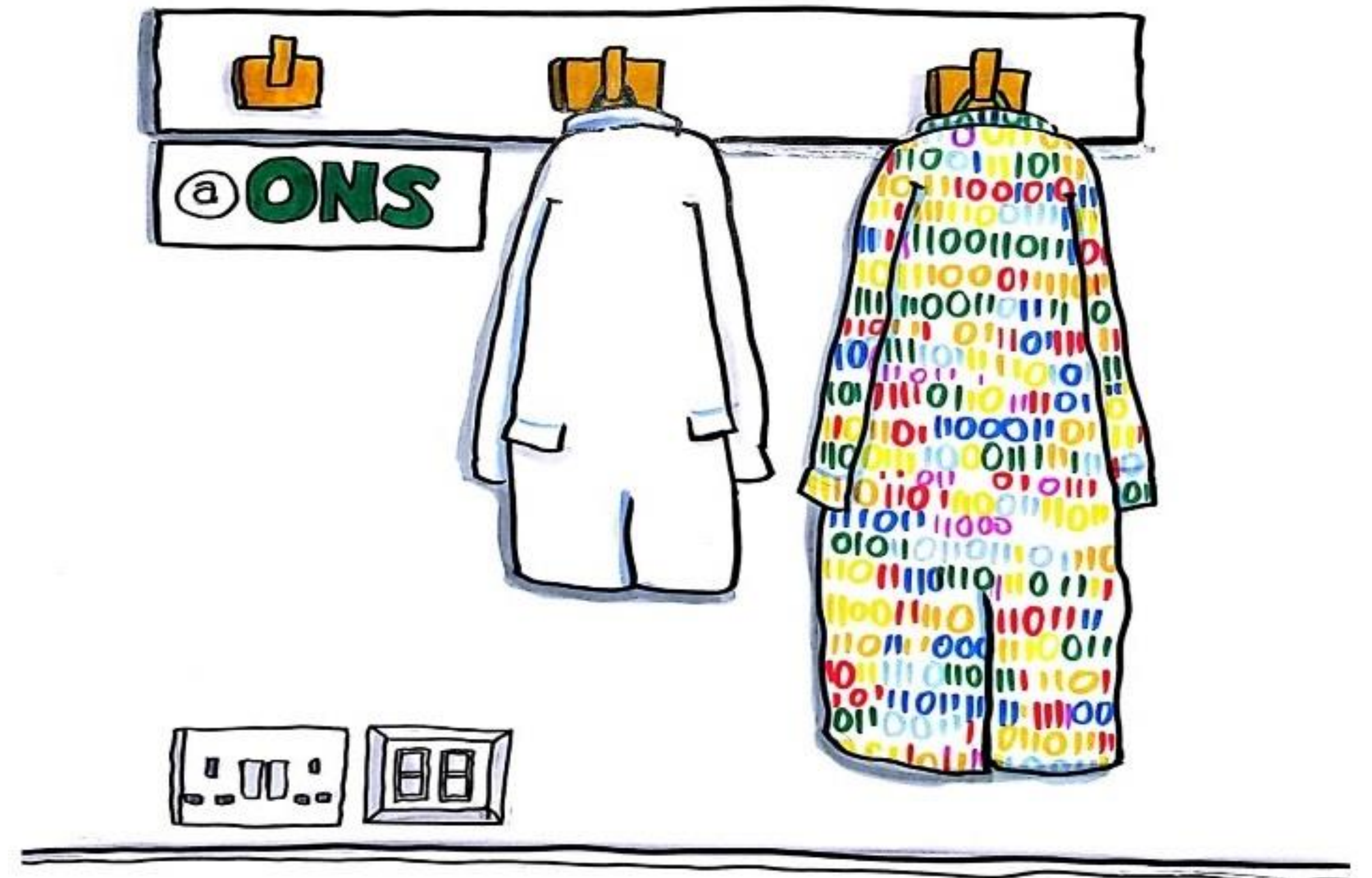# UK Data Science Campus
# Urban Forests, SDGs & UN Global Platform

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**Data Science Campus**

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In a recent study produced for the Office for National Statistics (ONS) Natural Capital Accounts, the UK's trees were estimated to remove 1.4 million tonnes of air pollutants in a single year. This would result in an annual saving of £1 billion in avoided health damage costs. In another study, London's 8.42 million trees have been estimated to remove 2,241 tonnes of pollution per year, which in addition to other services, is estimated to provide £132.7 million in annual benefits.

For Cardiff, the annual benefit is close to £8 million.

