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

David Green, Sean Beevers, Annalisa Sheehan

SAQN+ Launch Event 14-15 Jan 2020

MRC
Centre for Environment & Health
MRC
Imperial College London
KING'S COLLEGE LONDON

www.environment-health.ac.uk

Emission Inventories

Emission Inventory

Vehicle Count

Au

- Point Locations
- Not every road
- 1, 2, 4 or 8 years
- What about other countries

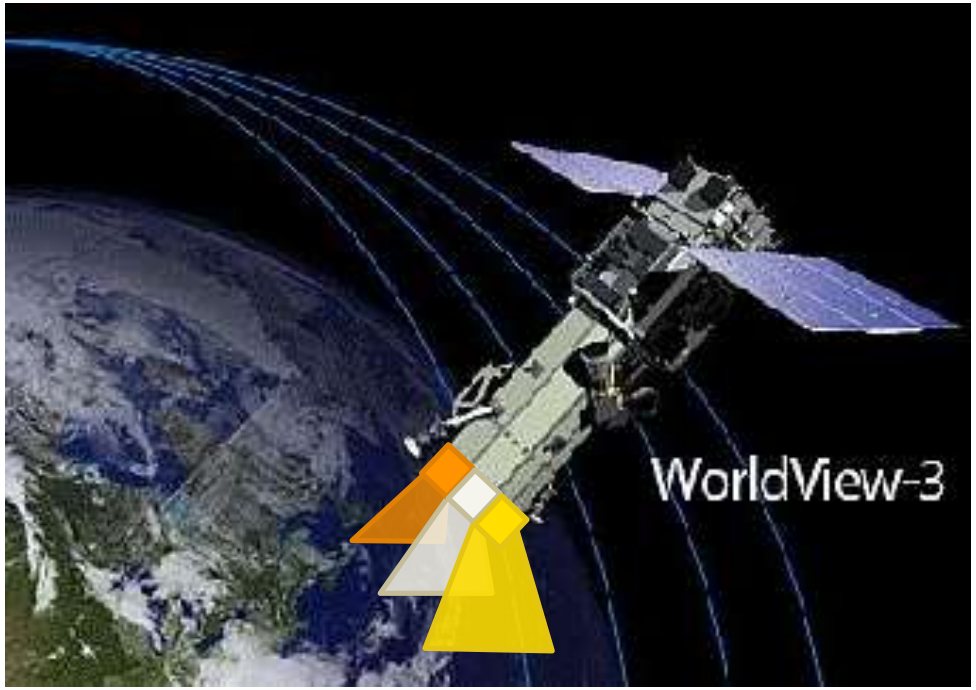
Automatic Traffic Counters

Can we identify vehicle using high-resolution satellite imagery?

Specification	World View-2	World View-3
Launch date	8th October 2009	13th 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; **8 Multispectral bands**: Blue, Green, Red, Near-IR1, Coastal Blue, Yellow, Red Edge, Near-IR2	Panchromatic; **8 Multispectral bands**: 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?**



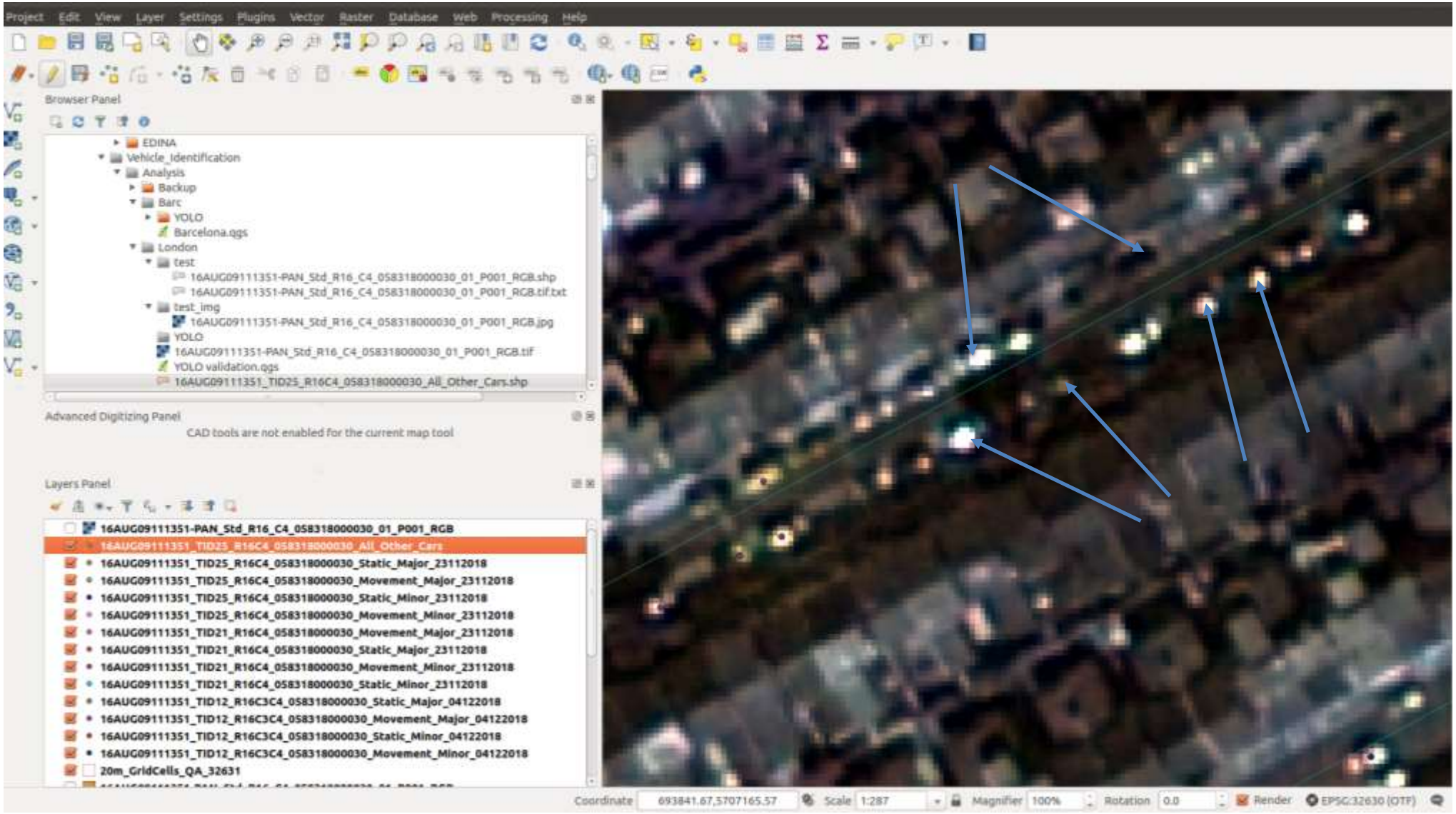
Layout of Multispectral 1 sensor (Yellow), Panchromatic sensor (Grey) and Multispectral 2 sensor (Orange) onboard the WV-3 (and 2) satellites (ESA, 2019 , image manipulated by Author).

