IRIX4US: Chaining AI models for a comprehensive change detection of building footprints from super-resolved Sentinel-2 images

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End-users' necessities

Urban planning and city governance require innovative solutions to face new urgent requirements and priorities.

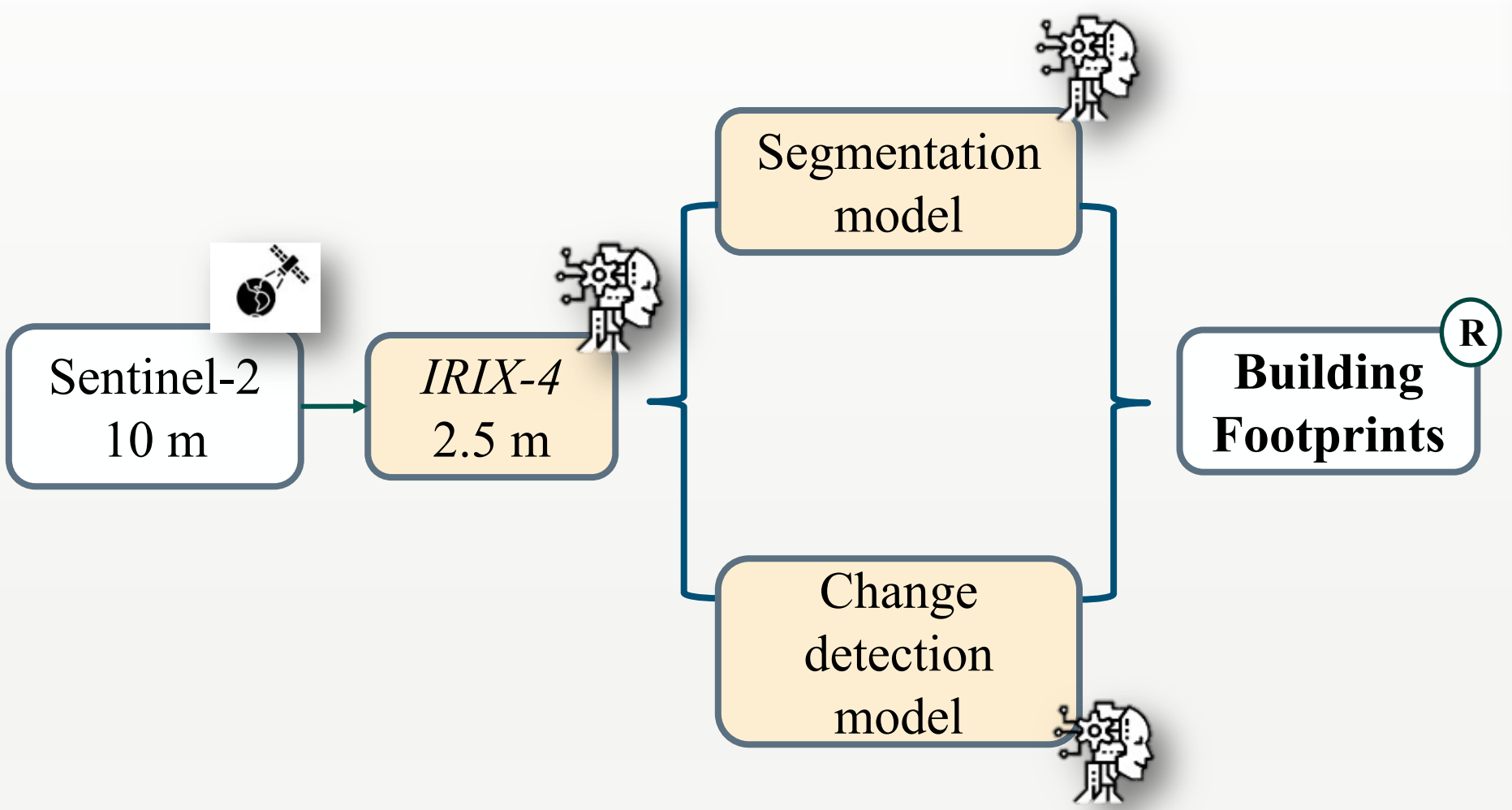
Some of this requirements are:

- Accurate building footprints.
- Recent data with constant updates.
- Detect changes to detect new buildings.