**Aim**: Generate a scalable, consistent, automated, **urban vegetation index**
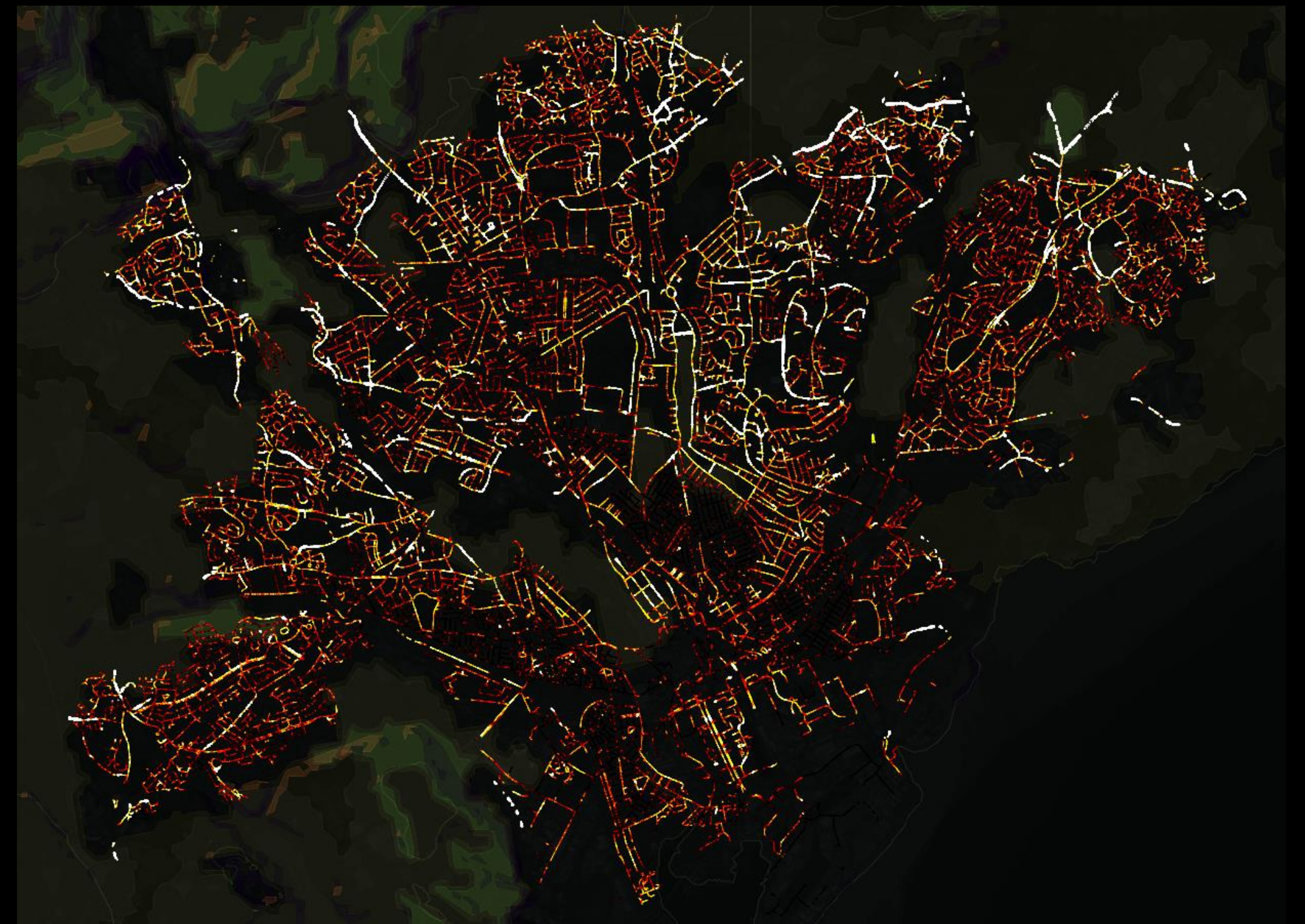
**Outcome**: An end-to-end processing pipeline.

Making use of: **17 million images** from **Google Street View** for 112 cities in the UK.

