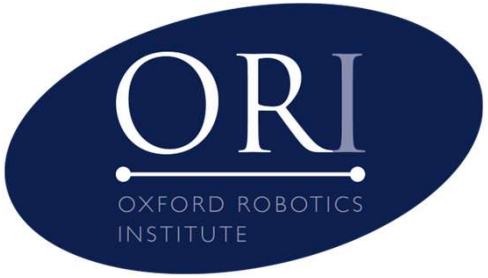
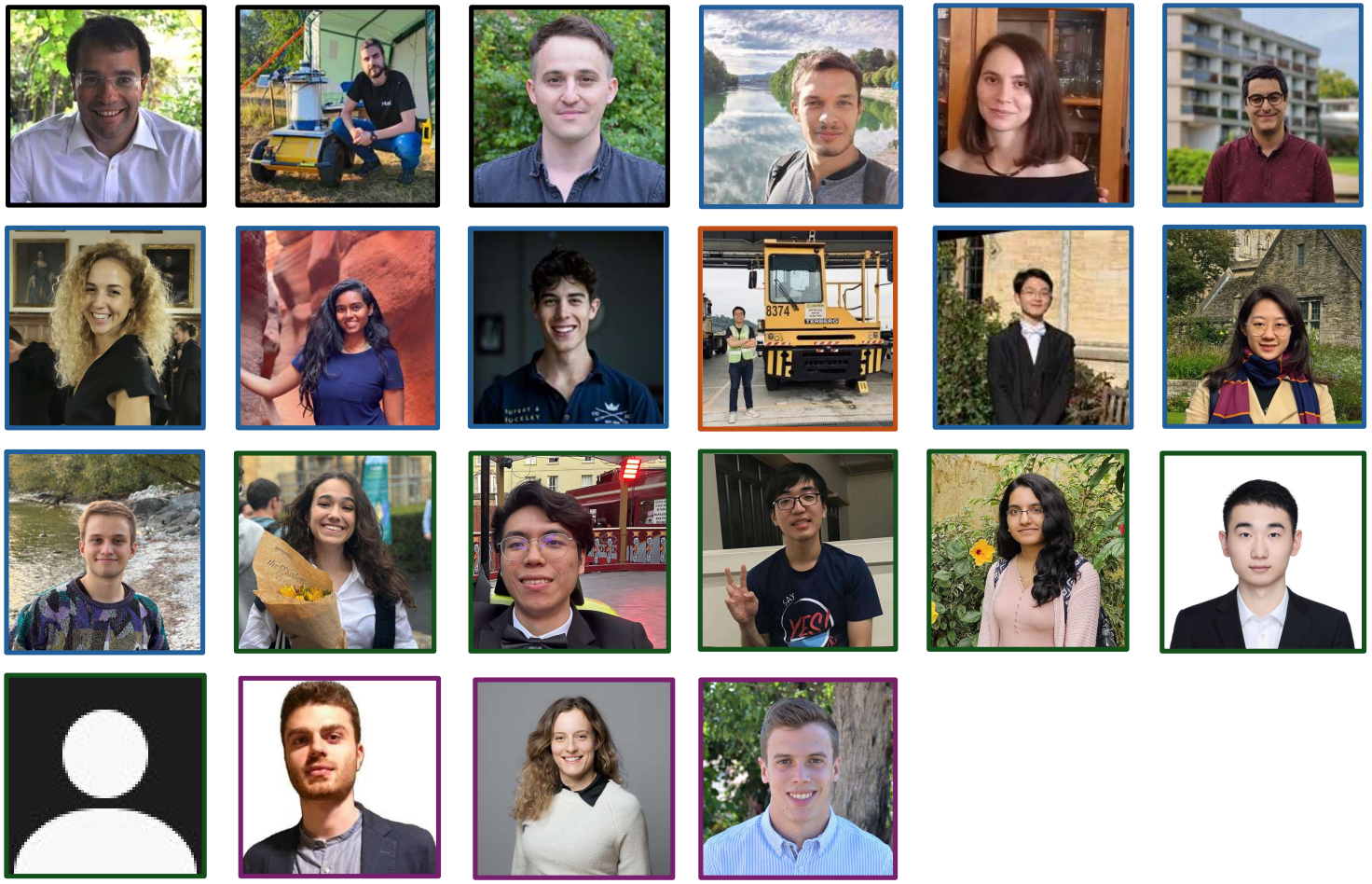
What we do at MRG