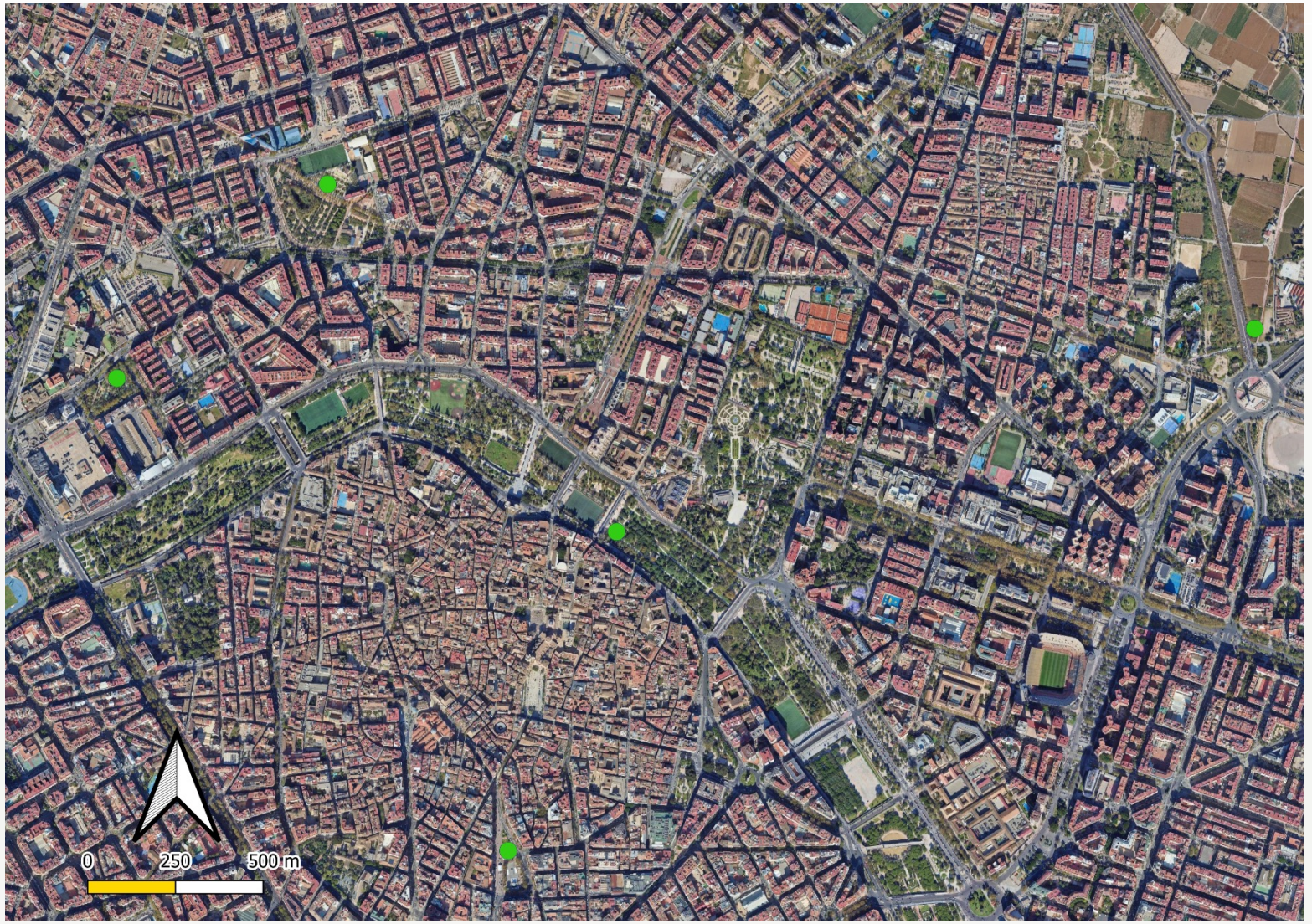
Limiting factors:

- Aerial imagery has VHR but low frequency and high costs.
- Commercial images require high economic investment.
- Publicly available satellite imagery does not have sufficient resolution.
- Visual identification and delineation of building footprints is time consuming.
- Change detection is even more complicated.