… **OpenStreetMap** road network data
… Deep **image segmentation** methods

# Current approach…

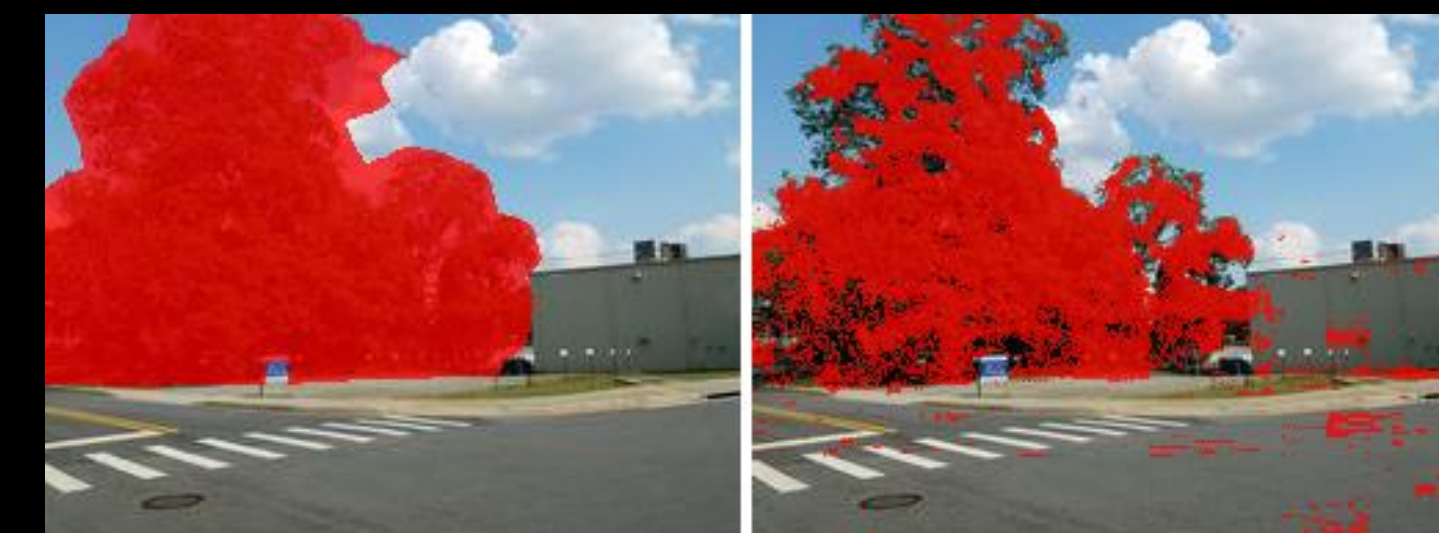… Pyramid Scene Parsing Network

Hengshuang Zhao, Jianping Shi, Xiaojuan Qi, Xiaogang Wang, Jiaya Jia.
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017.

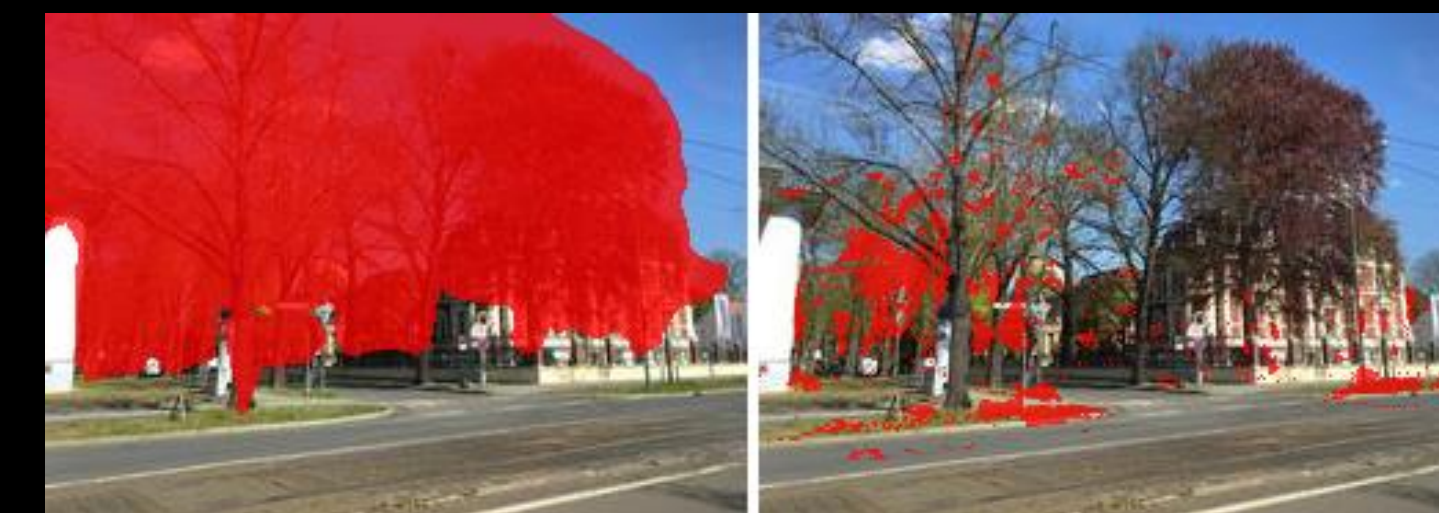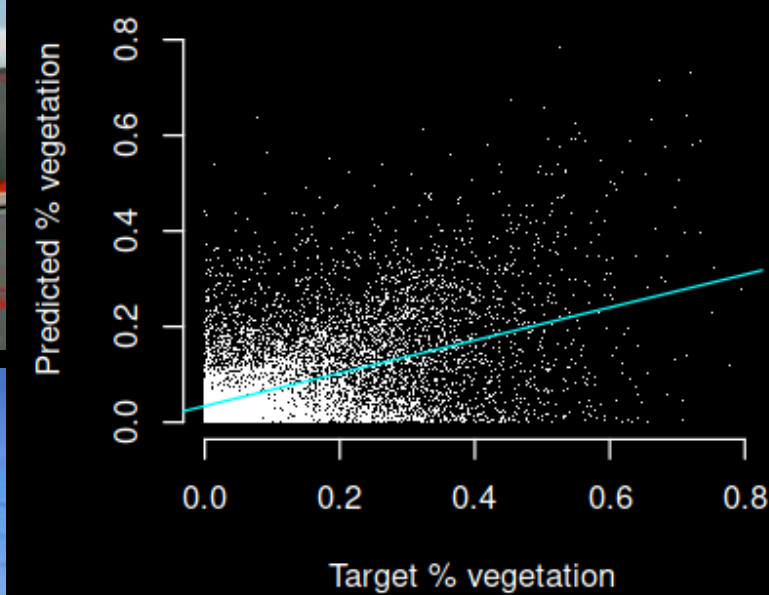| Model | BACC | Pre | Rec | F1 | MCC | $R^2$ | $\tau$ |
|---|---|---|---|---|---|---|---|
| PSPNet (city) | **0.90** | 0.66 | **0.87** | 0.75 | 0.72 | **0.83** | **0.77** |
| PSPNet (ade20k) | 0.85 | **0.82** | 0.73 | **0.77** | **0.74** | **0.83** | 0.76 |
| Random forest | 0.62 | 0.48 | 0.29 | 0.36 | 0.31 | 0.25 | 0.32 |
| Lab (a* b*) | 0.62 | 0.47 | 0.28 | 0.35 | 0.29 | 0.20 | 0.28 |
| Lab (a*) | 0.55 | 0.33 | 0.14 | 0.19 | 0.15 | 0.04 | 0.15 |

