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Satellite and Ground Data to Slash Risk Uncertainty

OUTLINE

- Who we are
- The problem - or the market opportunity …
- Our solution - and our marketable service …
- ESA Kick-Start Activity CountFloors
- The Groningen service case
- Conclusions and future outlook

WHO WE ARE

Ticinum Aerospace (TA) is a spin-off company of the University of Pavia

Based on three main pillars:

- Big Earth-Observation Data
- Large-Scale Machine and Deep Learning
- Smart Geospatial Data Analysis

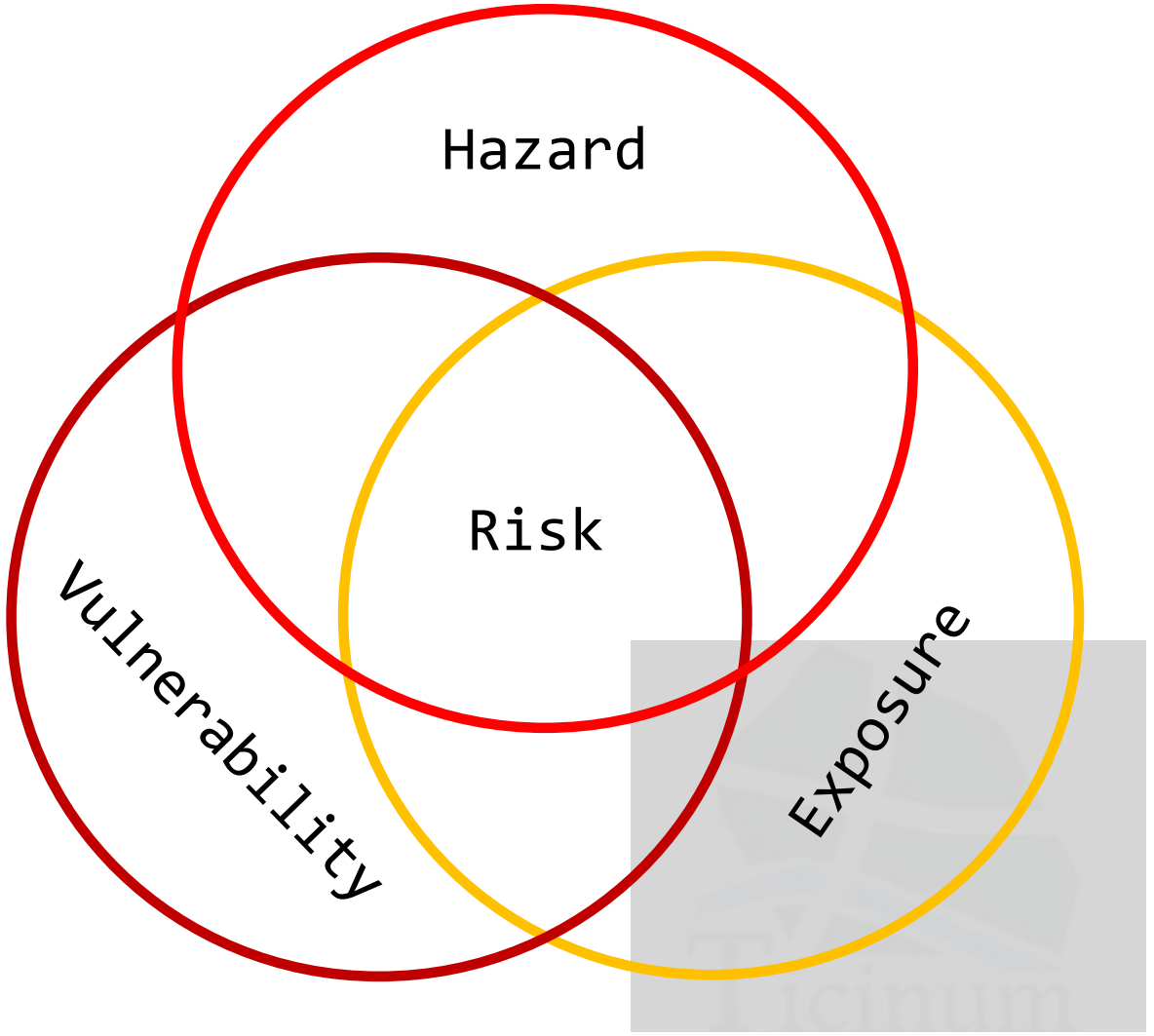
RISK MODELLING

RISK MODELS

Risk models are incredibly information-hungry!

For accurate risk assessment, all the three components of risk need to be known with sufficient confidence

Data is frequently difficult to access, or simply non-existing …



THE PROBLEM

Re/Insurance companies
lack building-level data for
risk/vulnerability/exposure assessment

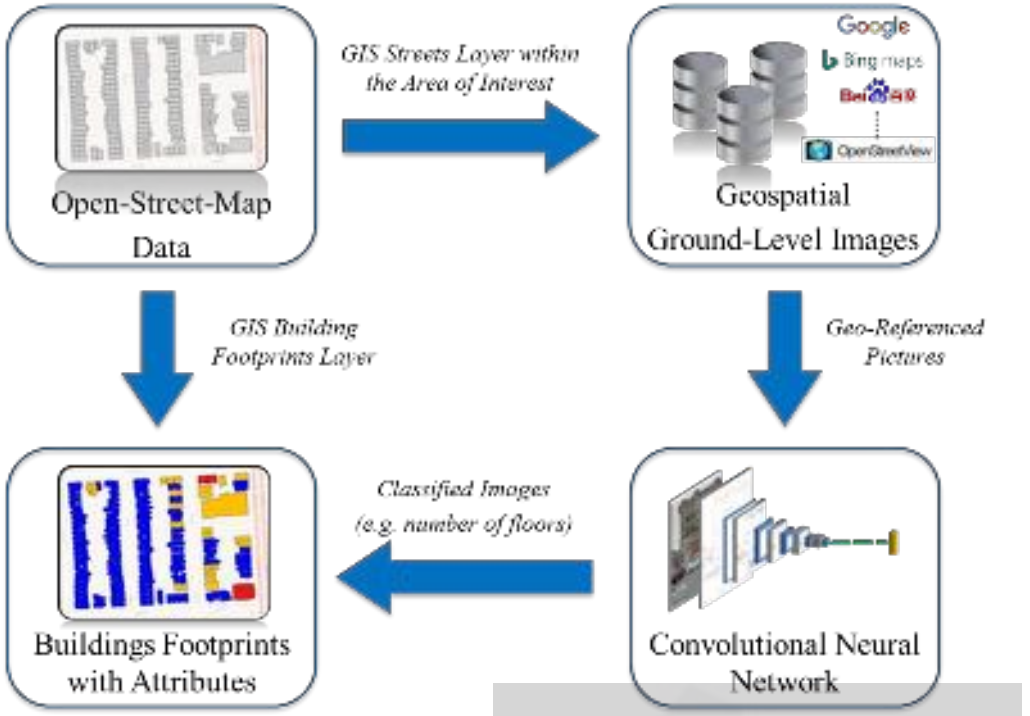
They use large-scale statistics as proxies