Solution developed IRIX4US



IRIX-4 on dense urban landscape



Google satellite

IRIX-4 on dense urban landscape

Sentinel-2

10 m

RGB

- Build areas
- Wide avenues
- Green areas
- Agricultural parcels

IRIX-4 on dense urban landscape

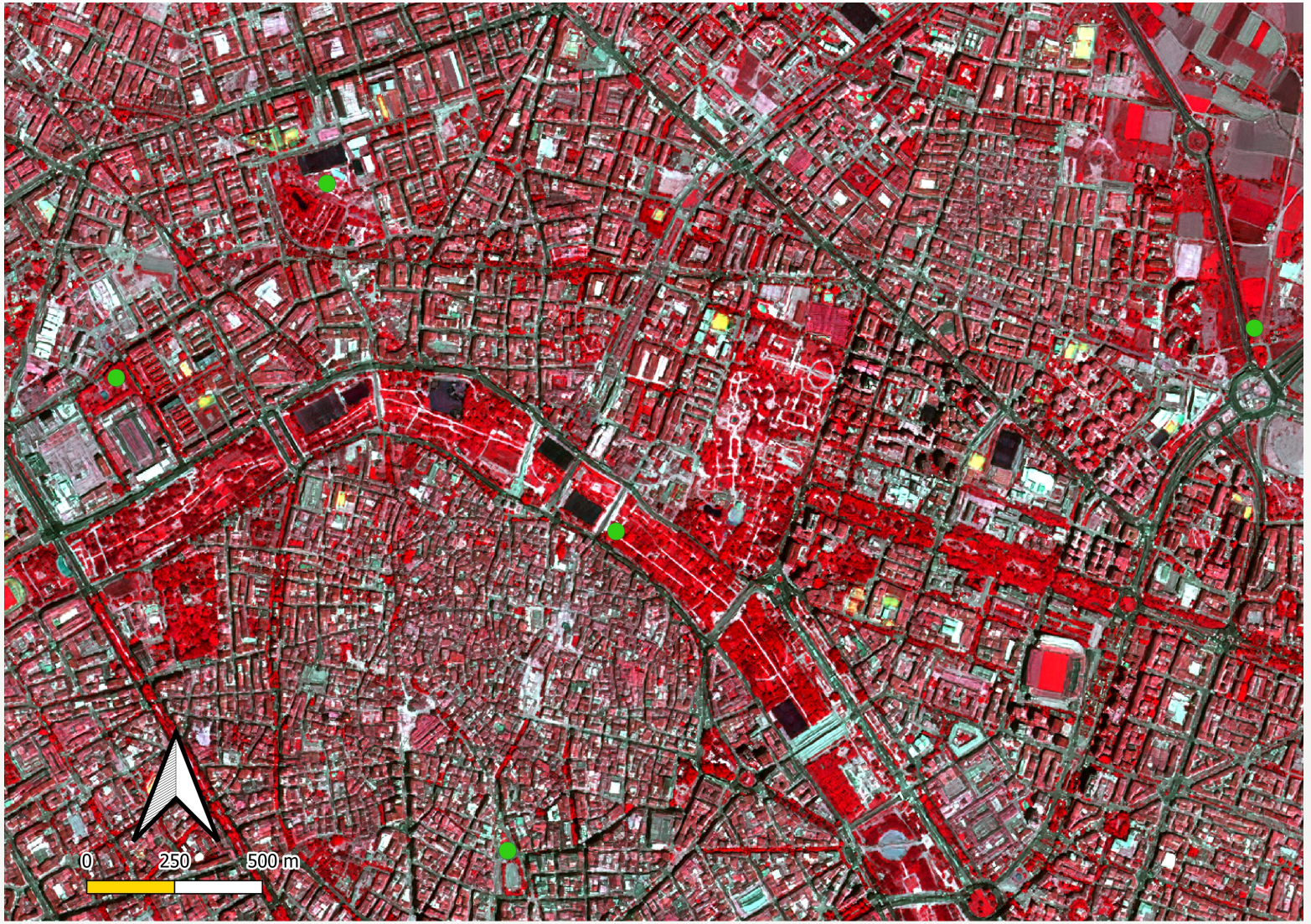
IRIX-4

2.5 m

RGB

- Sharp edges
- Individual buildings
- Vegetation and water bodies
- Agricultural parcels

IRIX-4 on mixed-urban landscape**********



IRIX-4 NIR

2.5 m

False Colour

- Sharp edges
- Individual buildings
- Vegetation and water bodies (enhanced)
- Agricultural parcels