Images segmented by cars, buildings, path, people, **trees**.
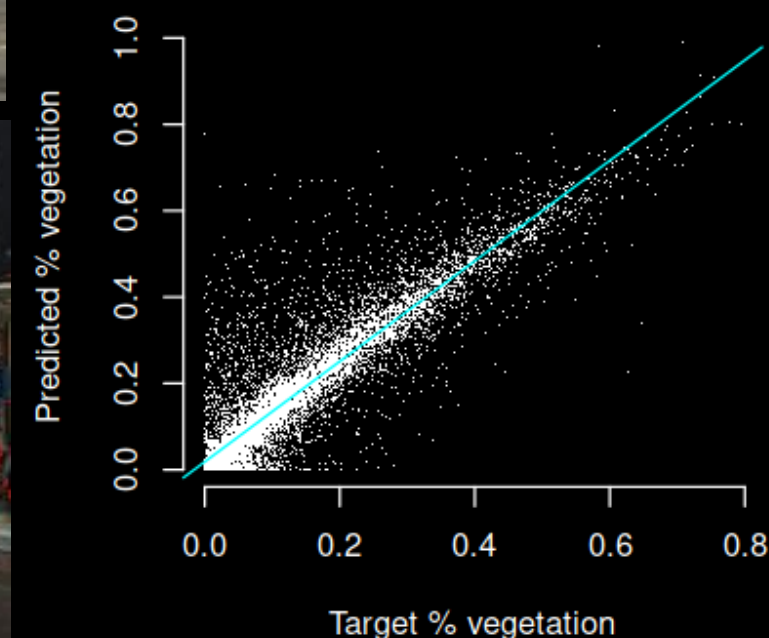
**90%** vs 62% class balanced accuracy.

