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The use of artificial intelligence in monitoring of cadastral cartography aimed at protecting public assets

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The Italian Cadastral System

The Italian cadastral system is mainly divided into two parts:

LAND CADASTRE:

Records all cartographic changes and mainly concerns the graphic conformation of parcels and buildings on the map

BUILDINGS CADASTRE:

Records all plan order changes made within buildings and floor plans of new construction

The two types combined are for tax purposes only. The Italian cadastre is not probative for private property

Historical Background of italian land Cadastre

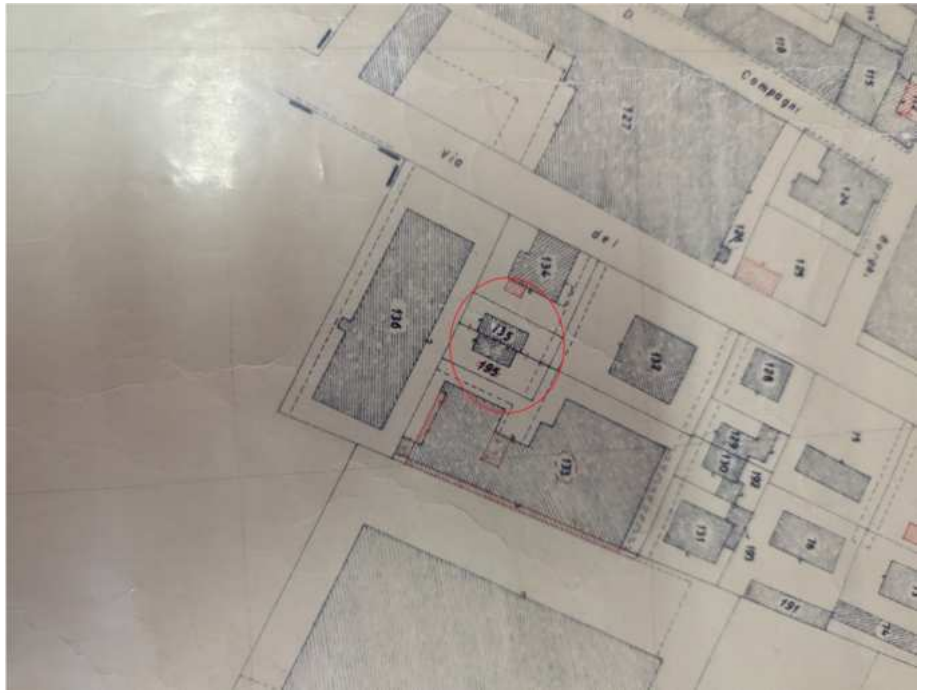
The Italian cadastre came into effect following the unification of Italy that occurred in 1848 but it was not until 1886 (through the Massedaglia law) that it was truly established with its associated public offices and institutions

The first cadastral cartographic representations date back to 1890 and were made by hand by surveyors and topographers following surveys aimed at the census of cadastral parcels