IRIX-4 on mixed-urban landscape

Google satellite

IRIX-4 on mixed-urban landscape

Sentinel-2

10 m

RGB

- Build areas
- Wide streets
- Vegetation
- Agricultural parcels

IRIX-4 on mixed-urban landscape

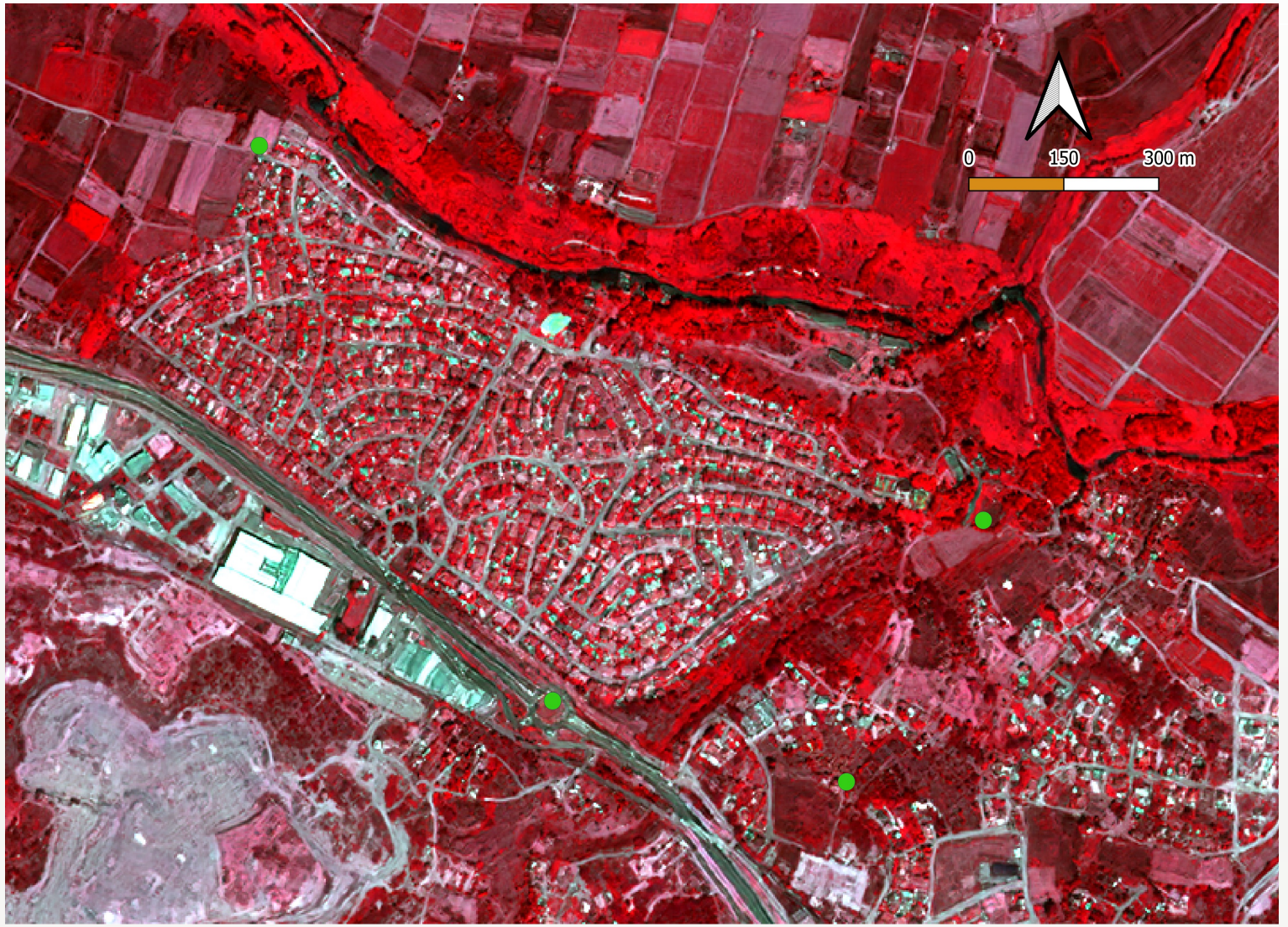
IRIX-4

2.5 m

RGB

- Individual buildings
- All streets
- Vegetation
- Differentiated crops

IRIX-4 on mixed-urban landscape



IRIX-4 NIR

2.5 m

False Colour

- Water stream
- Vegetation
- Differences in agricultural parcels

Building identification

Sentinel-2

10 m

- Big construction areas
- No separation between buildings

Building identification

IRIX4

2.5 m

- Sharper edges.
- Increased detection.
- Individual buildings.
- Smaller buildings.