AI-BASED FRAMEWORK

Opportunity created by wide availability of satellite data and georeferenced ground-level images of urban areas.

A framework could be designed to tackle the information need

We called the framework **CountFloors**



Picture from:

Iannelli, G.C.; Dell'Acqua, F. Extensive Exposure Mapping in Urban Areas through Deep Analysis of Street-Level Pictures for Floor Count Determination. *Urban Sci.* **2017**, *1*, 16.

STREET-LEVEL DATA

The **CountFloors service** can automatically extract building features by analyzing street-level pictures.

FEATURES

All visible exposure and vulnerability proxies can be automatically identified

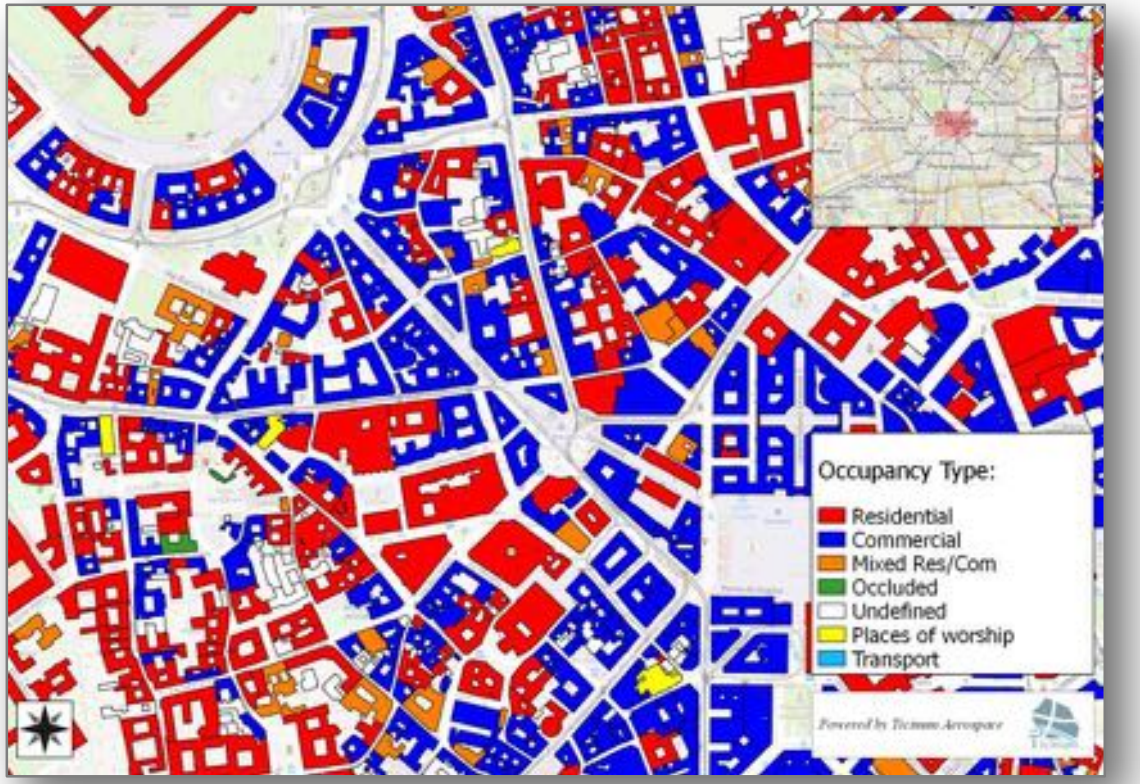
Examples are:

- Number of floors
- Occupancy
- Trees
- Roof shape
- Maintenance status
- Basements
- Materials
- Fences
- Stairs
- …

THE PRODUCT

A city-wide / region-wide GIS layer with building footprints and all the required attributes

PRODUCT EXAMPLE



Milan (Italy)

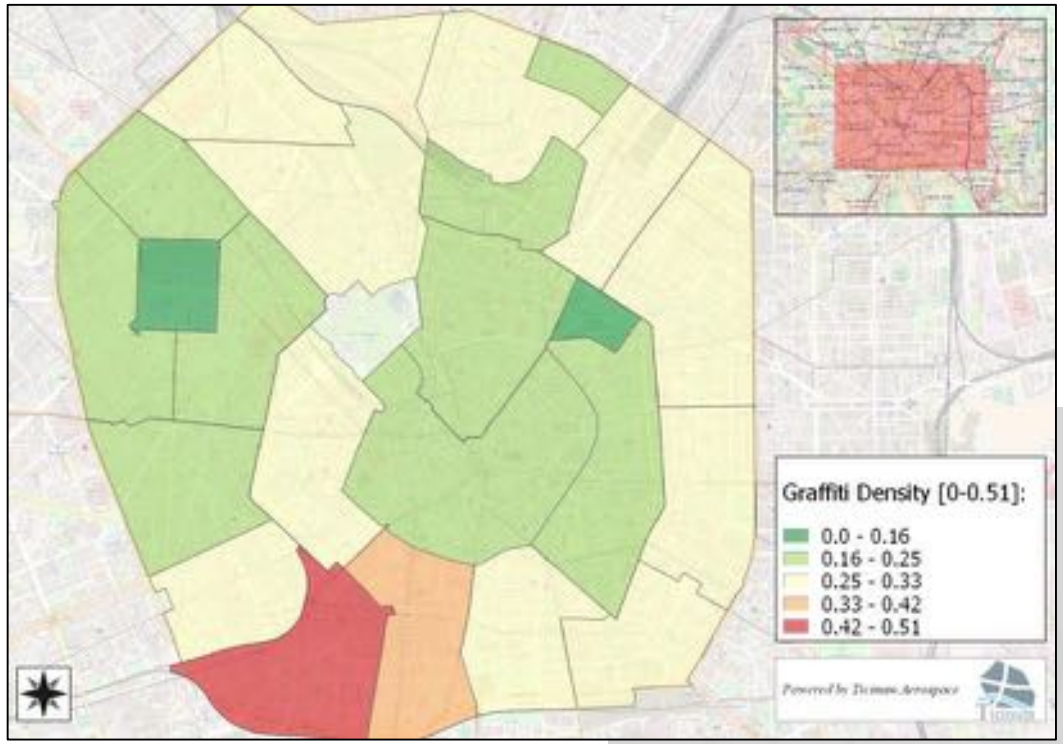
Manila (The Philippines)

