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Use of satellite imagery and deep learning algorithms for population census in the overseas departments

Clément Guillo, French national Institue of Statistics (INSEE)

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Two **use cases** we want to address:

- **Credibility** of INSEE figures in overseas departments. French Guiana: M.P. Pastor believes INSEE underestimates the population size.

- Comprehensive **census** in Mayotte in 2014 was very costly, leading to a switch to a sample-based estimated census. The first results will be released in December 2025.

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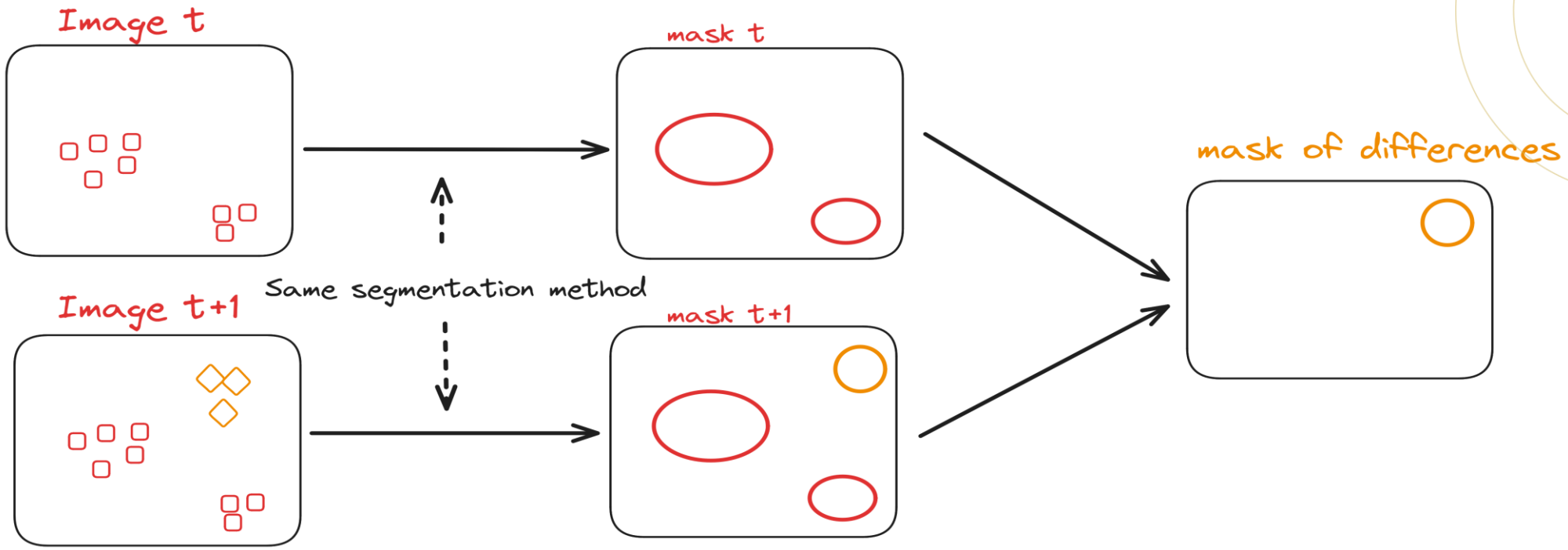
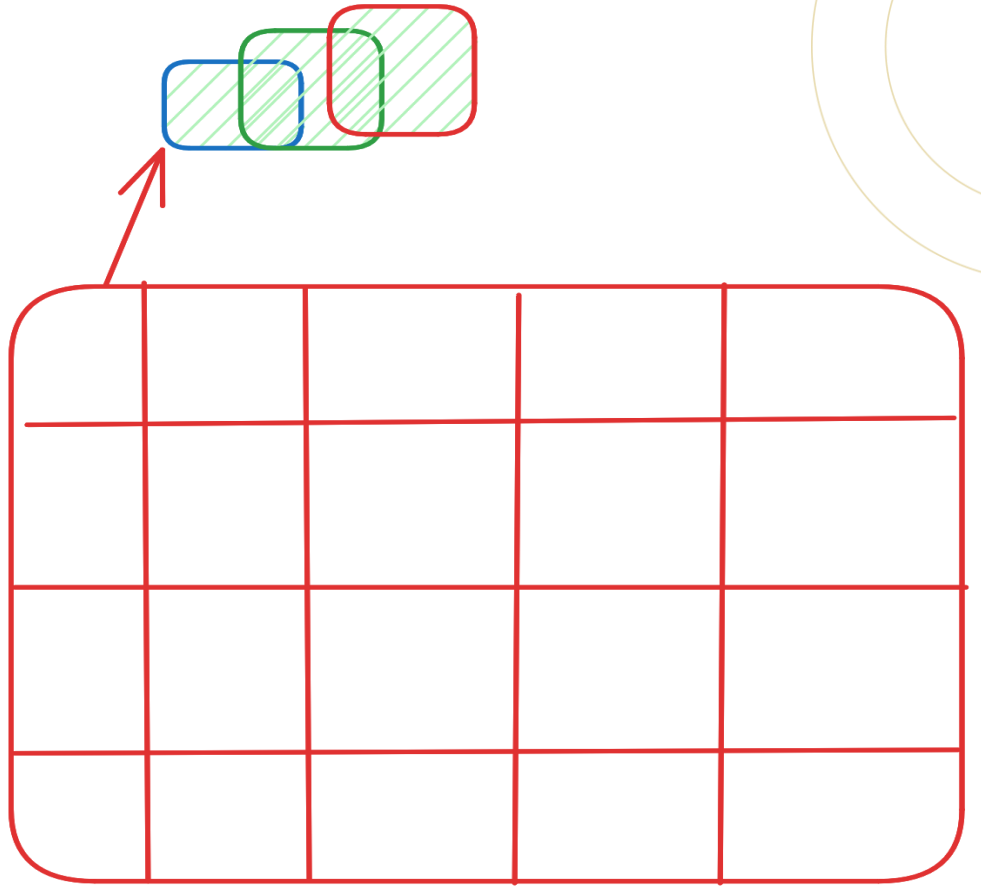


