Use of artificial intelligence to update tax bases and the French cadastre

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Sommaire

1. the French cadastral map
2. Current methods to update the cadastral plan
3. The project's goals
4. The use of artificial intelligence to detect buildings and represent them on the plan
1. The French cadastral map

The cadastral plan is a graphic representation of a municipality which draws up an inventory of its land properties as well as the floor-space of the buildings.

The cadastral plan can also indicate certain topographical details facilitating location.
2. Current methods for updating the cadastral plan

Several processes to update the plan:
- surveys by terrestrial methods,
- positioning by satellites or photogrammetry,
- use of external plans;
- from orthophotographs to directly update the cadastral map or to detect changes and carry out a land survey.
3. Project goals

The exploitation of aerial shots from the National Institute of Geographic and Forest Information (IGN) using innovative technologies of artificial intelligence and data enhancement makes it possible to meet two objectives:

- Optimize the process of detecting constructions or developments, to make it possible to fight more efficiently against declarative anomalies and thus better respond to the wishes of fairness and tax justice of citizens, by the fair taxation of goods by making the tax bases more reliable

- Updating the outlines of the buildings detected by the algorithms on the cadastral plan
4. Use of artificial intelligence to detect buildings and swimming pools and represent them on the cadastral map

General presentation of the detection process on aerial shots of swimming pools and potentially non-taxable buildings as well as their treatment
1. The first step consists in the artificial intelligence algorithm to learn to recognize buildings and swimming pools from a learning base. It is now made up of a panel of images (10,000 taxable and non-taxable swimming pools, 100,000 buildings)
2. The second step consists in identifying the algorithmic model of the outlines of buildings and swimming pools and make them available to the topographic and tax data cross-referencing platform.
3. The object (building or swimming pool) detected is, from its geographical coordinates and following geomatics processing, automatically matched to its plot of land.
Some illustrative examples output from the image processing platform

1. InPut Picture
2. Labels
3. Prédiction
4. InPut Picture
5. Labels
6. Prédiction
4. The cross-checking algorithm vets that the buildings or pools:
- is assessed in the tax land base management application (MAJIC application)
- or that it is monitored in the dedicated application (example: sheet alerting that the building will soon be built)
Illustrations of the detection and data cross-referencing steps

Detect a pool on the orthophoto

Cross with the cadastral plan

Cross-reference with tax data

In both cases, the swimming pool is well detected on the orthophoto.

In both cases, the topographic intersection makes it possible to consider an absence in the cadastre plan.

In case 1, the swimming pool is not considered in the tax bases.
In case 2, the swimming pool is well assessed but absent from the cadastre plan.
4.5. Principle to update the buildings detected by the algorithms on the cadastral plan

The update takes place in 3 stages

1. Identification of topographical and fiscal updates obtained from artificial intelligence processing on orthophotographs to be integrated into the plan automatically

2. Processing of the topographical updates via aerial shots in the plan management application

3. Update by ground survey of buildings that cannot be processed from aerial shots either by the AI or using the plan management application
4.5 Examples of shapes obtained from Artificial Intelligence from aerial shots

The first results of the algorithmic process of report on the plan of the detected objects