PRODUCT EXAMPLE

Thematic Map representing the buildings with/without basements in Milan, Italy

PRODUCT EXAMPLE

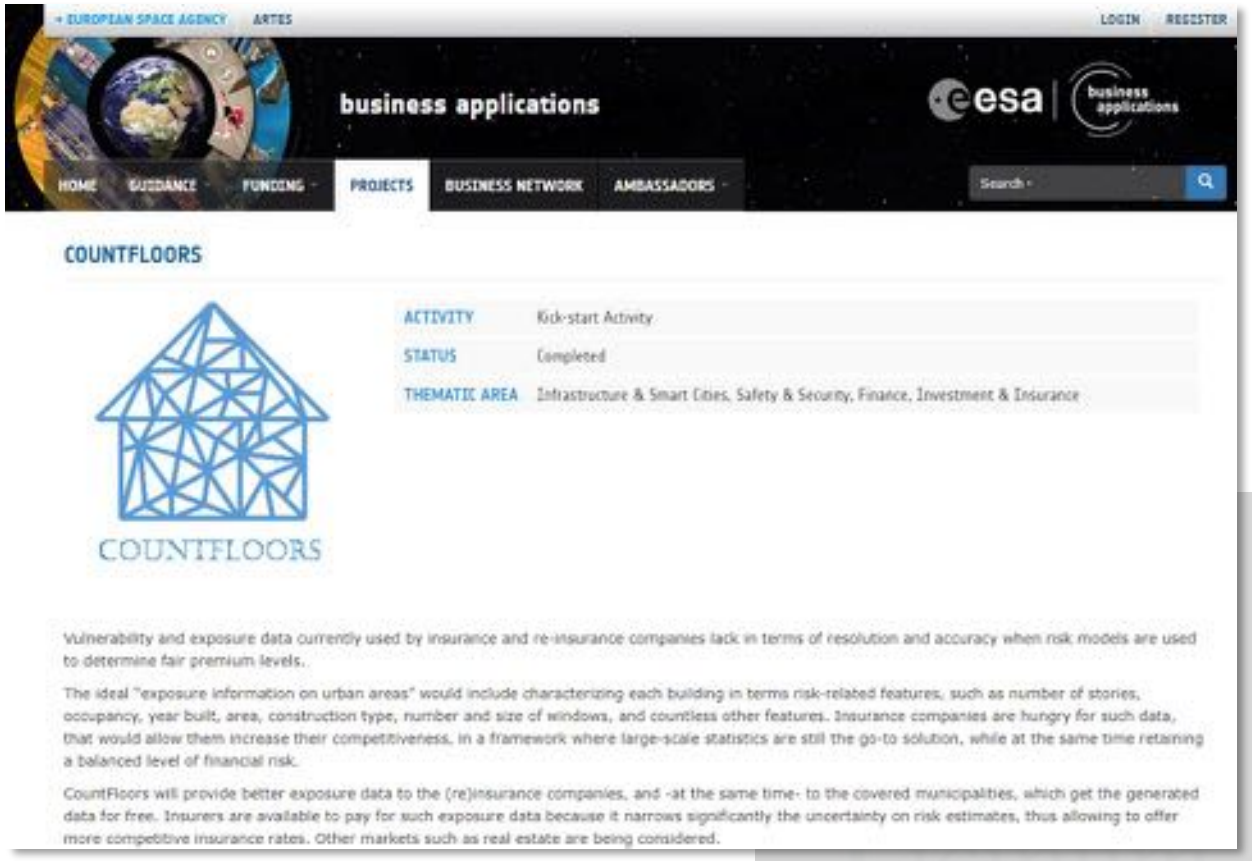
Thematic Map representing the density of 'graffiti/murals' within the city of Milan, Italy *(Administrative boundaries)*



ESA KICK-START ACTIVITY

- «Space for Municipalities» call
- Cooperation with the Municipality of Pavia, Italy
- A formal agreement has been reached and made official at the beginning of November 2018
- Funds allocated by the Italian Space Agency, whose support is gratefully acknowledged here

https://business.esa.int/projects/countfloors



FIRST CUSTOMER

TA has been contracted to extract, and measure, risk-related features in urban area in the Dutch province of Groningen

The requested features are:

- Number of floors and its variants (e.g. ground-floors, attics, etc..)
- Presence of masonry chimneys
- Building openings (attribution of an empty-to-total area)