Segmentation strategy

Images

- **Spatial resolution:** equivalence between pixel and surface.
-
- **Temporal resolution:** how many pictures of the same territory you can obtain in one month?



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- **Annotations** coming from the topographic database of the French National Geographic Institute.
- Building outlines in **polygon** form. Mismatch between the images and the topographic database, no synchronization.

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Training parameters

- Training on a segmentation model like SegFormer
- Training dataset: Martinique and Guadeloupe 2022
- Test on Mayotte

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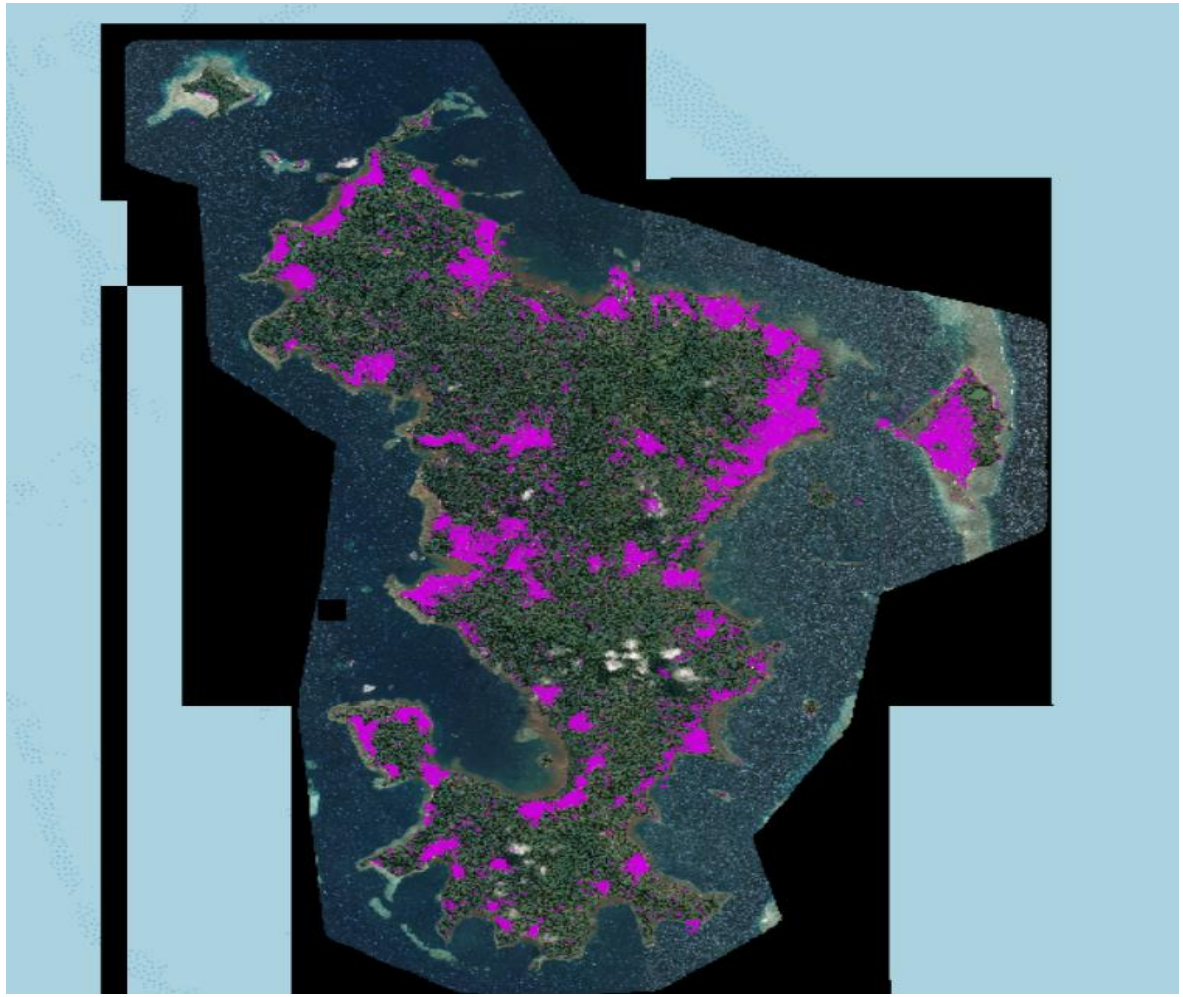