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)

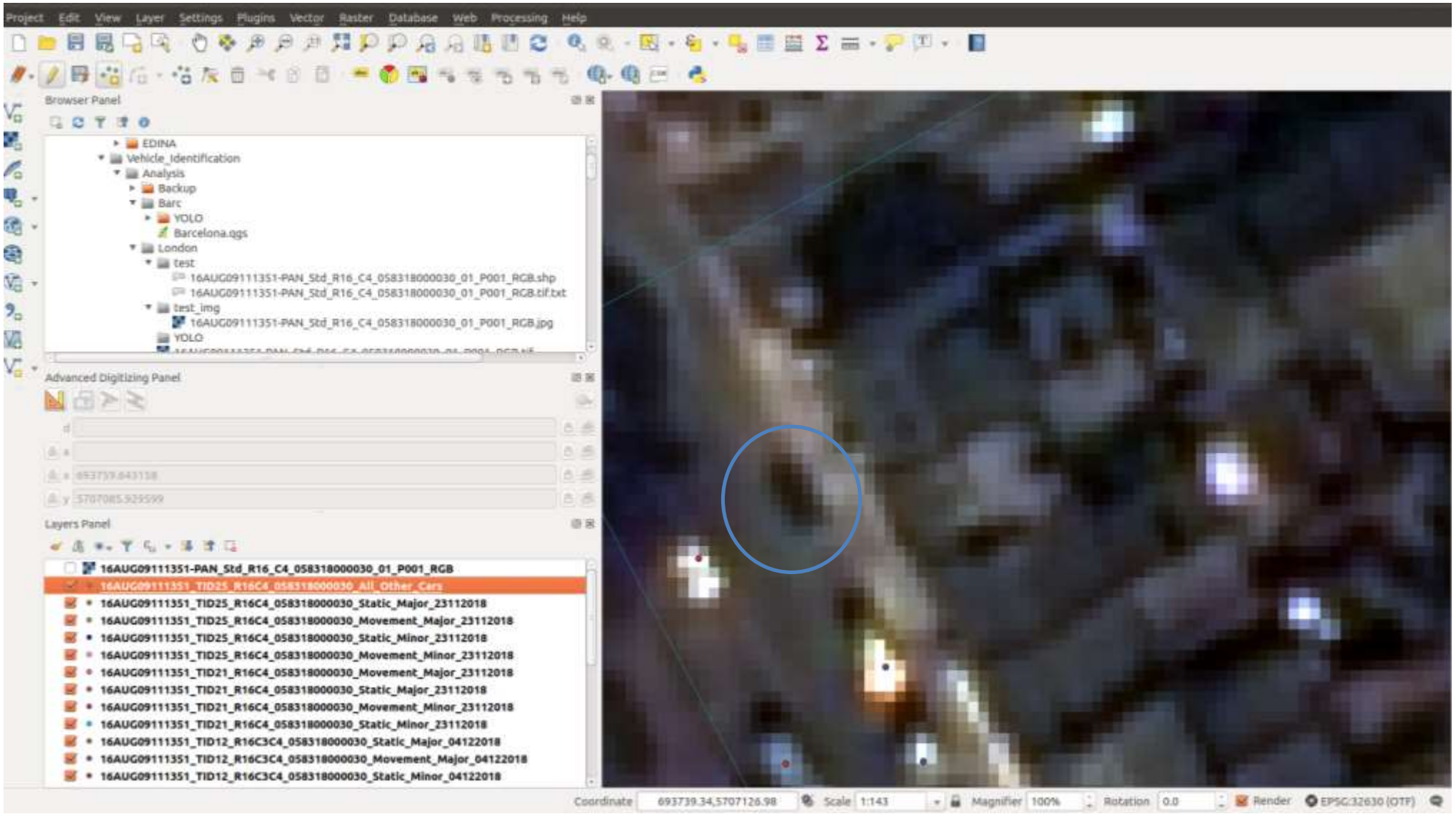
Xview-YOLOv3 algorithm classification of WV2/3 imagery over London on the 16th August 2009. Satellite image ©2019 Maxar Technologies.

Challenges 1 – what objects are cars?



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

Black car or shadow?...



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

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?