EXPOSURE DATA

Almost 150 k buildings to be analysed and labelled

No data on number of floors

No data on chimneys

Few data (5%) on building openings, dating back 10 years

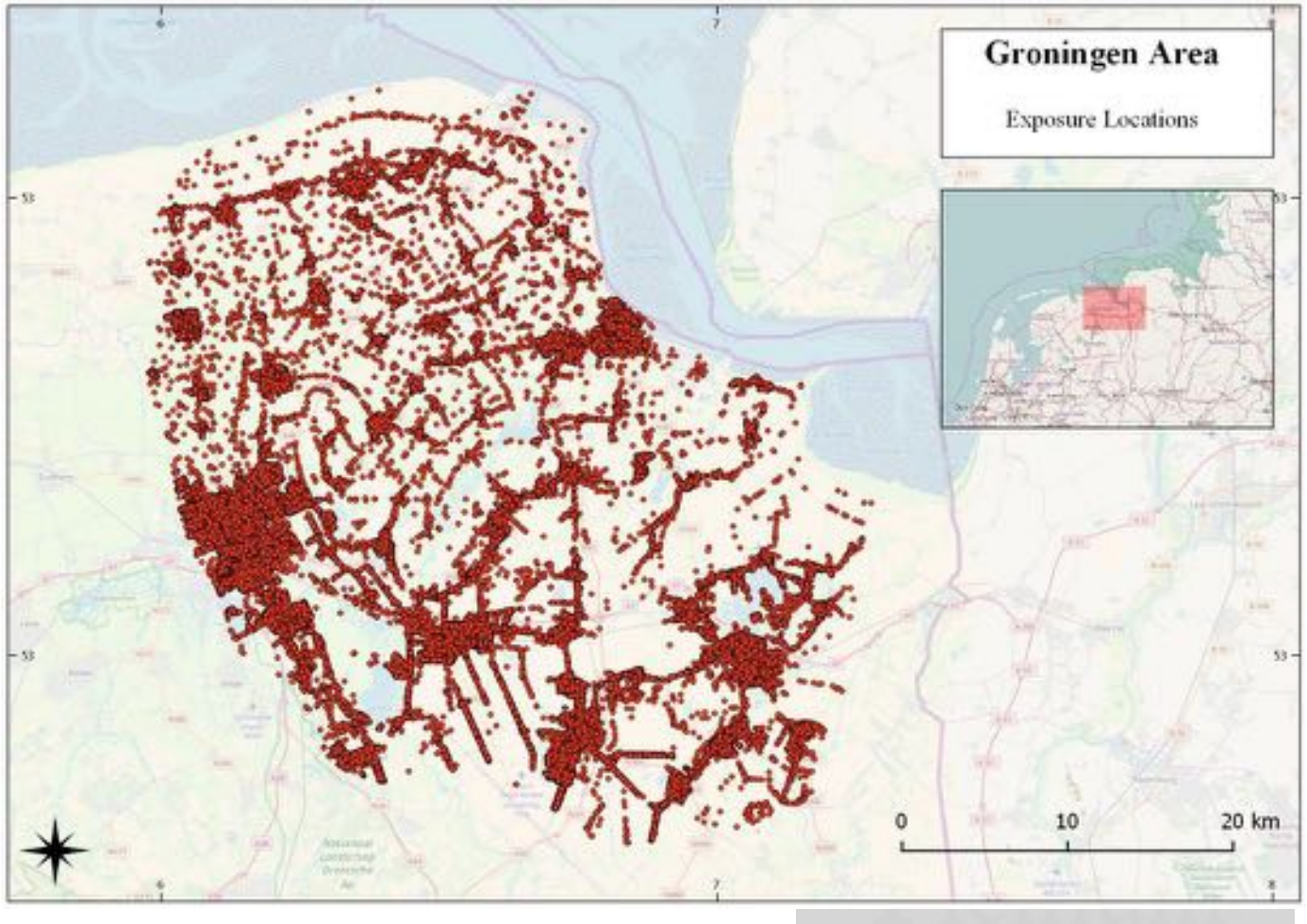


IMAGE PROVIDER

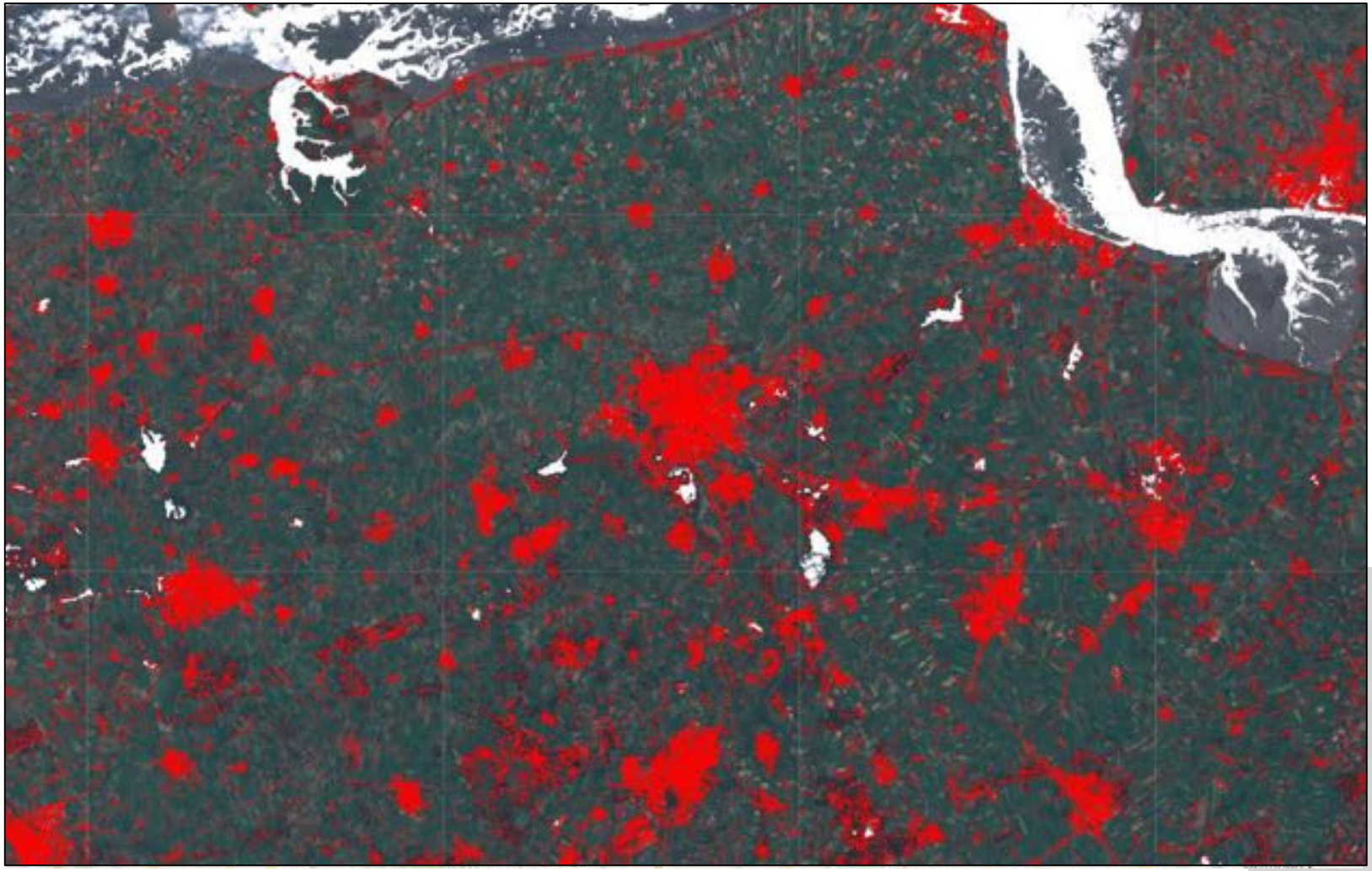
Google Street View was discarded due to licensing policy issues.