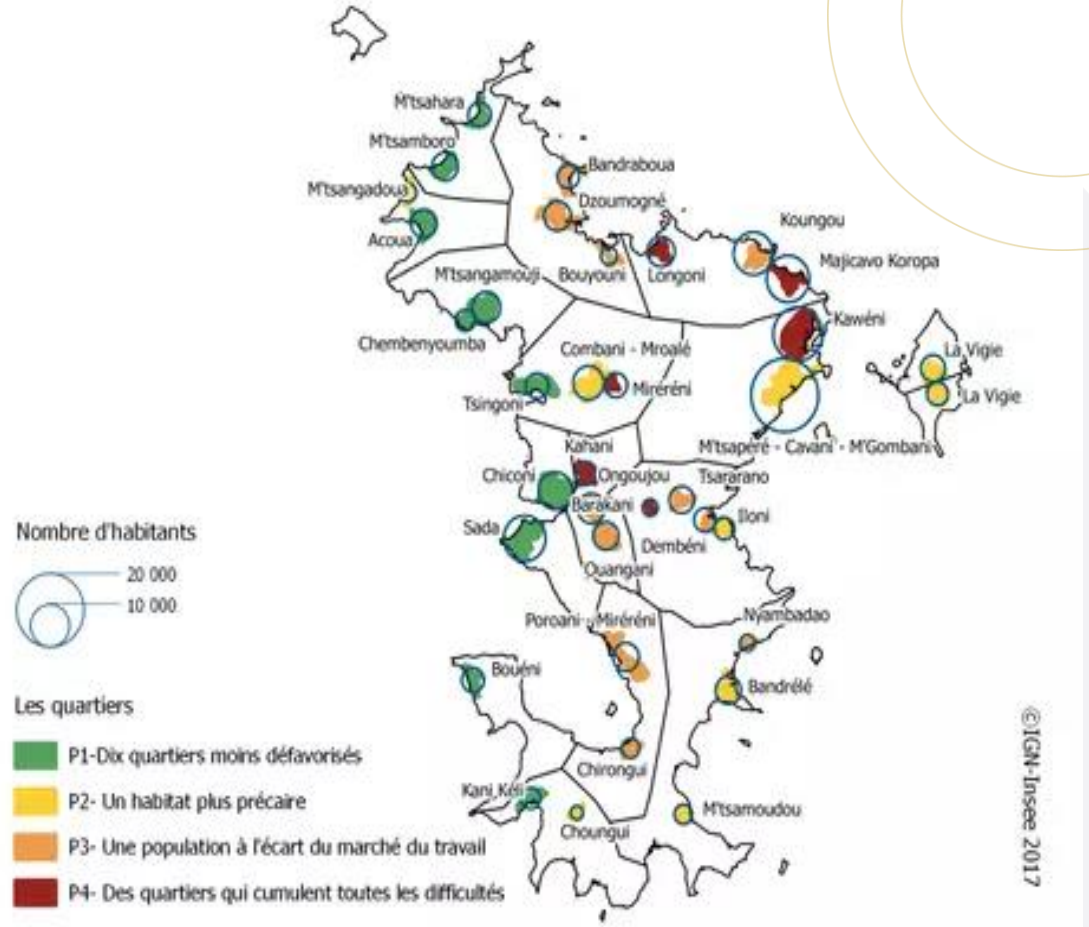