Building identification

Building footprints

IRIX-4
Segmentation on 2.5 m

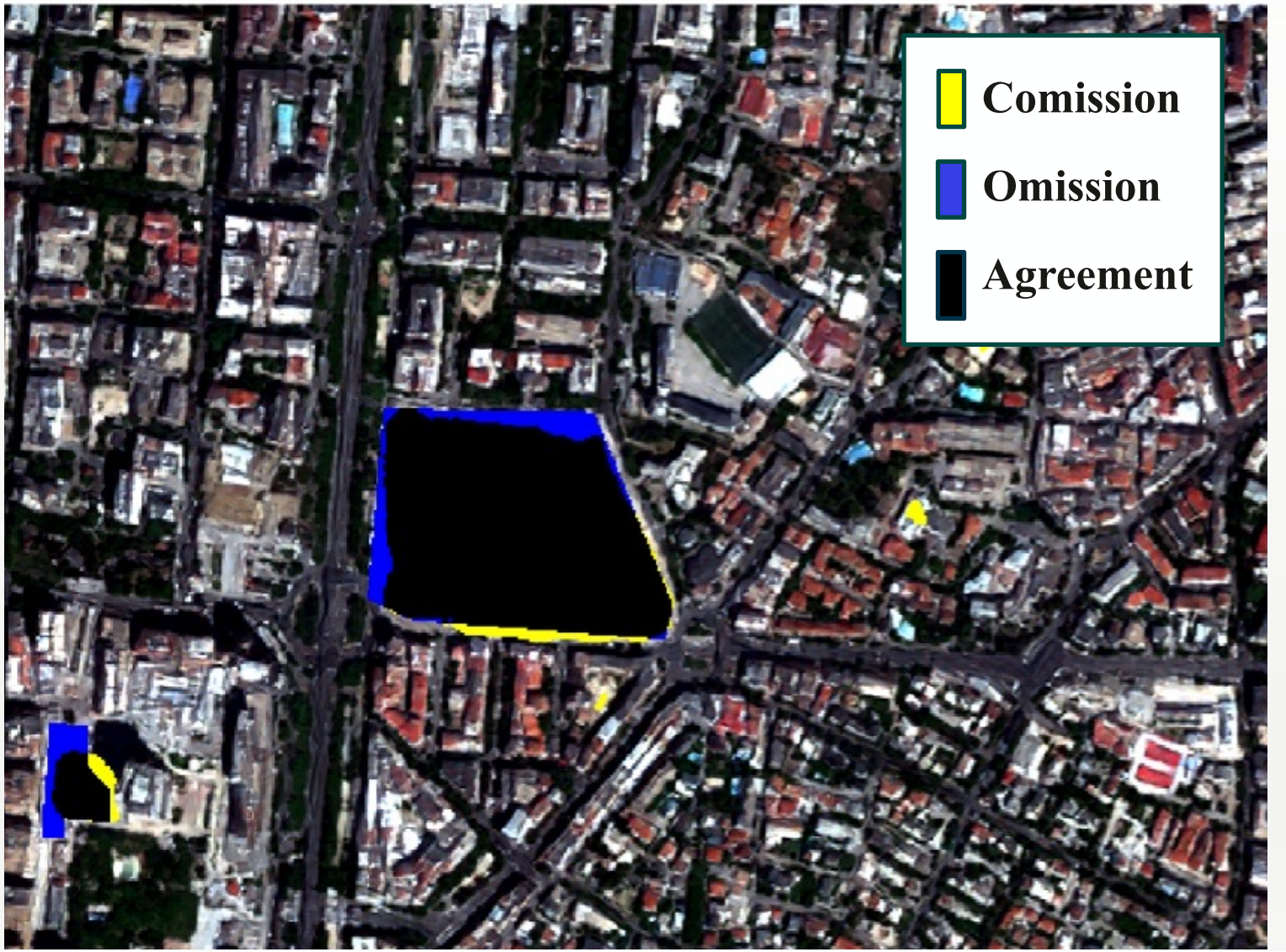
Metrics of segmentation

Results and comparisons

Output Metric	Sentinel-2 native	IRIX4US
Intersect over Union	53%	63%
Building identification accuracy	57%	78%
Precision	59%	72%
Recall	59%	73%

