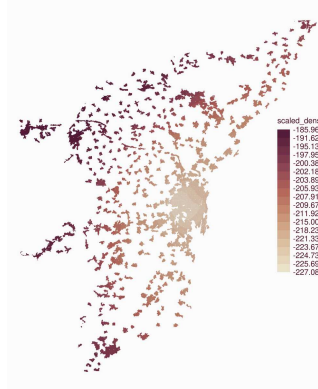
A spatial statistics analysis of residential densification drivers across France, Germany and England

Götze V., Raimbault J., Ehrhardt D., Olteanu-Raimond A.-M., Perret J.; **target journal:** CEUS; **submission planned:** December 2025; **progress:** 80% (30MH remaining).

	Strasbourg		Dortmund		Liverpool	
	Plain	With lag	Plain	With lag	Plain	With lag
Intercept	(-1.7)	(-2.7)	(-2.0)	(-3.2)	(-2.0)	(-3.7)
Distance to train	0.03 (0.2)	0.01 (0.1)	0.03 (0.3)	0.02 (0.2)	-0.02 (-0.3)	-0.00 (-0.1)
Squared distance to train	-0.02 (-0.1)	-	-0.01 (-0.1)	-0.01 (-0.1)	0.02 (0.3)	0.01 (0.1)
Distance to park	-	-	0.01 (0.1)	0.01 (0.1)	-	-
Squared distance to park	-	-	-0.01 (-0.1)	-	-	-
CCI	**0.11** (0.8)	0.03 (0.3)	0.01/(-0.1)	-	**0.03** (0.4)	-
Squared CCI	**-0.11** (-0.8)	-0.04 (-0.3)	-0.02 (-0.2)	-	**-0.03** (-0.4)	-
Density 2011	**0.10** (0.7)	0.08 (0.7)	0.04 (0.4)	0.05 (0.6)	0.01 (0.1)	0.01 (0.2)
Squared density 2011	**-0.12** (-0.8)	-0.11 (-0.9)	**-0.09**(-0.9)	-0.10 (-1.2)	-0.02 (-0.3)	-0.03 (-0.5)
ln Amenity count	-0.01 (-0.1)	-	0.00 (0.1)	0.00 (0.0)	0.00 (0.1)	0.00 (0.0)
High-density neighbors	0.01 (0.1)	0.01 (0.1)	-0.02 (-0.2)	-	-0.01 (-0.1)	-0.00 (-0.0)
Low-density neighbors	-0.04 (0.2)	0.01 (0.1)	-0.00 (-0.0)	-	0.01 (0.1)	0.00 (0.0)
Unbuilt neighbors	0.02 (-0.3)	-0.01 (-0.1)	-0.01 (-0.1)	-0.01 (-0.1)	-0.03 (-0.4)	-0.02 (-0.4)
Presence of ...						
... incompatible landuse	-0.06 (-0.4)	-0.03 (-0.3)	-0.02 (-0.2)	-0.01 (-0.1)	-0.01 (-0.2)	-0.01 (-0.1)
... parks	-	-	-0.01 (-0.1)	-0.01 (-0.1)	(-0.1)	-
... sports fields	-0.03 (-0.2)	-0.02 (-0.1)	-0.01 (-0.1)	-0.01 (-0.1)	-0.03 (-0.3)	-0.01 (-0.1)
... industry	**-0.06** (-0.4)	-0.02 (-0.2)	**-0.05** (-0.5)	-0.02 (-0.3)	-0.01 (-0.2)	-0.01 (-0.1)
... port	-0.01 (-0.1)	-0.01 (-0.0)	-0.02 (-0.2)	-0.02 (-0.2)	-0.01 (-0.1)	-0.00 (-0.1)
... nature	-0.02 (-0.1)	-0.02 (-0.1)	-0.02 (-0.2)	-0.01 (-0.1)	-0.00 (-0.0)	-0.00 (-0.0)
... agriculture	-0.01 (-0.1)	-0.02 (-0.2)	-0.01 (-0.1)	-0.01 (-0.1)	0.01 (0.1)	-
Densified cells in neighborhood	-	0.49 (3.98)	-	0.43 (5.2)	-	0.41 (7.1)
F1	0.42	0.5	0.29	0.44	0.21	0.48
AUC	0.71	0.81	0.68	0.82	0.66	0.87
Moran's I	0.18	-0.06	0.20	-0.07	0.26	-0.08