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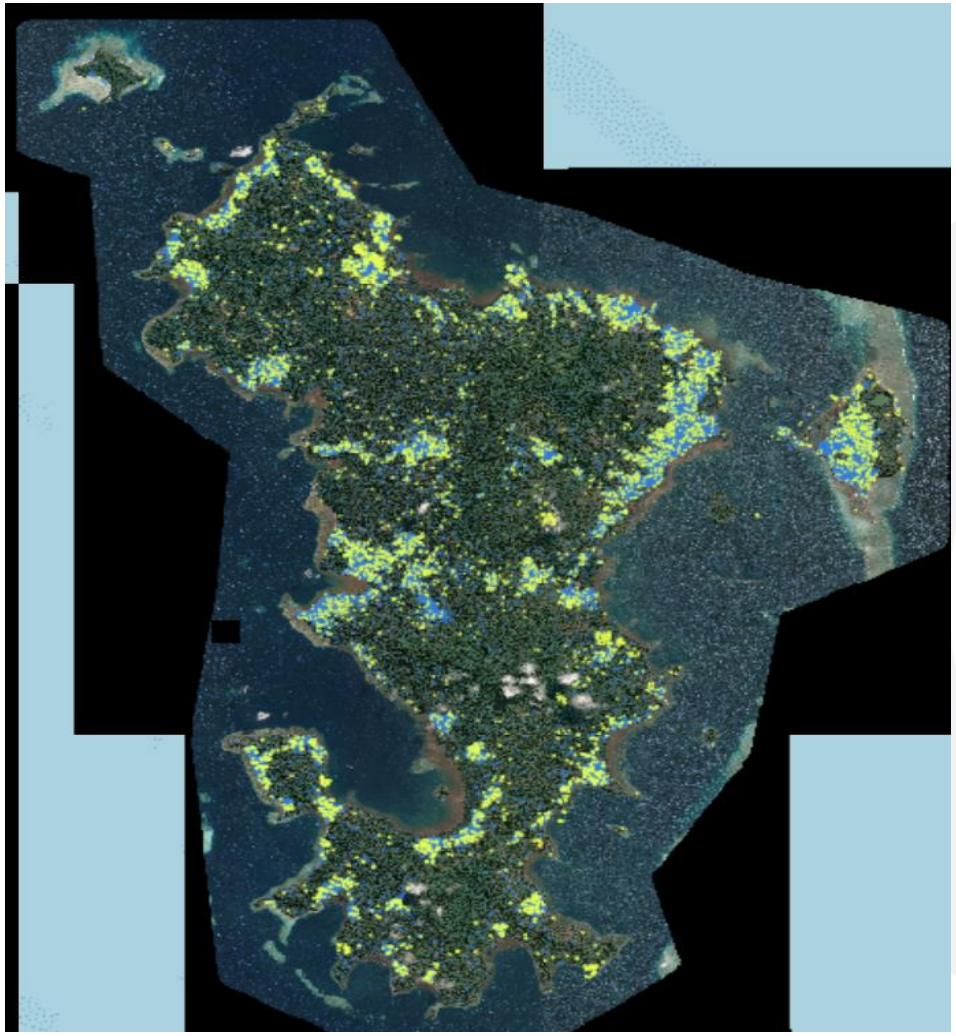