Cartographic Progression

First cartographic representation
(Mappa d'impianto) 1890 to 1979

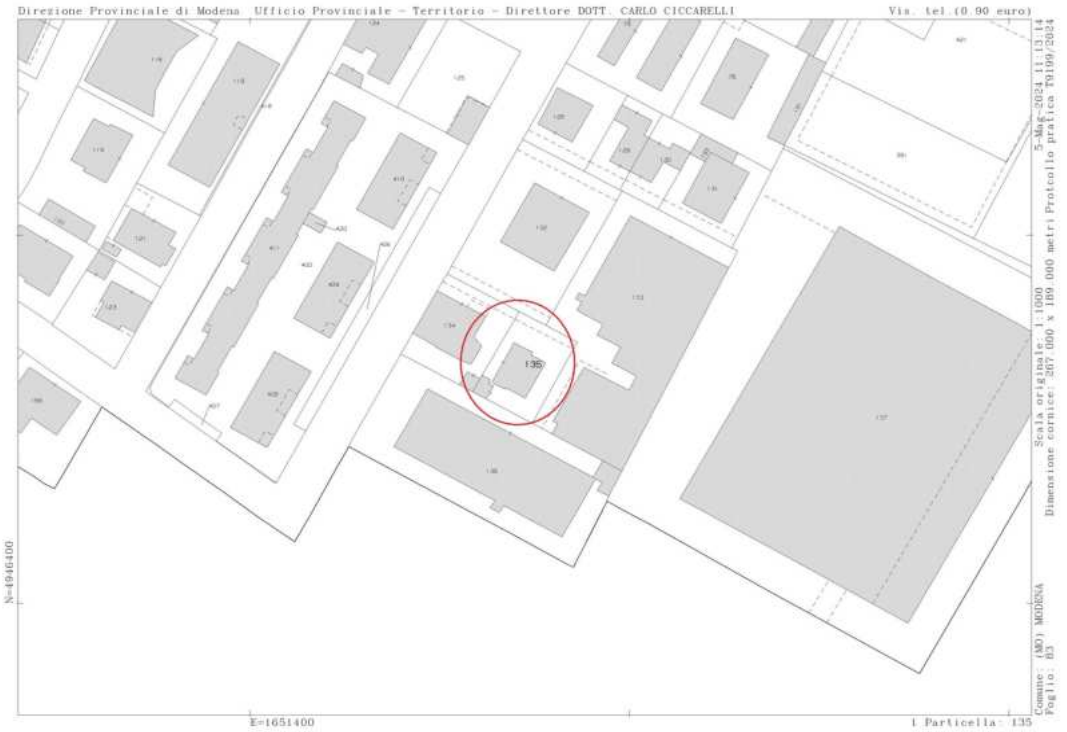
Second cartographic representation
(Copioni di visura) 1979 - 1990



Mechanized System & Updates

Today cadastral mapping consists of a mechanized and digital system that is continuously updated almost automatically by users. These updates which are respectively:

- “Tipo Mappale” for the modification or insertion of buildings in the cadastral cartography
- “Tipo Frazionamento” for the modification or creation of new boundaries
- “Tipo Frazionamento e Mappale” for the simultaneous updating of buildings and boundaries represented in the cartography
- “Tipo particellare” for the definition of metric and census values entered in the database of individual land parcels



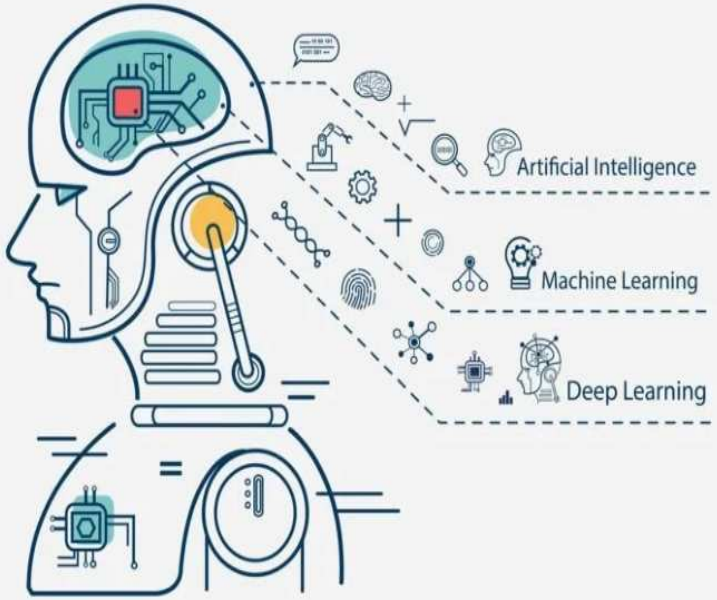
Introduction to Artificial Intelligence

Artificial intelligence (AI) is the ability of a machine to exhibit human capabilities such as reasoning, learning, planning and creativity

AI allows systems to understand its environment, relate to what it perceives and solve problems, and act toward a specific goal. The computer receives data, processes it and responds

AI systems are capable of adapting their behavior by analyzing the effects of previous actions and working autonomously

It is not correct to give a single definition of AI, as it is always evolving



Types of AI Relevant to Cadastral Mapping

Deep learning:

- Teaches computers to process data in a way that is inspired by the human brain
- Deep learning models can recognize complex patterns in images, text, sounds and other data to produce accurate information and predictions.
- Automate tasks that typically require human intelligence