Daniele De Martini





MRG

MOBILE ROBOTICS GROUP

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Mobile Robotics Group

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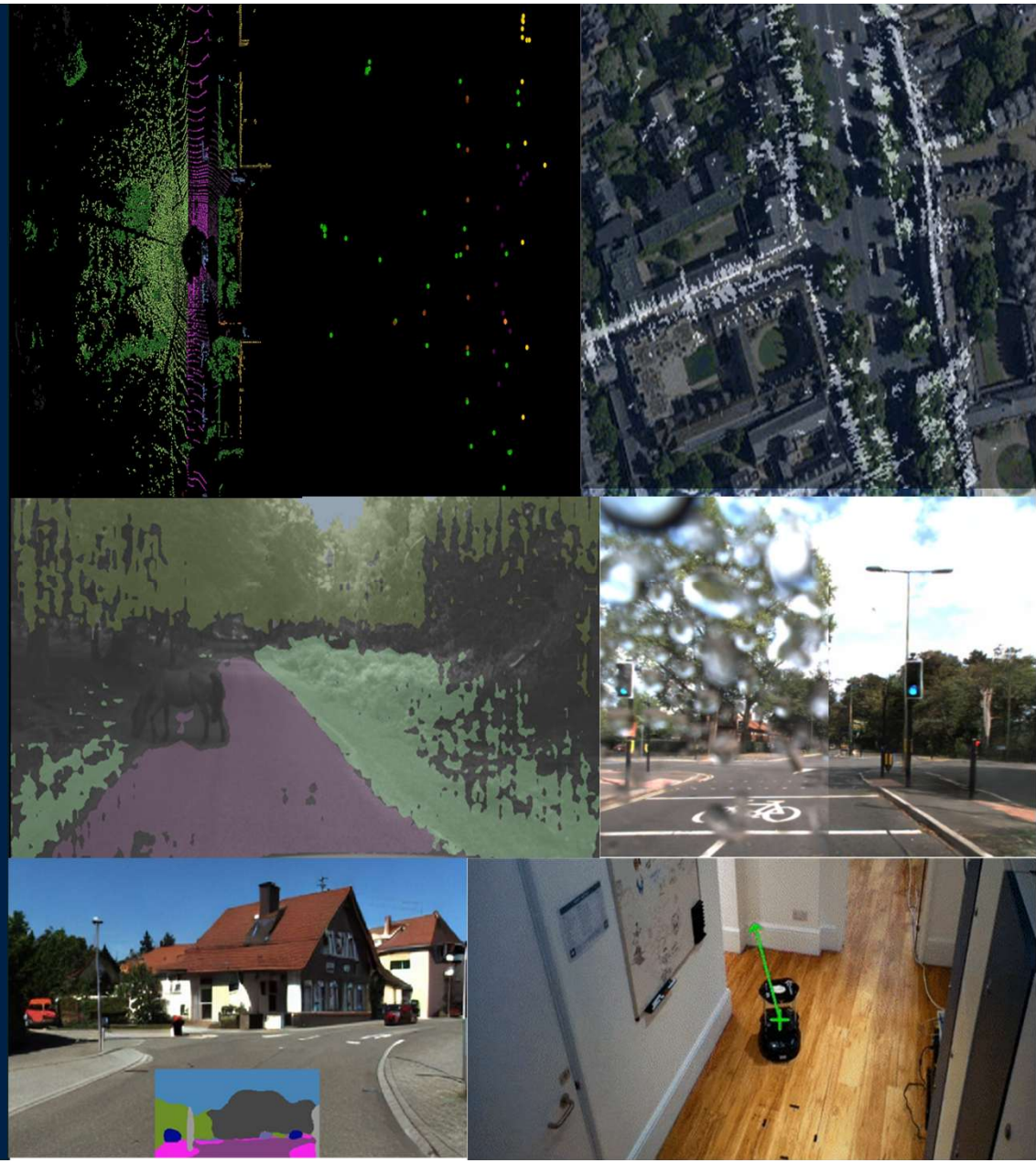
Robust robot navigation in any situation through:

- Uncommon sensor modality: Radar, Satellites, CCTV cameras
- Training/inference procedures: Realistic data synthesis, Introspective segmentation, data gathering and analysis




VK15 NHE

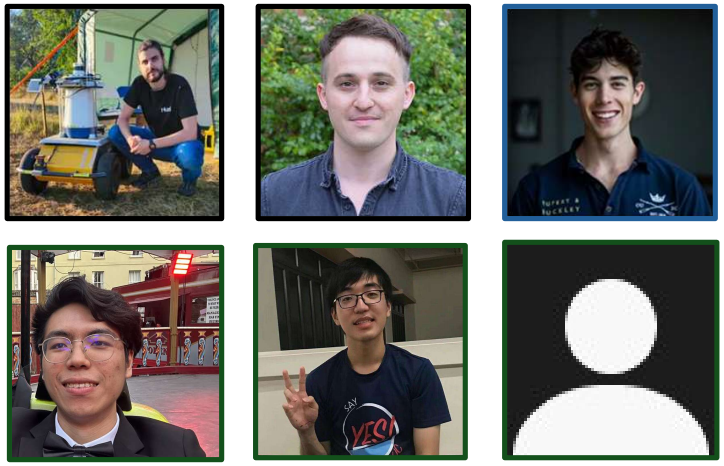
Robustness via:

Uncommon sensing

High-level reasoning

Synthetic data

Real data + deployment



Uncommon sensing

Radar, satellites and CCTV cameras

FMCW scanning RADAR

The long wavelength (76 to 77 GHz) allows the radar to pass through small particles, like dust or snow.