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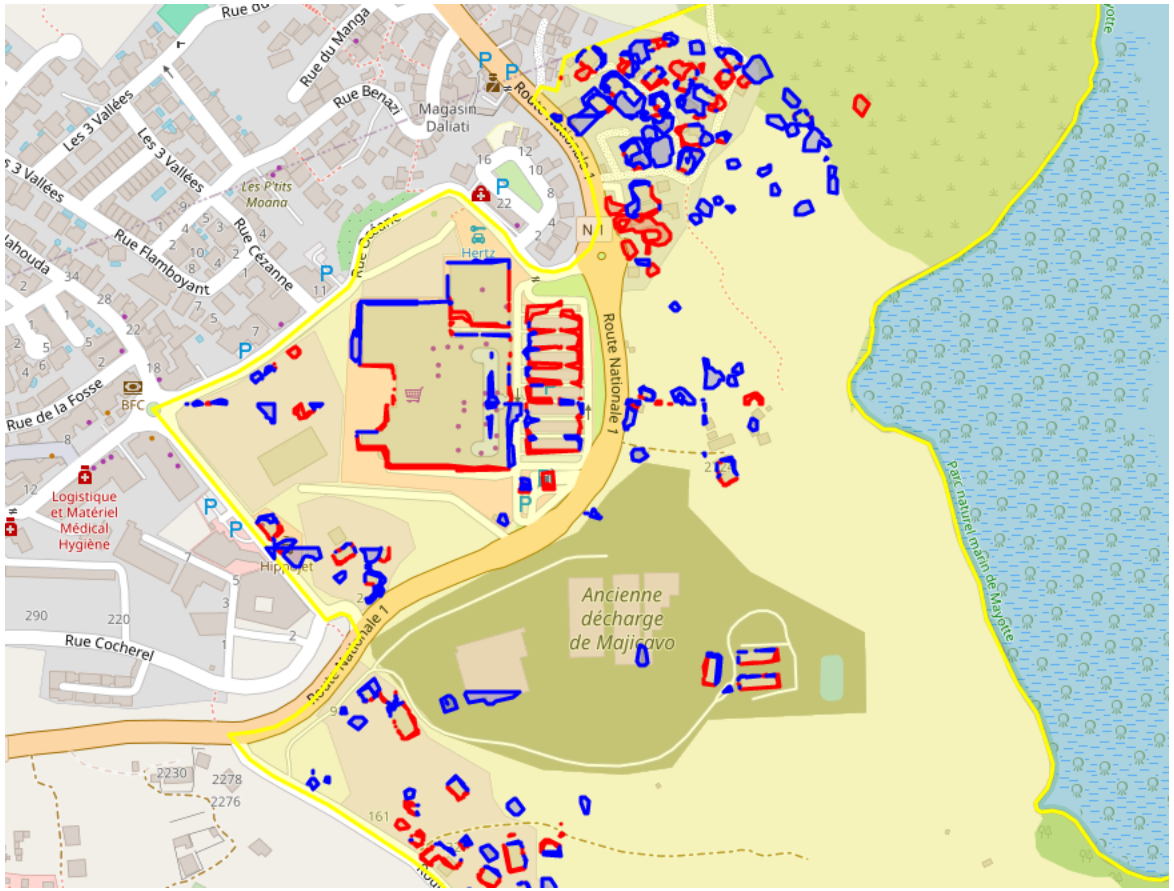