Statistical models linking explanatory variables to the presence of densification

Contributions

→ modelling with heterogeneous data across 3 countries

→ spatial statistics for densification

→ sensitivity analysis

Takeaways

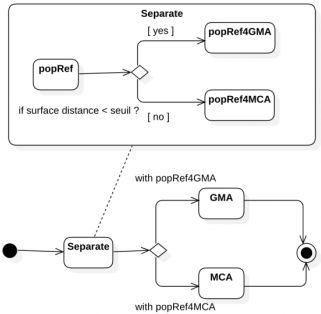
→ varying explanatory power across countries

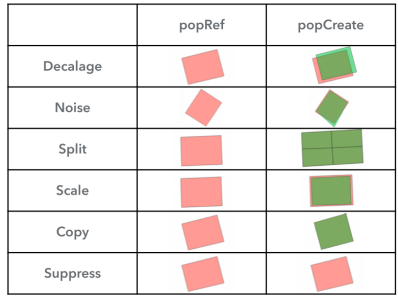
→ strong effect of spatial lag and spatial structures like core-periphery

→ no generic rules, need for tailored planning policies

A multi-modelling algorithm for matching geospatial vector data

Raimbault J., Guardiola P., Perret J., Olteanu-Raimond A.-M.; **target journal:** IJGIS; **submission planned:** March 2026; **progress:** 50% (90MH remaining), presented at CCS2024.





A novel algorithm for matching combining GMoA and MCA into a multi-modelling approach

Contributions

→ novel algorithm performing better than state-of-the-art for change detection

→ validated and benchamrked on synthetic data and ground-truth datasets

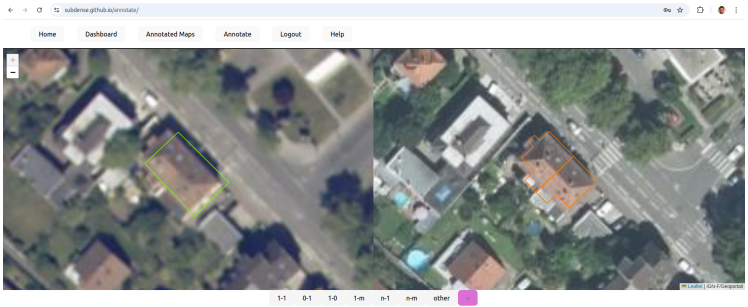
→ an open python library for matching https://github.com/umrlastig/pymatch

Takeaways

→ improved quality of change detection, thus of quantitative analysis of densification

A collaborative open source annotator application to crowdsource ground-truth dataset for geospatial vector matching

Perret J., Raimbault J., Olteanu-Raimond A.-M.; **target journal:** Transactions in GIS; **submission planned:** April 2026; **progress:** 75% (60MH remaining), presented at CCS2025.



An open web application to produce ground-truth datasets for matching

Contributions

→ web app to annotate matching links

→ proof-of-concept of a “serverless” deployment with user input through git

Takeaways

→ ground-truth datasets to optimise the matching algorithm

→ git feedback architecture to be integrated into the dashboard

An agent-based model of stakeholder dynamics in suburban densification

Raimbault J., Perret J., Götze V.; **target journal:** JASSS; **submission planned:** June 2026; **progress:** 10% (120MH remaining), presented at JR-IGN-ENSG 2025.

Simulation of densification dynamics with behaviouraln modelling for several stakeholders

Contributions
→ stylised simulation of complex densification dynamics
→ parametrised on synthetic cities and real data
→ integrates SimPLU3d and ParcelManager as submodels

Takeways
→ automatic exploration of planning scenarii
→ optimisation of SDGs linked to densification

Plot-based quantification and simulation of suburban densification

Colomb M., Raimbault J., Perret J.; **target journal:** Geographical Analysis; **submission planned:** March 2026; **progress:** 40% (60MH remaining).

Simulation of potential plot splits with the ParcelManager model and comparison with actual dynamics for France (Strasbourg and Toulouse)

Contributions
→ densification potential based on plots
→ calibration of ParcelManager

Takeways
→ comparison with actual densification dynamics in terms of buildings