It has a very long range (up to hundreds of meters) and good discretisation (down to 4 cm).

Sources of “noise” make it challenging to work with.

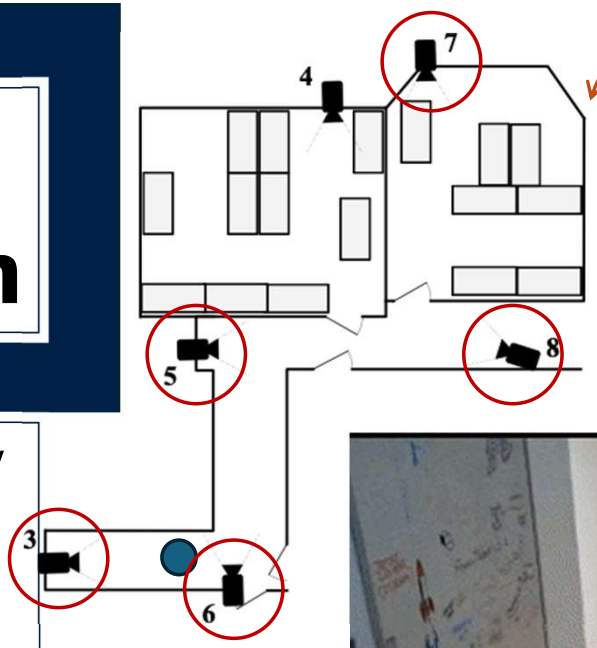
The robotic inversion

Robots can access flexible, virtually unbounded **computing and sensing** via low-latency and high-bandwidth comms, but **off-board**.

Focus on **fast setup and deployment** of any robot anywhere.

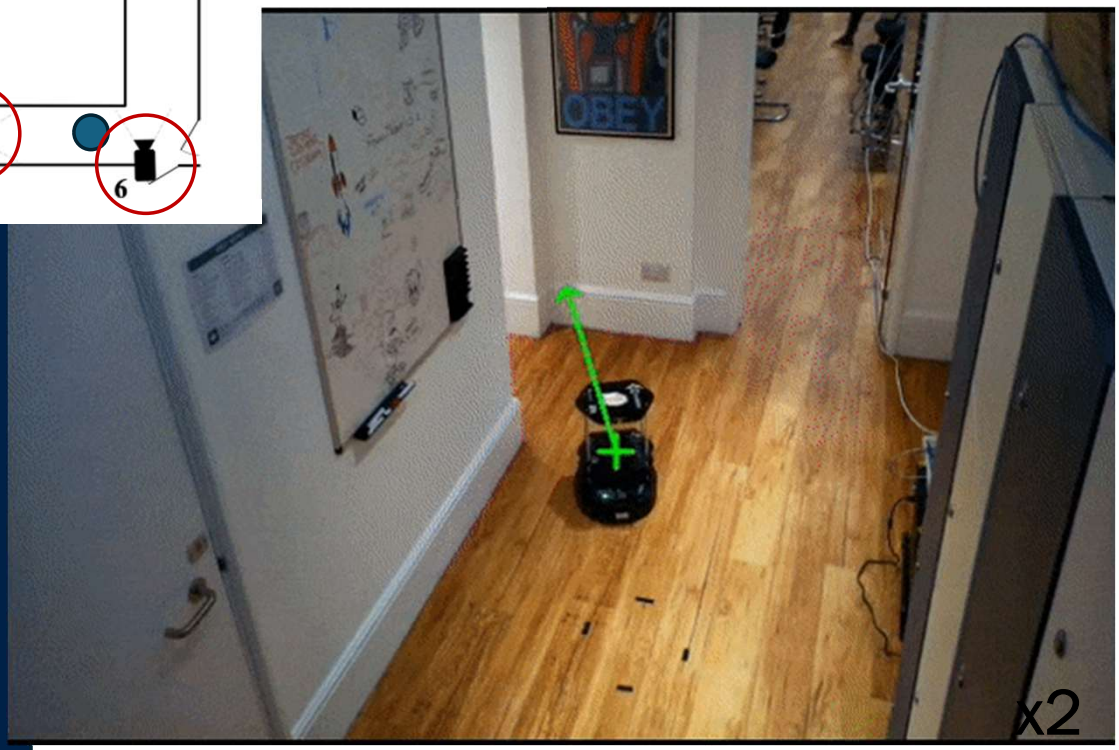
Interesting challenges on "**when/what/where**" to compute and sense, and **safety**.