We searched for an alternate provider and found the Dutch company **Cyclomedia** in Zaltbommel (NL) offering a large and deep archive of multitemporal acquisitions on the Netherlands and in other locations

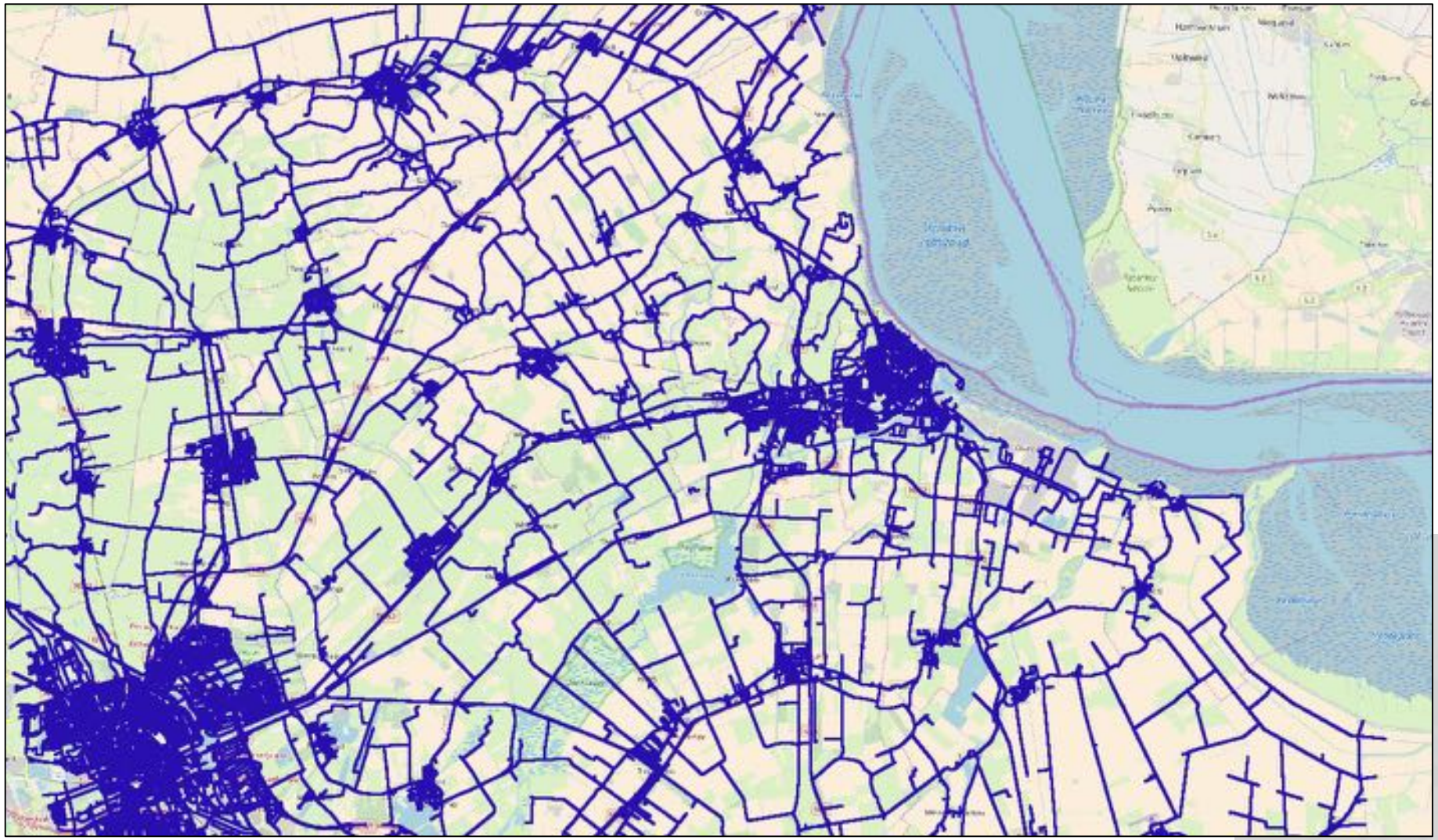
https://www.cyclomedia.com/