Machine learning:

- Algorithms and statistical models used by computer systems to perform tasks without explicit instructions and instead relying on patterns and inference
- Computer systems use machine learning algorithms to process large amounts of historical data and identify patterns
- Allow to predict outcomes more accurately from a given initial data set

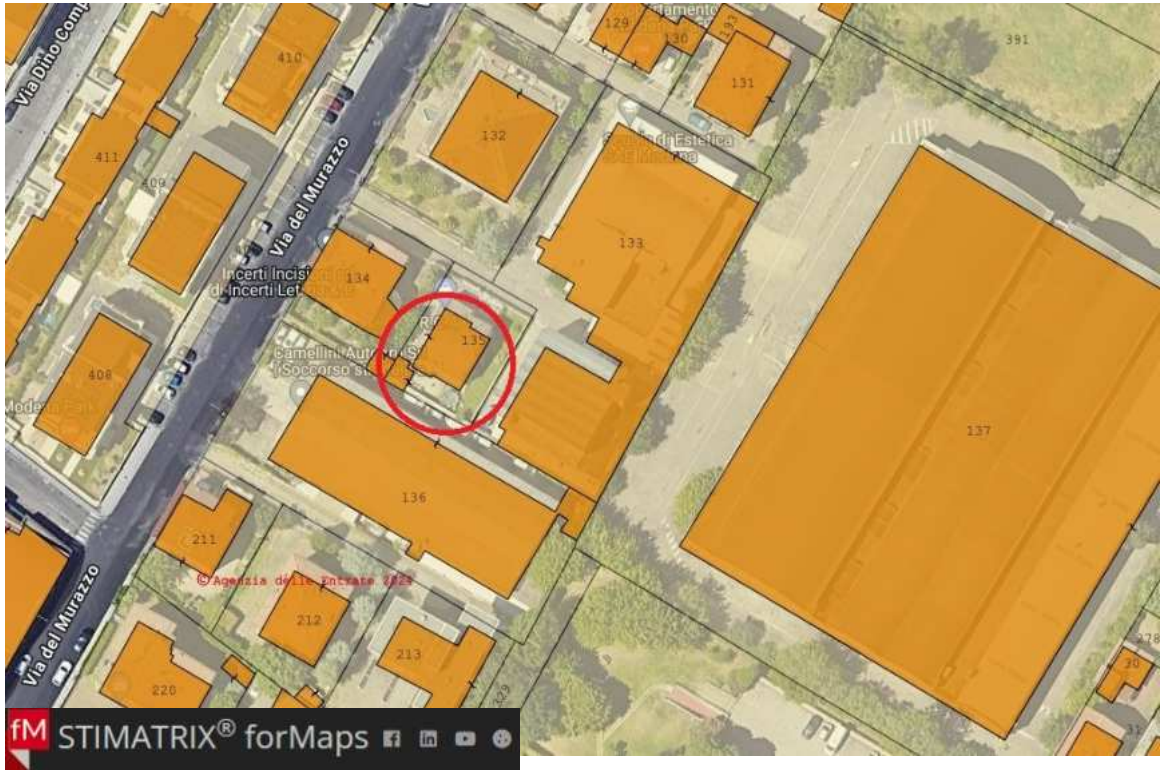
In order to generate a simple alert or warning to the technician of italian cadastal agency the best type of AI is **machine learning**

Cartographic Error Example

Specifically you can see how in our case the access road to the buildings is graphically absent

The Civil Code obliges us to keep a minimum distance of 5 metres from the property boundary for buildings, and the Road Code obliges us to keep a further 2.5 metres from the road boundary

This macroscopic mismatch could cause numerous problems for the surveyors, architects or engineers who will be working on this building in the future



Conclusions

- We're in the early stages of a groundbreaking historical moment in managing cartographic data
- To date, no technician has the weapons to detect this anomaly, unless they happen to be working in that part of the territory
- AI has the potential to alert public administration officials to these errors, improving the accuracy of location representations
- Cartographic data will never be the same again, nor will their updating and census

Today we are laying the foundations for the quality of cartographic data and we must use all known methods to facilitate the work of the future

Thanks for your attention

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Cadastre and land management

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