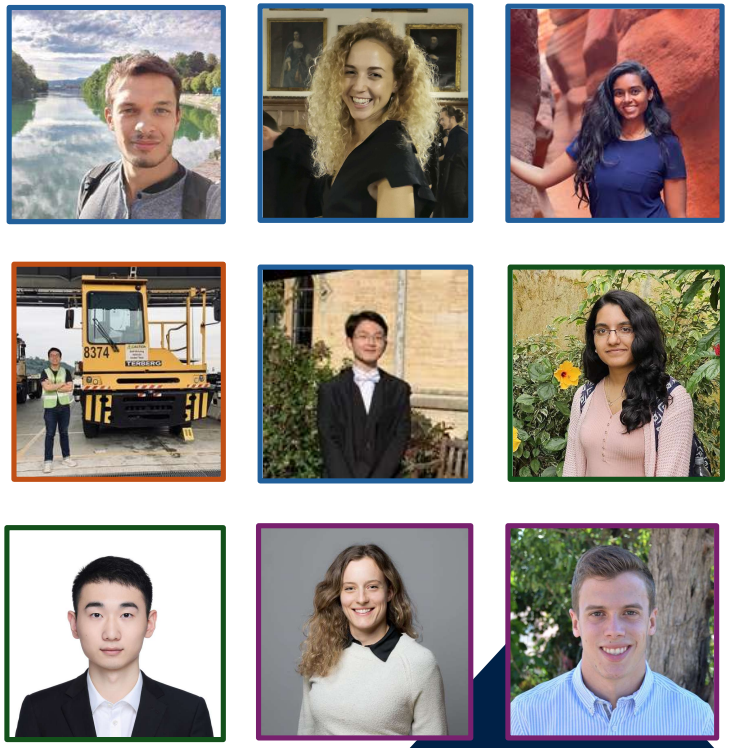
Comms bring latencies and bandwidth issues!



Large-scale, dynamic and heterogeneous environment and robots!

No explicit 3D info (non-homogeneous dynamics and appearance)!