SENTINEL-2 DATA ON GRONINGEN

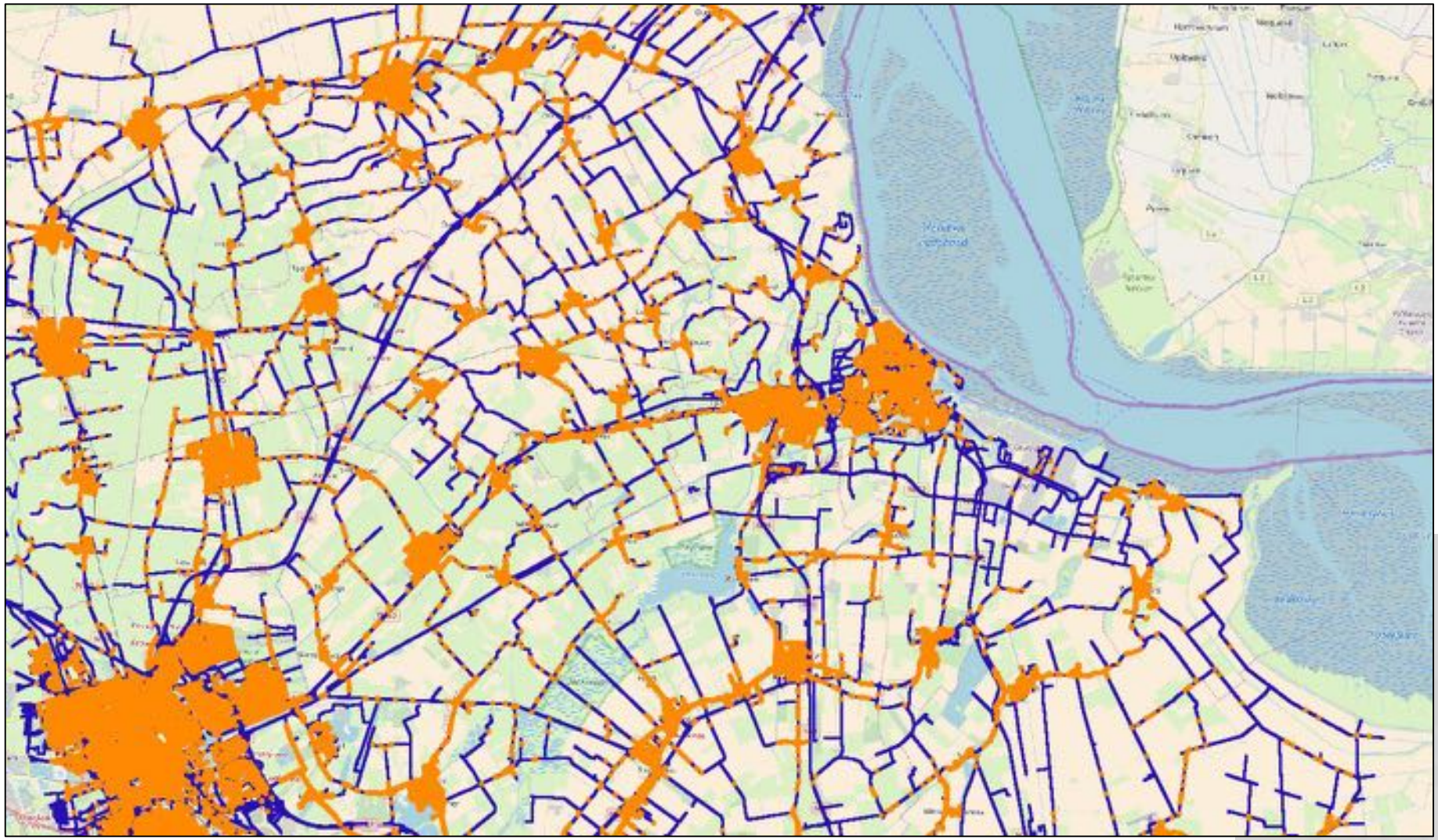
URBAN MASK



STREET-LEVEL IMAGE ACQUISITION POINTS



SATELLITE-FILTERED ACQUISITION POINTS



STREET-LEVEL IMAGES

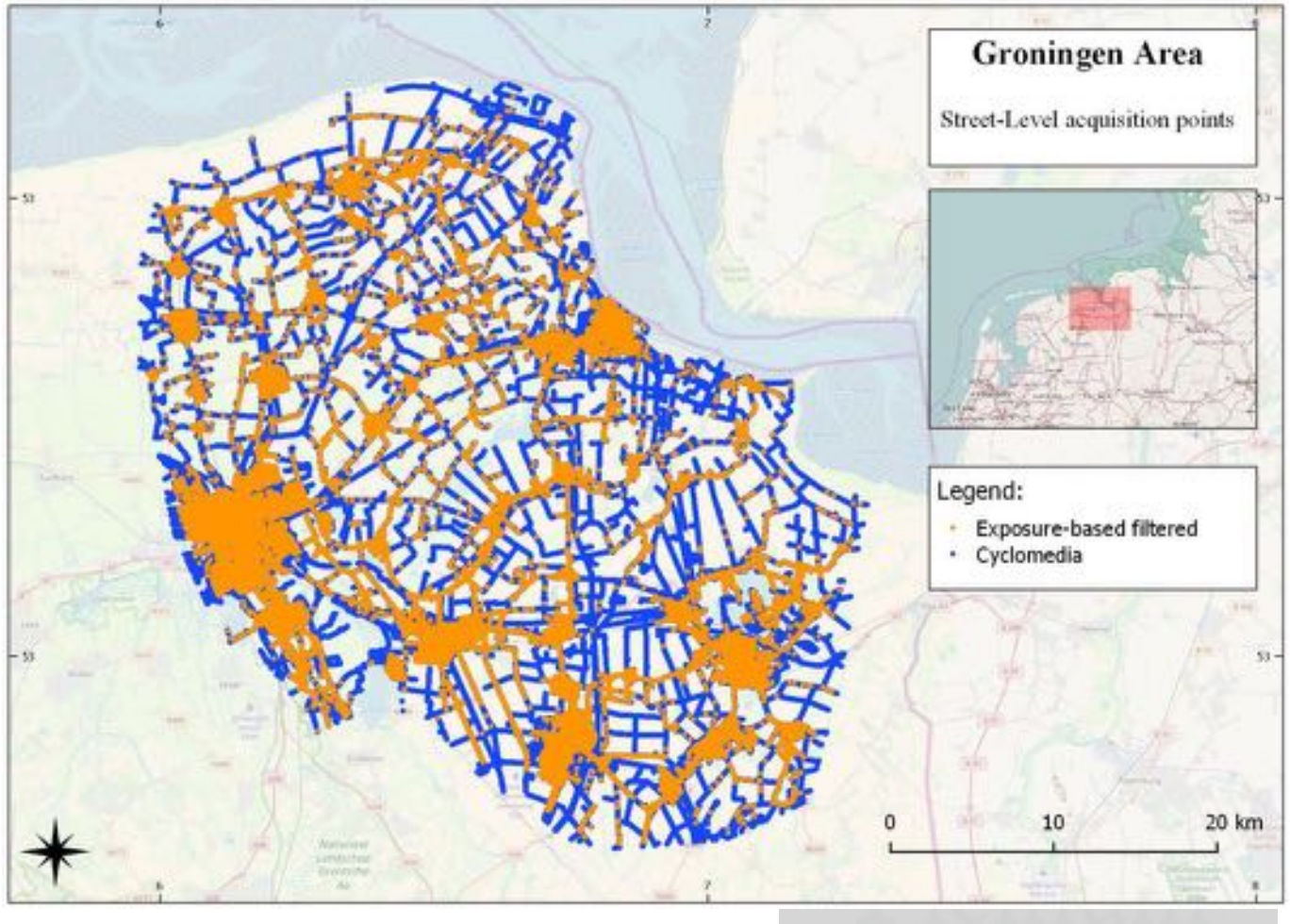
The list of acquisition points has been provided by Cyclomedia