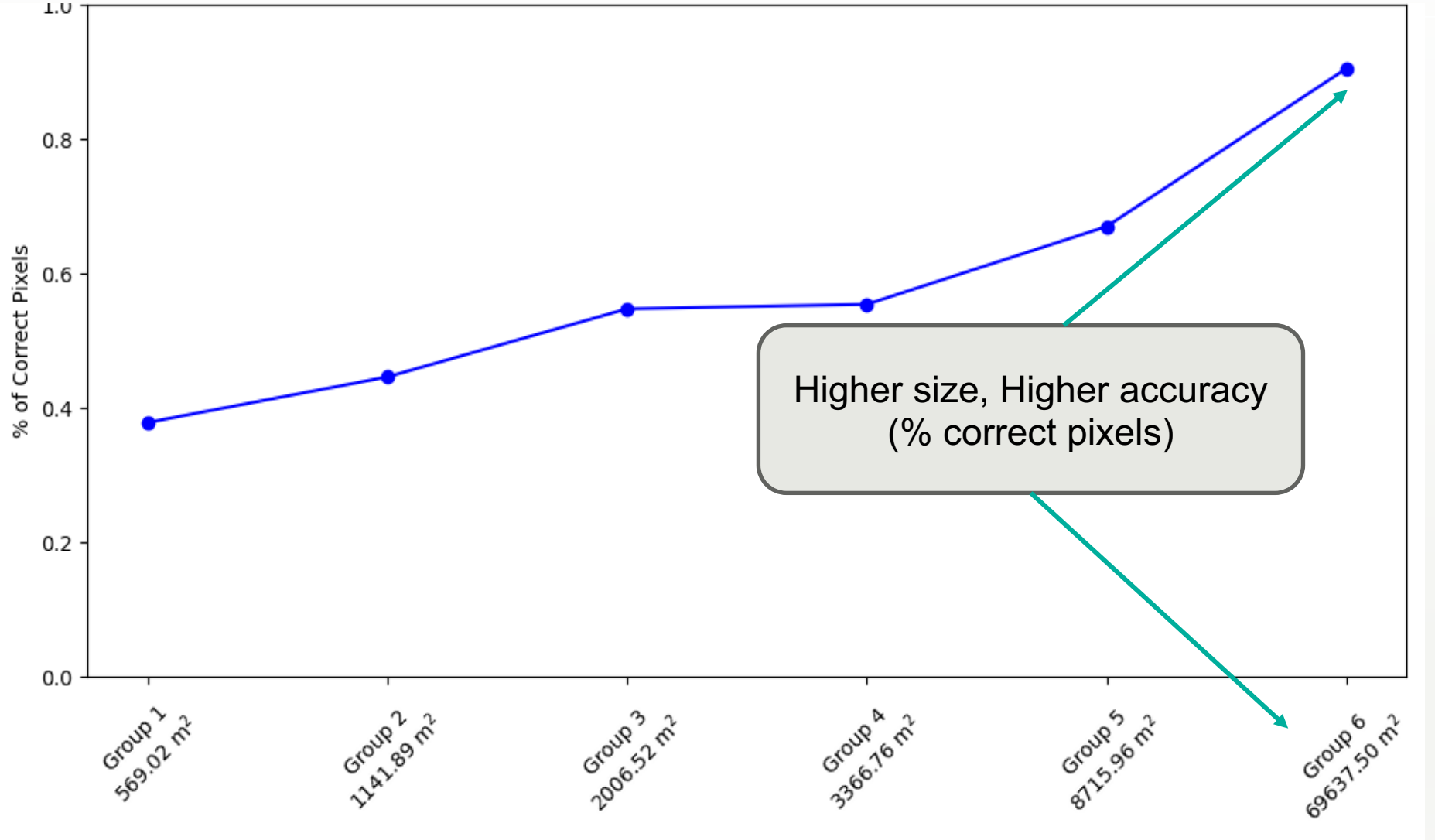
Metrics calculated in number of pixels

Change detection



Change detection metrics

Building identification accuracy: 64%
Comission: 3,5%



Conclusions

- **Super resolved images** allows us to identify of buildings of **smaller size** reducing omission errors.

- Automating the change detection on super resolved images identifies **changes on the areas in a reduced time for urban planners**

- The resulting building footprints are accurate enough to become a **valuable tool** for the **involved stakeholders.**

Next steps

- **Add more bands** to the super resolution algorithm.

- **Refine** and improve the **training datasets**, to reduce the commission and omission errors

- **Increase the variability of the training datasets** to include new shapes of buildings and extend the capabilities to other areas of the world.

- Improve the change detection algorithm.

Q&A

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