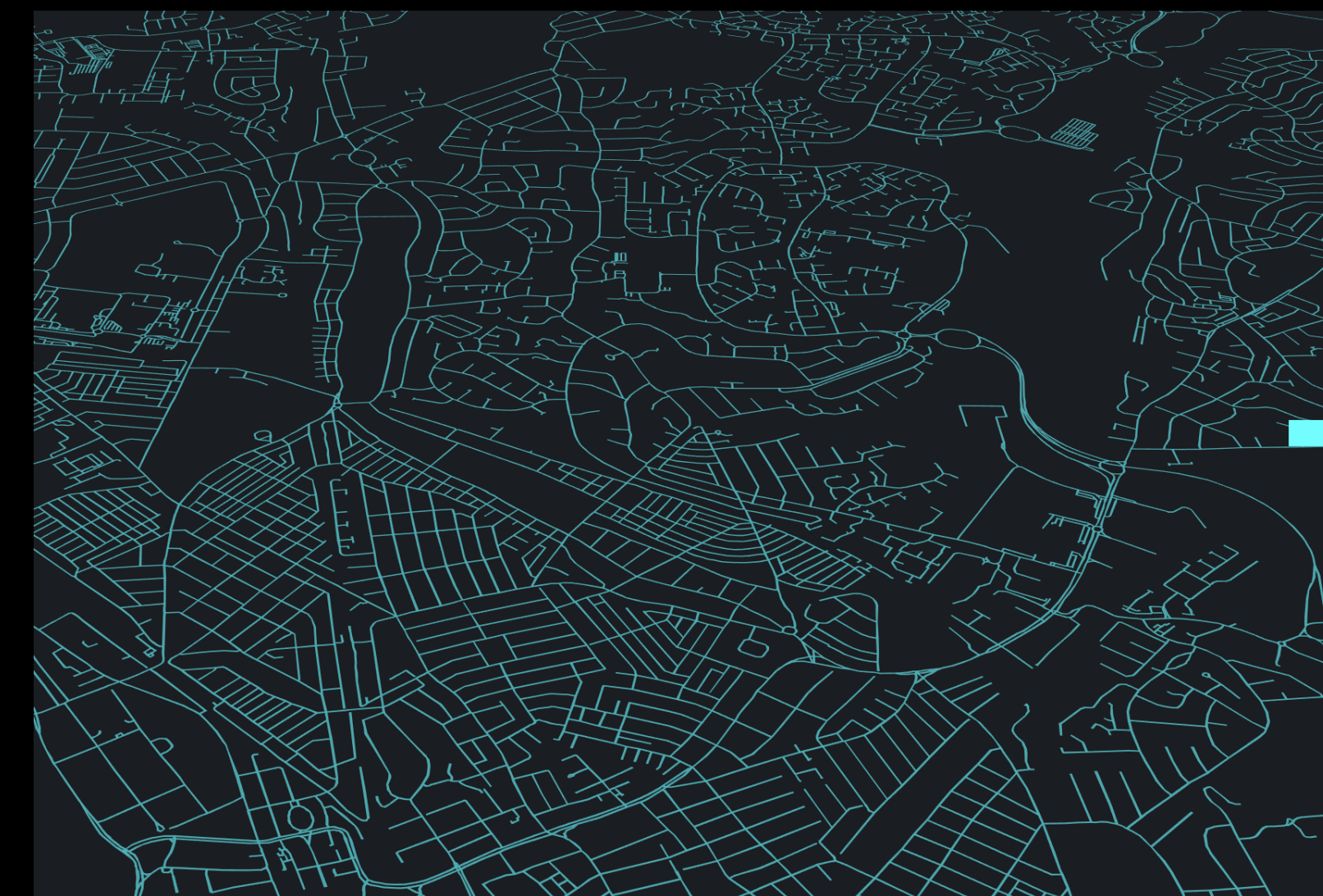Validated using the Mapillary Vistas Dataset for semantic understanding of street scenes. https://research.mapillary.com/

