UK Data Science Campus

Urban Forests, SDGs & UN Global Platform

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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.

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

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/](https://research.mapillary.com/)
StreetView image processing pipeline

- OpenStreetMap road network data
- 17 million StreetView images
- Percentage trees for each image
- Urban vegetation map
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

Northern Ireland Census 2011 population within 2km of dual carriageway
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