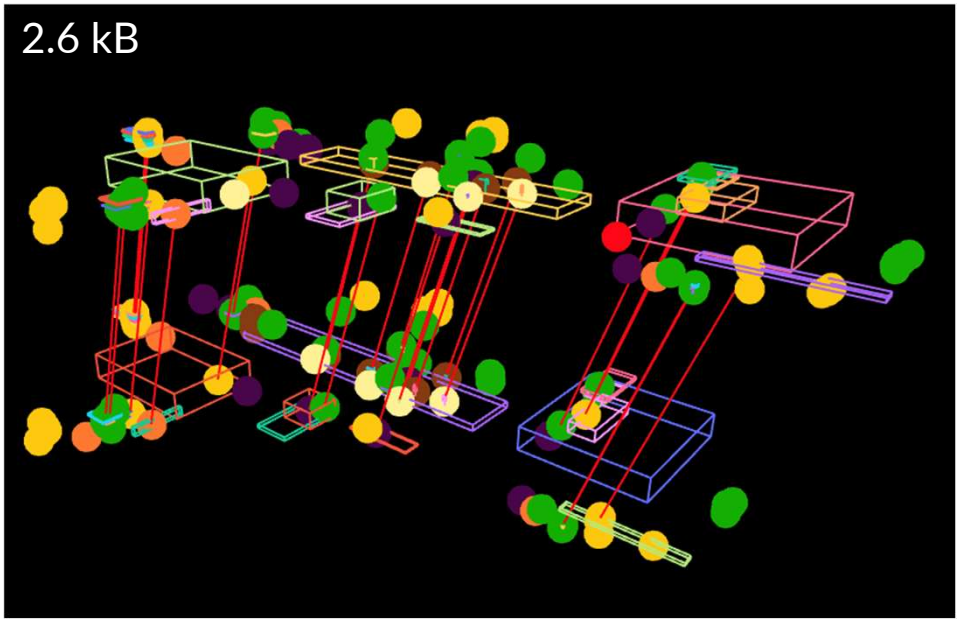


High-level reasoning

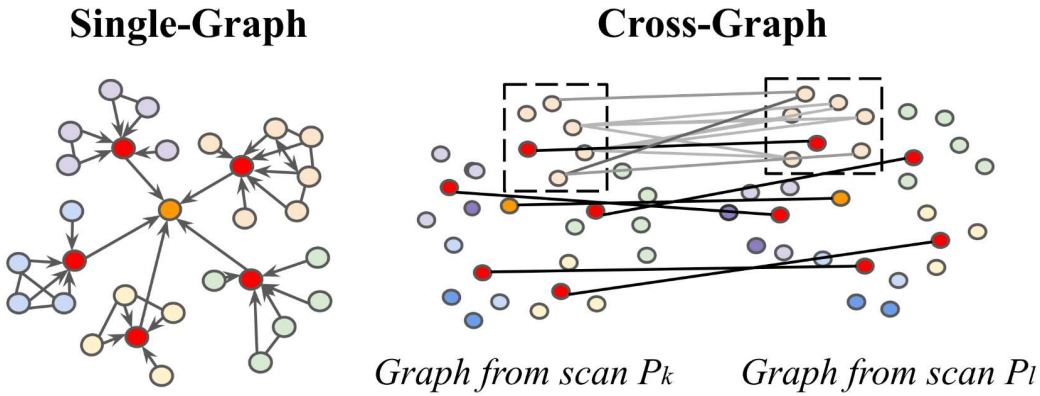
Semantics do not change with appearance

Mapping with high-level information

Small maps with only objects

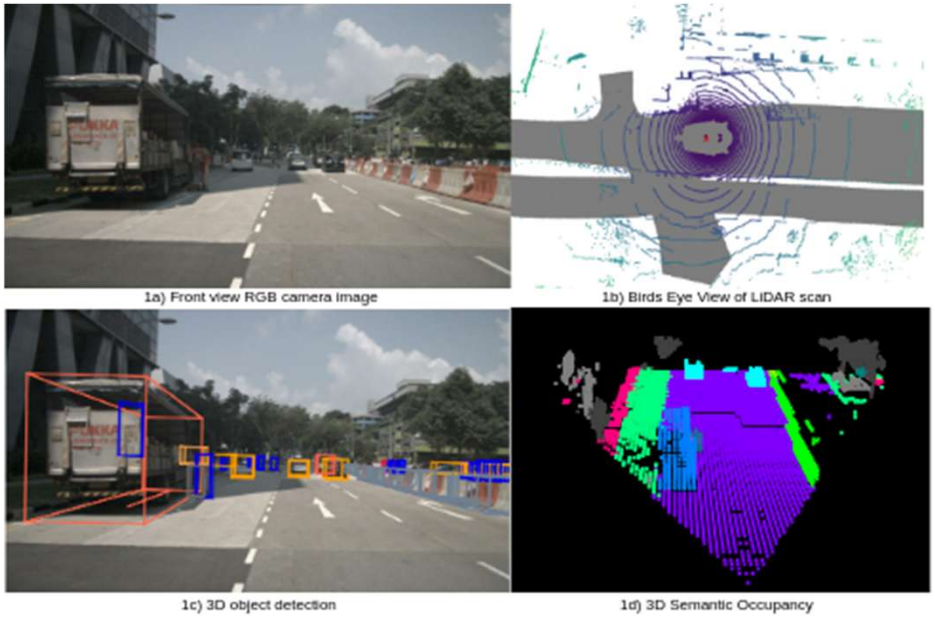


Registration guidance via objects

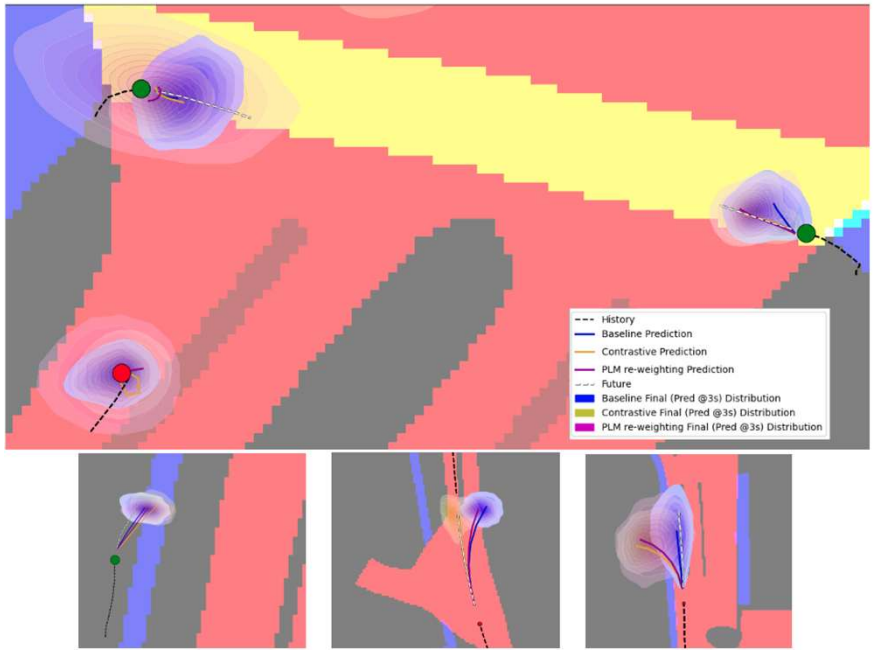


Prediction

Predicting semantic occupancy



Predicting agents' motions

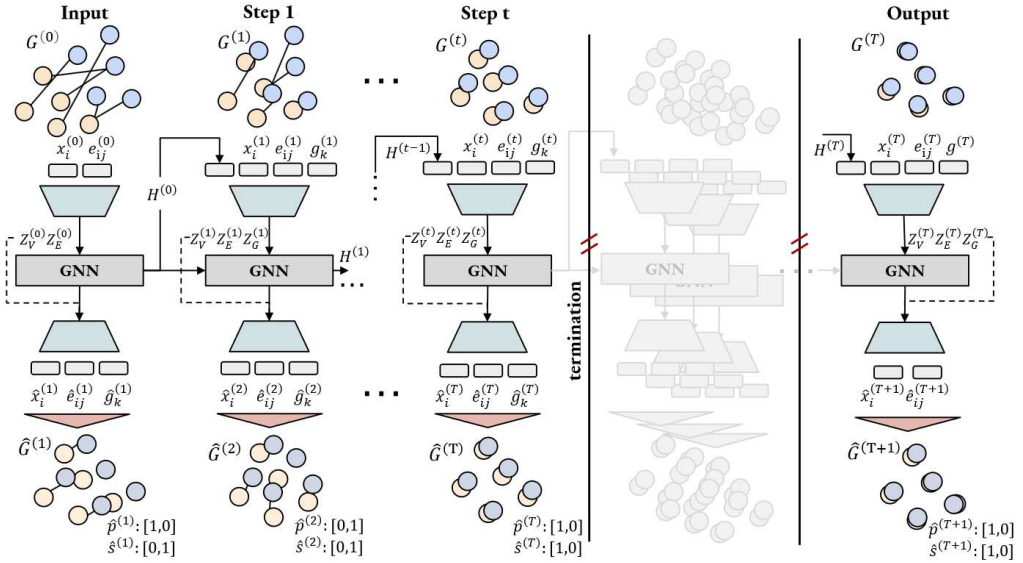


Language and algorithms

VLMS as “common knowledge” databases