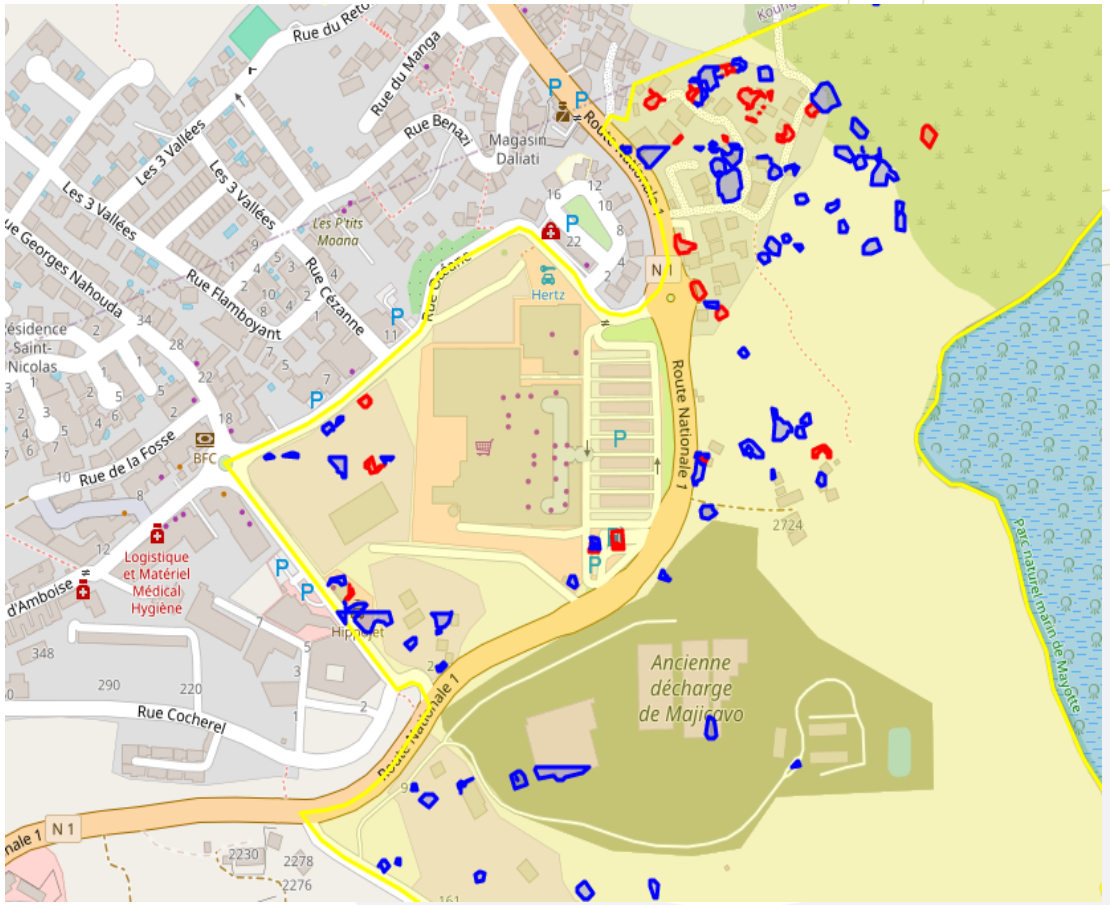

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Possible improvments

- **Final Uses:** Quality population estimates and planning depend on accurate algorithm predictions
- **Training Data:** Model needs diverse temporal/geographical training data beyond 2022 (Martinique & Guadeloupe)
- **Manual Labeling:** Building masks require intensive manual correction; external data sources like OpenStreetMap may help
- **Satellite Imagery:** Sentinel 2 and Spot imagery provide interim estimates; further exploration needed

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- **Academic Partnerships:** Collaborate with research institutions for innovation
- **Operational Perspective:** Internalize image acquisition; track lag between ordering and receipt

- **Algorithm Selection:** Continuous research required due to evolving segmentation models
- **Model Review:** Regular retraining needed; agents should verify predictions and suggest improvements

- **Dedicated Team:** A full-time team is vital for project maintenance and development

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Thanks for your attention!

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