**Random forest**

Predicted % vegetation

Target % vegetation

**PSPNet Cityscapes**

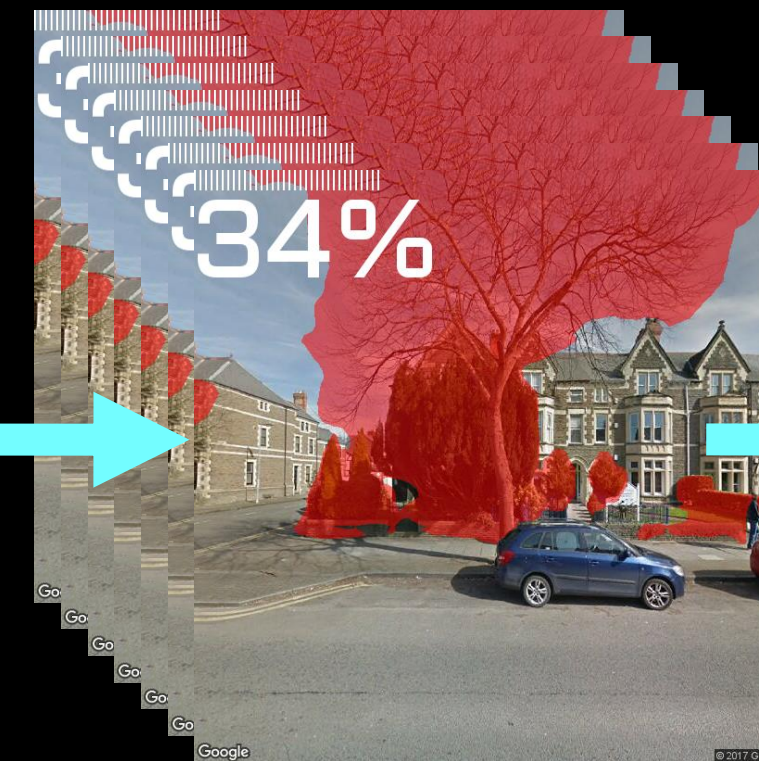Predicted % vegetation

Target % vegetation

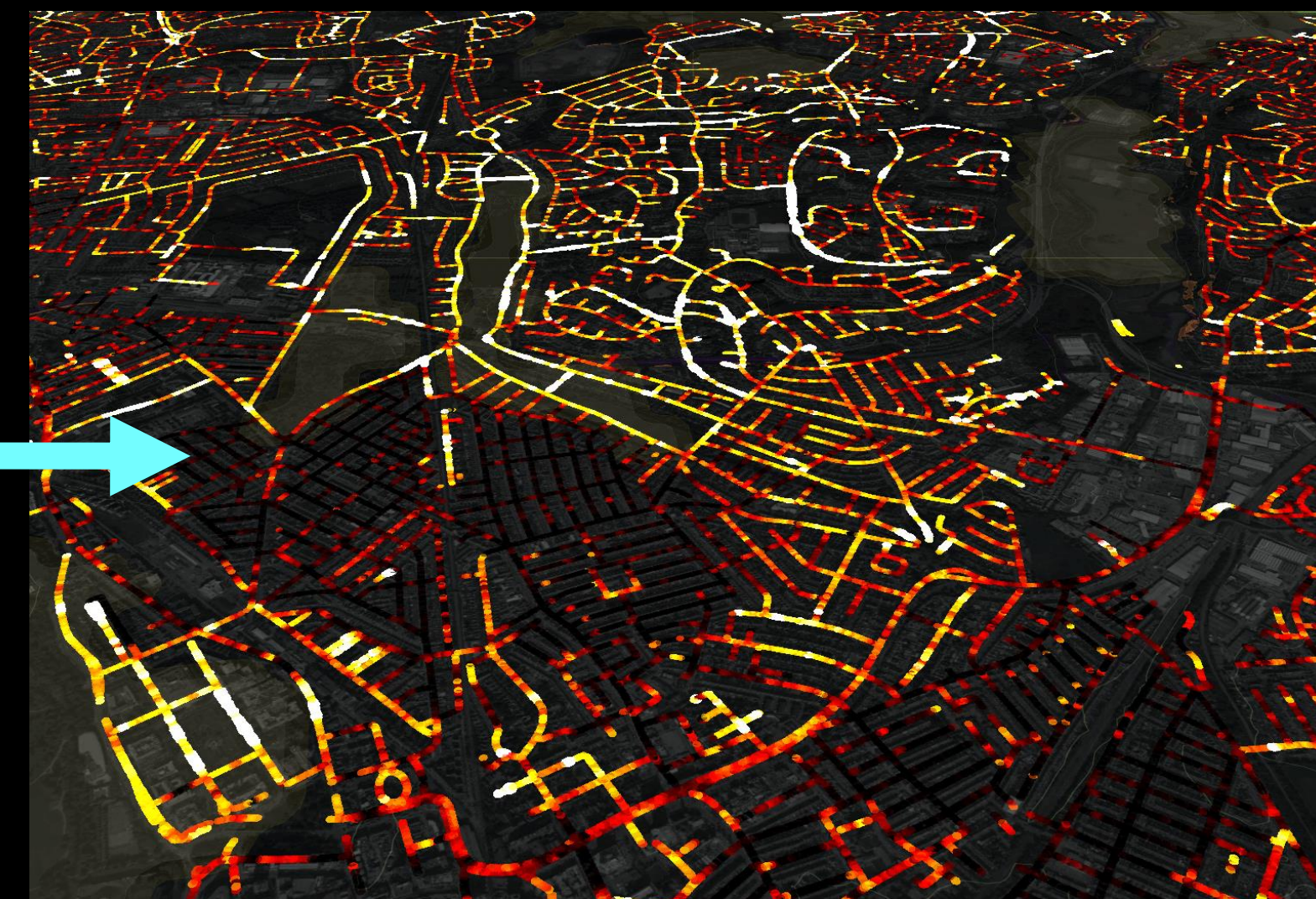# StreetView image processing pipeline

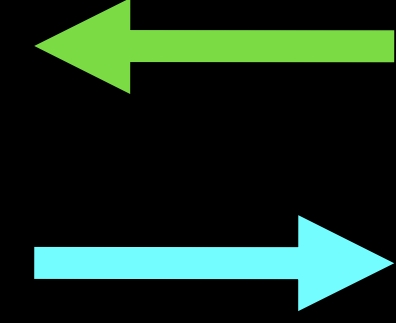OpenStreetMap road network data

17 million StreetView images

34%

Percentage trees for each image

Urban vegetation map

StreetView processing pipeline ← UNGP vegetation service ← UNGP segmentation service