Action:	*The car is stopped*
Justification:	*Traffic ahead of the car is stopped at an intersection controlled by a red light*
Control Signal:	*Speed: 0.0 (m/s) Course: -0.0 (deg)*

Can we learn to approximate robotics algorithms?

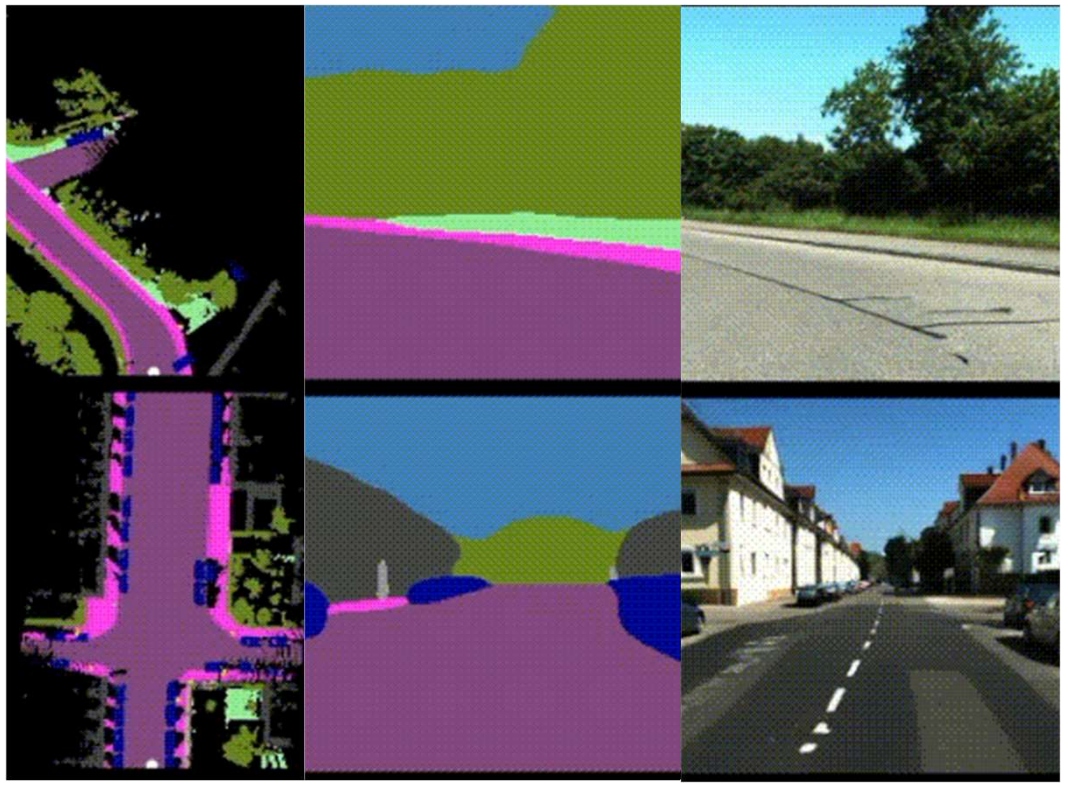


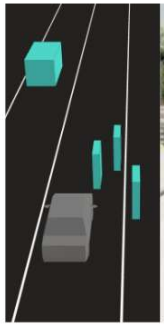
Synthetic data

No dataset are perfect

Create new worlds

Simulating the environment and creating situations make training and testing algorithms possible. Controllable scenes let you test even in very rare cases.

