural Intelligence

for robotic monitoring of habitats

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