StreetView image

Detected trees

34%
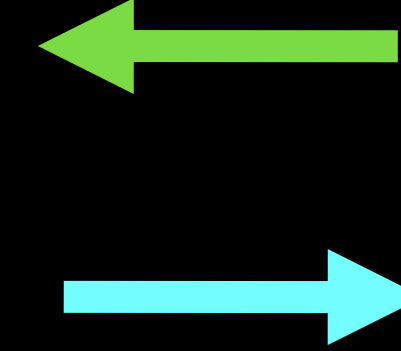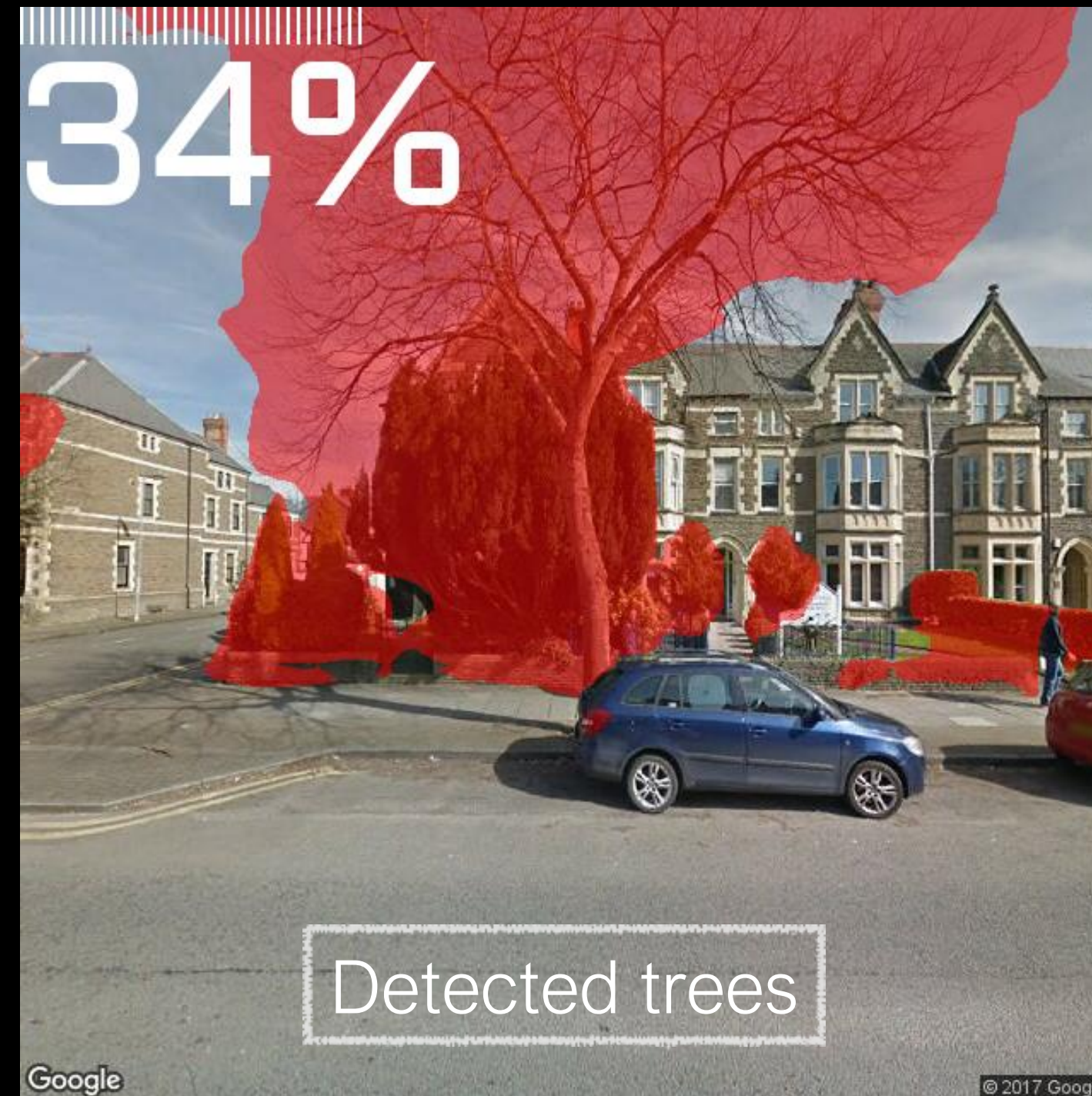
Segmented image