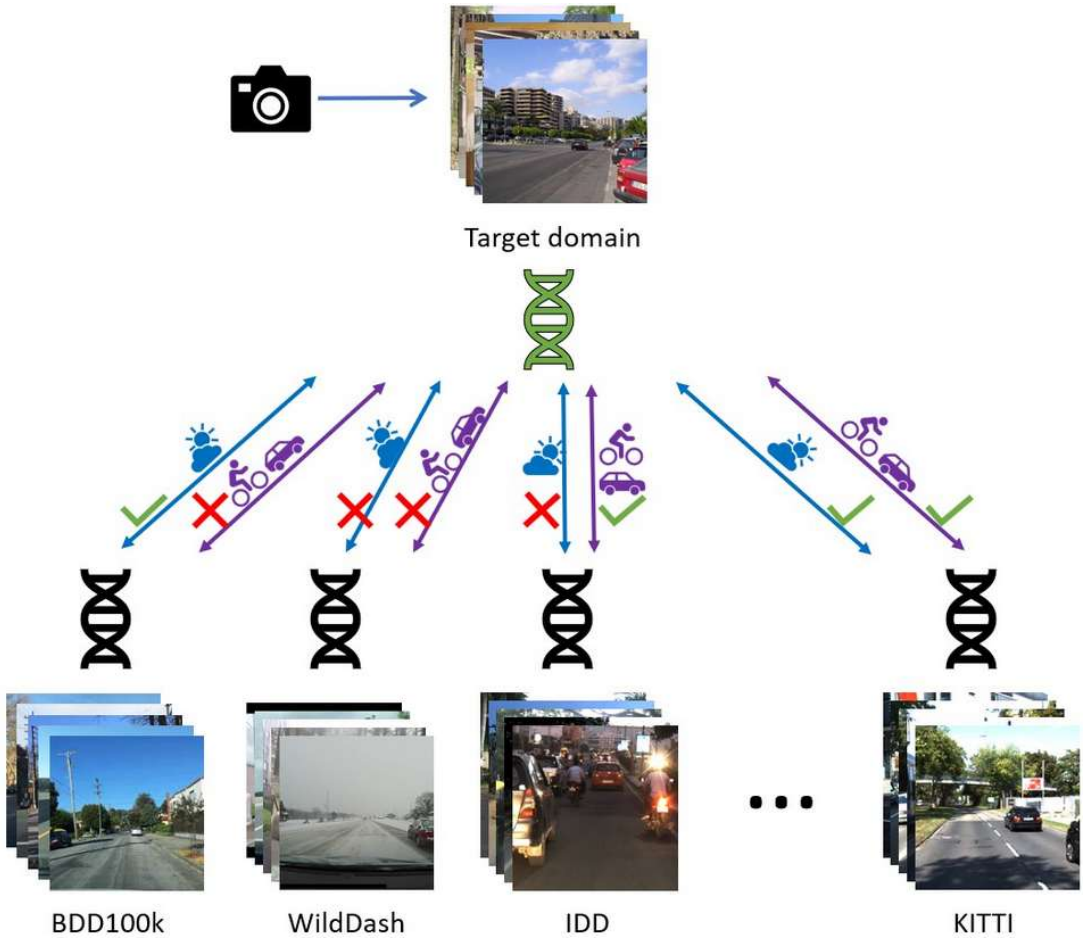




Measuring synthetic data

What tells us the scenes are realistic? And what does realistic even mean? Appearance, scenario? Both?