These have been automatically filtered based on targeted building locations

STREET-LEVEL IMAGES

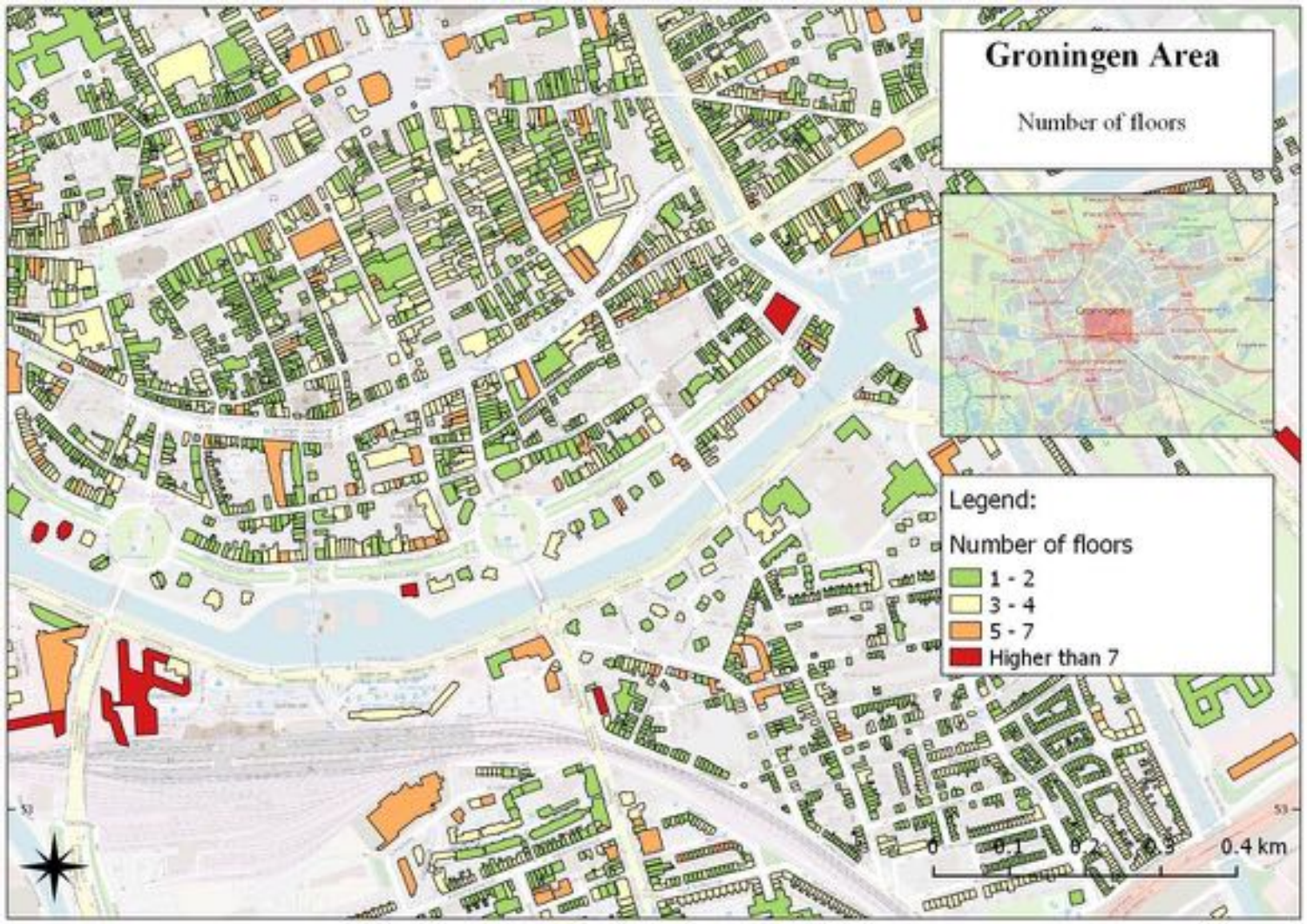
Raw images acquired by Cyclomedia are colored in blue

