

### Potential for use of satellites for AQ work ....counting cars from space

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#### SAQN+ Launch Event 14-15 Jan 2020

MRC Centre for Environment & Health



www.environment-health.ac.uk

#### **Emission Inventories**



# **Emission Inventory**

#### **Vehicle Count**



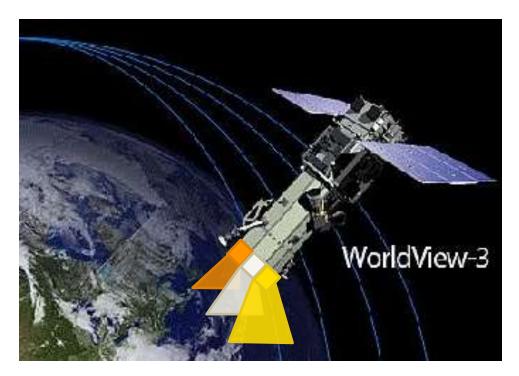
Automatic Traffic Counters

# Can we identify vehicle using high-resolution satellite imagery?

Specification	World View-2	World View-3
Launch date	8 <sup>th</sup> October 2009	13 <sup>th</sup> August 2014
Spatial and Temporal Resolution	MS Bands: 1.85m, PAN band: 0.46m; Global coverage every 1.1 days	MS Bands: 1.24m, PAN band: 0.31m; Global Coverage Daily.
Sensor bands	Panchromatic; <b>8 Multispectral bands</b> : Blue, Green, Red, Near-IR1, Coastal Blue, Yellow, Red Edge, Near-IR2	Panchromatic; <b>8 Multispectral bands</b> : Blue, Green, Red, Near-IR1, Coastal Blue, Yellow, Red Edge, Near- IR2; 8 SWIR bands; 12 CAVIS bands.
Swath Width at Nadir	16.4km	13.1km

#### **World View Satellites**

• WV-2/-3 satellite imagery has a 0.26 second gap between the multi-spectral (MS) sensors, can this be exploited to estimate **vehicle speed?** 



Layout of Multispectral 1 sensor (Yellow), Panchromatic sensor (Grey) and Multispectral 2 sensor (Orange) onboard the WV-3 (and 2) satellites (ESA, 2019, image manipulated by Author).

## Vehicle identification using 'deep learning' algorithm



Type of Road/ Movement	%
Movement Major	56% (18/32)
Movement Minor	17% (3/18)
Static Major	43% (3/7)
Static Minor	22% (2/9)
Other Vehicles	18% (31/168)



- Static Major
- Other Vehicles
- Movement Major
- Static Minor
- Movement Minor
- QA Areas
- YOLO\_16AUG09111351\_T12
- TQ\_RoadLink
- 25 0 25 50 75 100 m

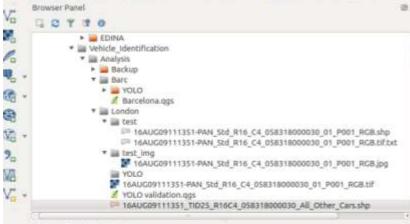
Xview-YOLOv3 algorithm classification of WV2/3 imagery over London on the 16<sup>th</sup> August 2009. Satellite image ©2019 Maxar Technologies.

### **Challenges 1 – what objects are cars?**

#### Project Edit View Layer Settings Plugins Vector Baster Database Web Processing Help

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Advanced Digitizing Panel

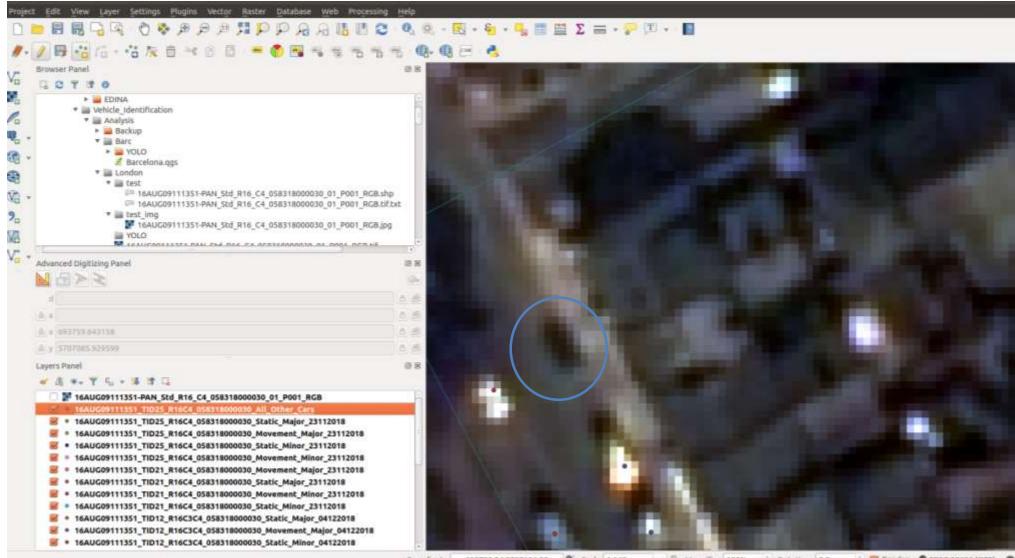
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Layers Panel \* 出来, 下ん, ままは 16AUG09111351-PAN\_Std\_R16\_C4\_058318000030\_01\_P001\_RGB # 1EAUG09111351 TID25 #16C4 058318000030 All Other Ca # 16AUG09111351\_TID25\_R16C4\_058318000030\_Static\_Major\_23112018 I6AUG09111351 TID25 R16C4 058318000030 Movement Major 23112018 I6AUG09111351 TID25 R16C4 058318000030 Static Minor 23112018 16AUG09111351\_TID25\_R16C4\_058318000030\_Movement\_Minor\_23112018 8 • 16AUG09111351\_TID21\_R16C4\_058318000030\_Movement\_Major\_23112018 I6AUG09111351\_TID21\_R16C4\_058318000030\_Static\_Major\_23112018 I6AUG09111351\_TID21\_R16C4\_058318000030\_Movement\_Minor\_23112018 16AUG09111351\_TID21\_R16C4\_058318000030\_Static\_Minor\_23112018 I6AUG09111351\_TID12\_R16C3C4\_058318000030\_Static\_Major\_04122018 I6AUG09111351 TID12 R16C3C4 058318000030 Movement Major 04122018 I6AUG09111351 TID12 R16C3C4 058318000030 Static Minor 04122018 I6AUG09111351 TID12 R16C3C4 058318000030 Movement Minor 04122018 20m GridCells QA 32631 



Xview-YOLOv3 algorithm classification of WV2/3 imagery over London on the 16<sup>th</sup> August 2009. Satellite image ©2019 Maxar Technologies.

#### **Black car or shadow?...**



Xview-YOLOv3 algorithm classification of WV2/3 imagery over London on the 16<sup>th</sup> August 2009. Satellite image ©2019 Maxar Technologies.

Coardinate 693739.34,5707126.98 😵 Scale 1:143 🔹 🖬 Magnifier 100% 📜 Rotation 0.0 📜 🖉 Render 👁 EPSC.32630 (OTF) 🗨

## Summary

- Preliminary work ability to identify objects such as cars from satellite imagery
- Can we identify other objects where we have gaps in the emission inventories?
- Are there other sources of data with either higher or lower resolution that can be used?