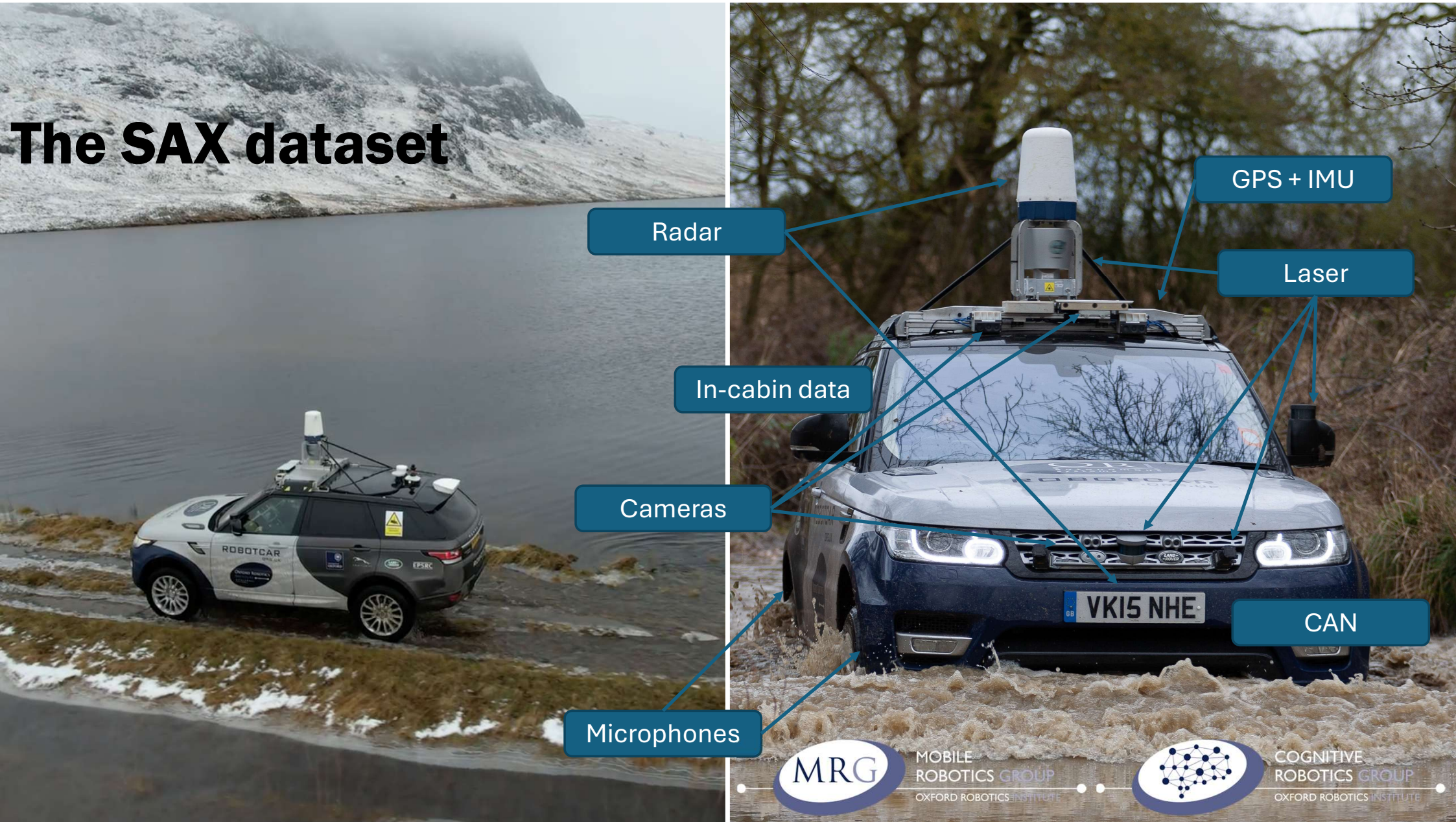
We tackle it as a difference measure between sets of data.



Data and deployment

But also, we want to see things working

The SAX dataset

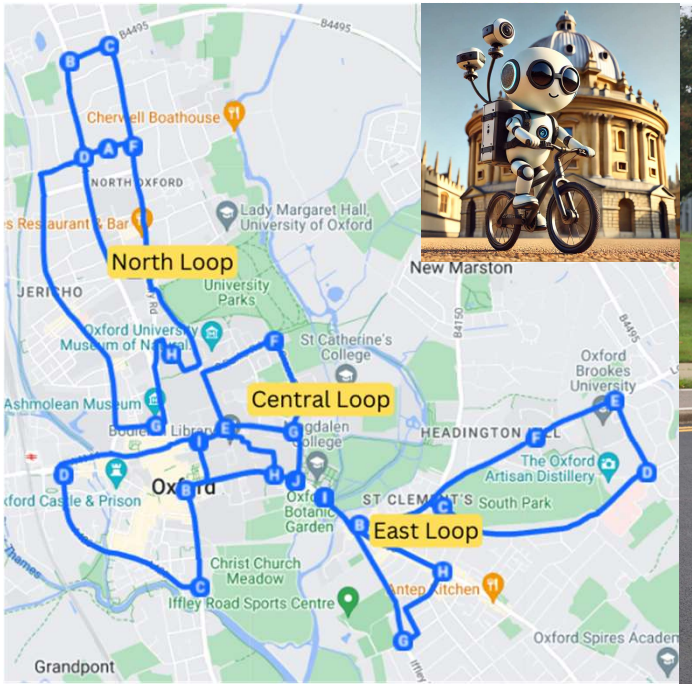


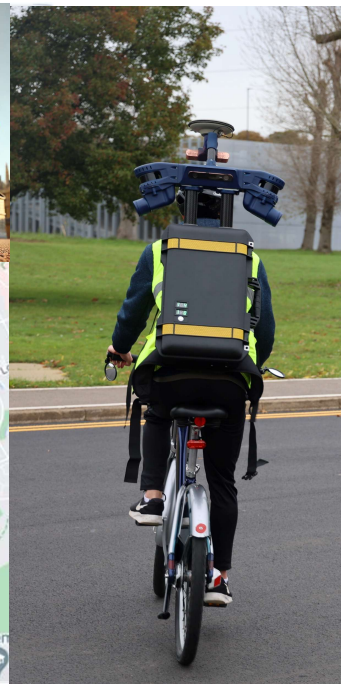
The SAX dataset

Other two deployment/datasets that will be available

Whytham Woods

RobotCycle





Thank you!

For further discussions, please contact me at daniele@robots.ox.ac.uk