Filtered images are colored in orange

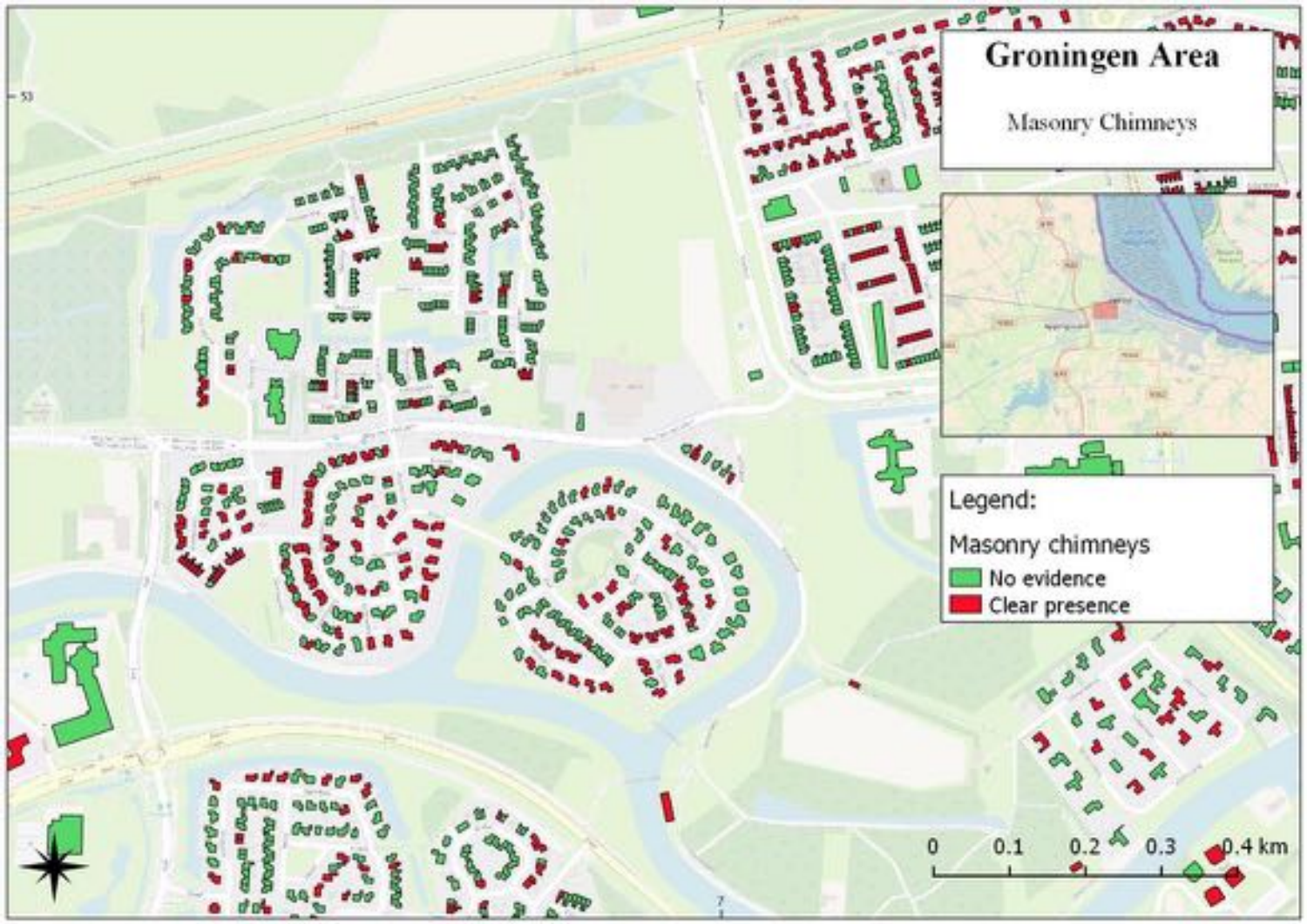


SAMPLE IMAGES

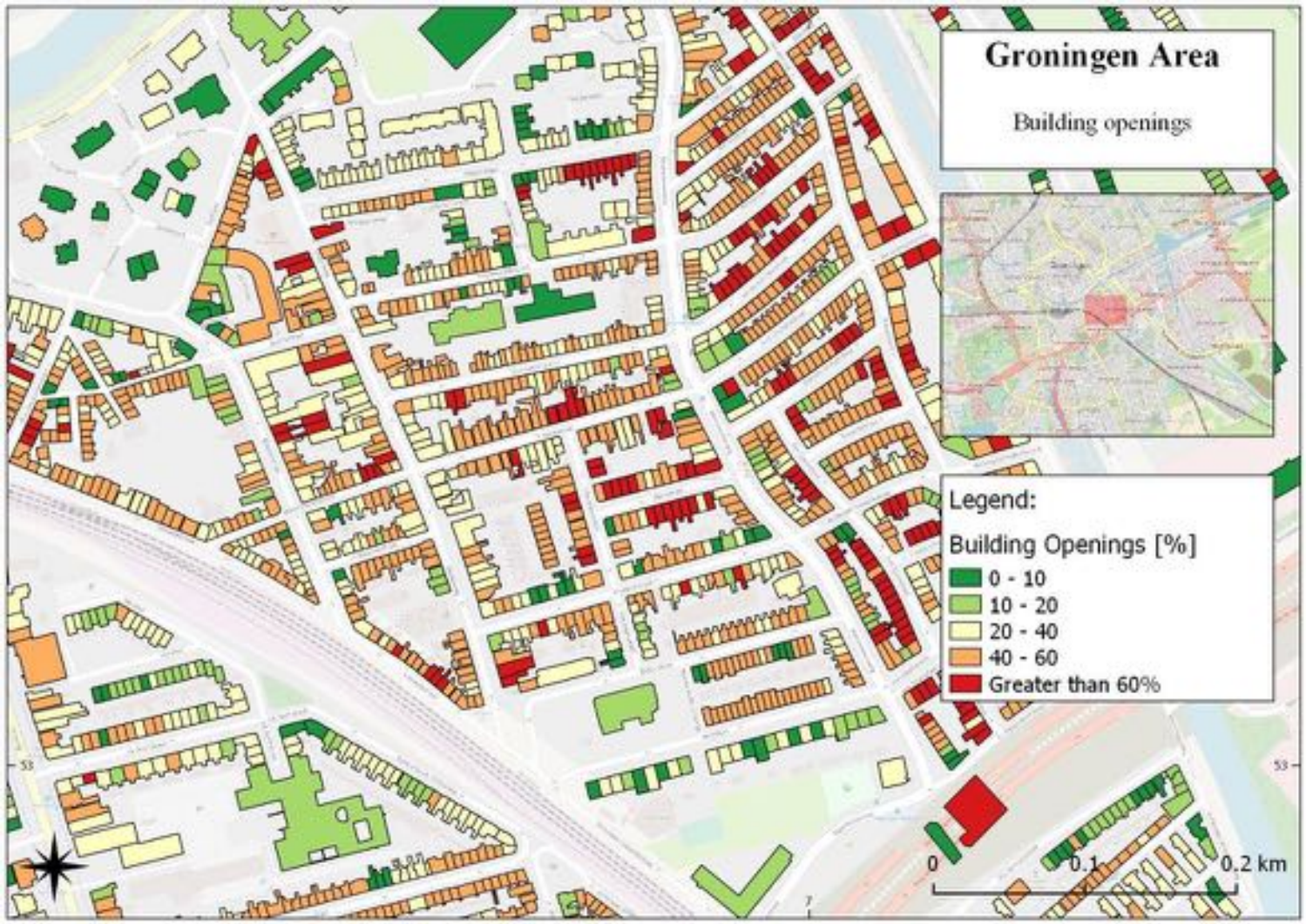
NUMBER OF FLOORS



MASONRY CHIMNEYS



BUILDING OPENINGS



FINAL RESULTS

92.5%

Accuracy

96%

of targeted buildings enriched

Positive

customer feedback

FUTURE DIRECTIONS

- **Go global** - regional data providers needed
- **Expand to other markets** – real estate, urban maintenance
- **Explore NRT applications** (e.g. pot holes mapping)
- Looking forward to future hyperspectral missions to incorporate **material information** into building labellings
- Last but not least – scientific use: **creating annotated data** for training of ML algorithms in classification of satellite data

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THANK YOU!

Ticinum