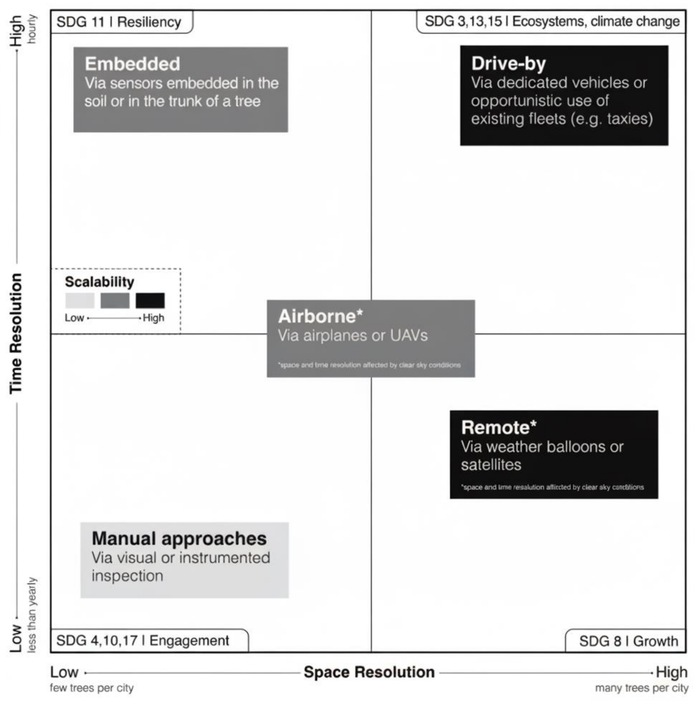
Gathering synchronized multispectral street-view imagery with opportunistic sensing to facilitate urban environmental insights

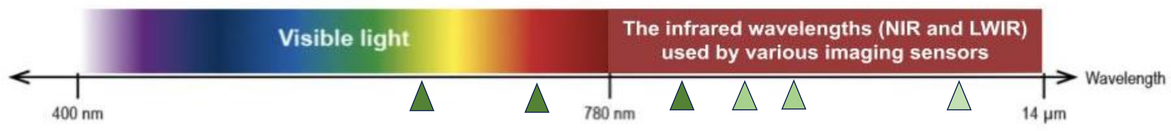
*Dataset Domain: Multispectral street-view imagery with very-high-resolution remote sensing for estimating the **health** of urban trees*

Ok, but why care about urban trees? Trees provide multiple ecosystem services, from regulating air temperatures to preventing surface run-off in events of heavy rainfall, while facing multiple stressors exacerbated by climate change.



Adapted from Tools and methods for monitoring the health of the urban greenery. Nature Sustainability (Gupta et al. (2024a))

- Current methods for monitoring **health** of urban trees are non-automated, costly and subjective. First step is visual tree assessment (VTA).
- Still, urban tree health data has both poor spatial and temporal resolutions (typically once every two years)
- Also, this is a problem domain where both top-view and street view from ground should be useful.
- Most street-view datasets are constrained with RGB channels whereas very-high-resolution satellites (30cm) like Pléiades NEO have many more channels.

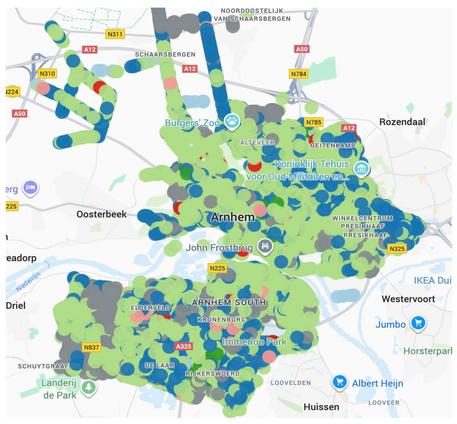


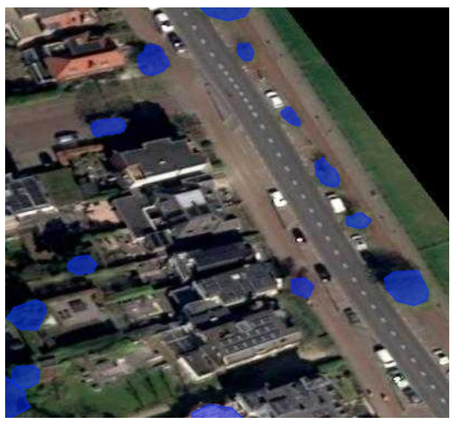
Spectral channels used in our methodology

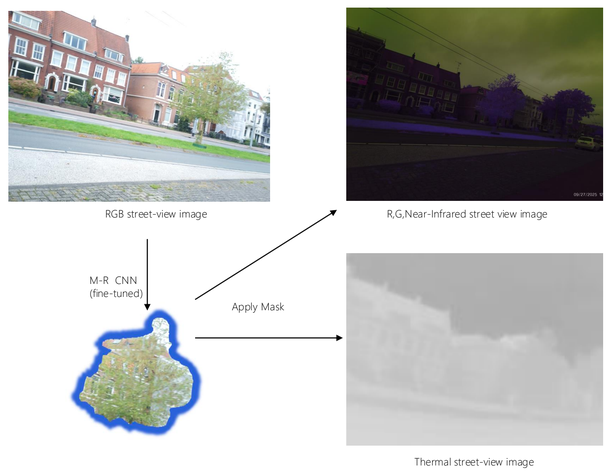
Methodology

Custom hardware | Segmentation | Opportunistic Sensing

1. Hardware with imaging sensors (on bike): RGB, Near Infrared, Thermal with GNSS.
2. Municipal inventory datasets with health and species (nested long-tail).
3. Pléiades NEO data from ESA, and YOLO V11 segment applied after fine-tuning.
4. Fine-tuned Mask-RCNN for extracting tree crown pixels from RGB and then applied to Near-Infrared and Thermal.







Dataset generated: Groups of thermal, optical and near-infrared, satellite images centered on a tree, masks and *labels* (tree health assessment by arborist and species), covering three cities in the Netherlands with different urban morphologies : Arnhem, Oirschot, Delft. Currently, we have 7608 synchronized street-view images.

Akshit Gupta, Joris Timmermans, Remko Uijlenhoet

Suggestions and collaborations welcome ☺. Reach out at: a.gupta-5@tudelft.nl

TU Delft