1. Image processing pipeline pushes image to vegetation service
2. Vegetation service pushes image to Segmentation service
3. Vegetation service returns percentage trees in segmented image.
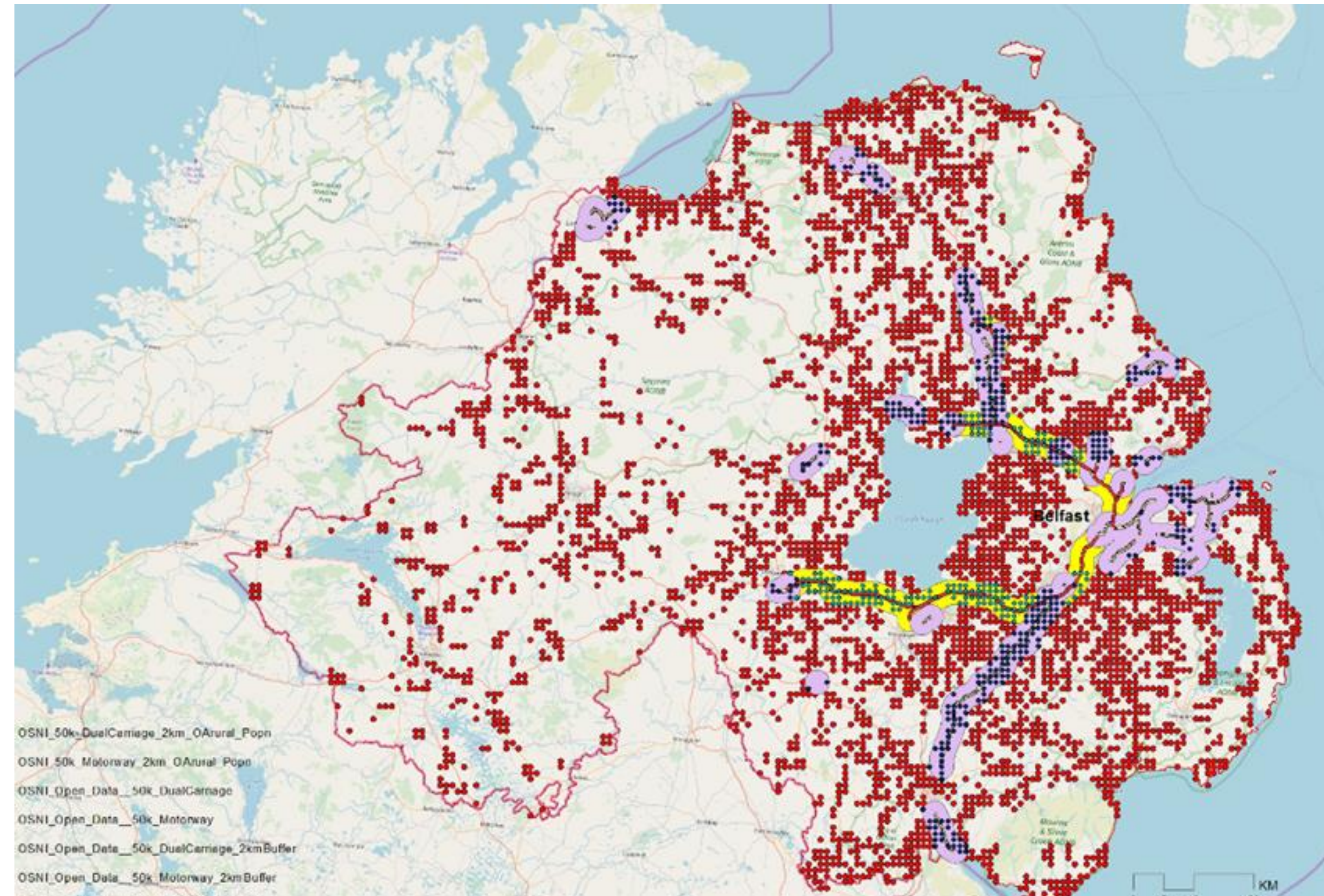
# Access to an all-season road – towards a global dataset

**SDG Indicator 9.1.1**
**Proportion of rural population who live within 2 km of an all-season road**

ONS team (Data Science Campus, UN Global Platform, ONS Geography, SDG team)

Producing example global indicator for 9.1.1:

- **Roads data**: Global coverage road network from Open Street Map (OSM) and Global Roads Inventory Project
- **Population data**: Gridded Population of the World (at 1km resolution) and WorldPop (at 100m resolution for some areas)
- **Methodology**: Derived from UK and Colombian Statistics Agency, made available
- **UN Global Platform**: Algorithms and dataviz for users to run methods against any data source



OSNI_50k_DualCarriage_2km_OArural_Popn
OSNI_50k_Motorway_2km_OArural_Popn
OSNI_Open_Data__50k_DualCarriage
OSNI_Open_Data__50k_Motorway
OSNI_Open_Data__50k_DualCarriage_2kmBuffer
OSNI_Open_Data__50k_Motorway_2kmBuffer

Northern Ireland Census 2011 population within 2km of dual carriageway

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