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Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

Status of HMMA

Federico Battini, Gionata Manduchi, Orso Peruzzi – IFAB Foundation

Spoke 3 II Technical Workshop, Bologna Dec 17 -19, 2024

Scientific Rationale

This project extends the **HaMMon initiative** by advancing **Work Packages 3 and 4**, integrating **advanced** AI **methods** with **domain expertise** to enhance weather forecasting, risk assessment, and built environment classification.

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An **interdisciplinary strategy** that combines advanced AI modeling and domain expertise to build upon HaMMon's strengths.

Work Package 3 Enhancements

Technical objective
Development of an **extreme events weather generator** for risk management

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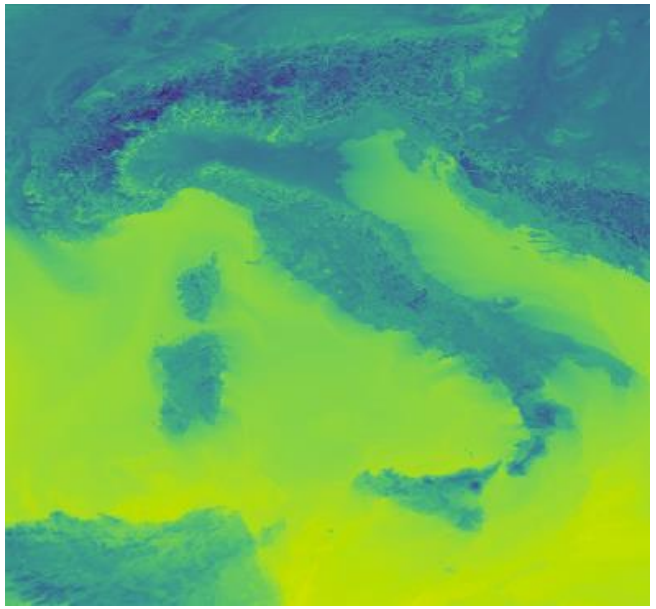
Methodology
- **Variable of Interest**: Temperature (minimum and maximum)



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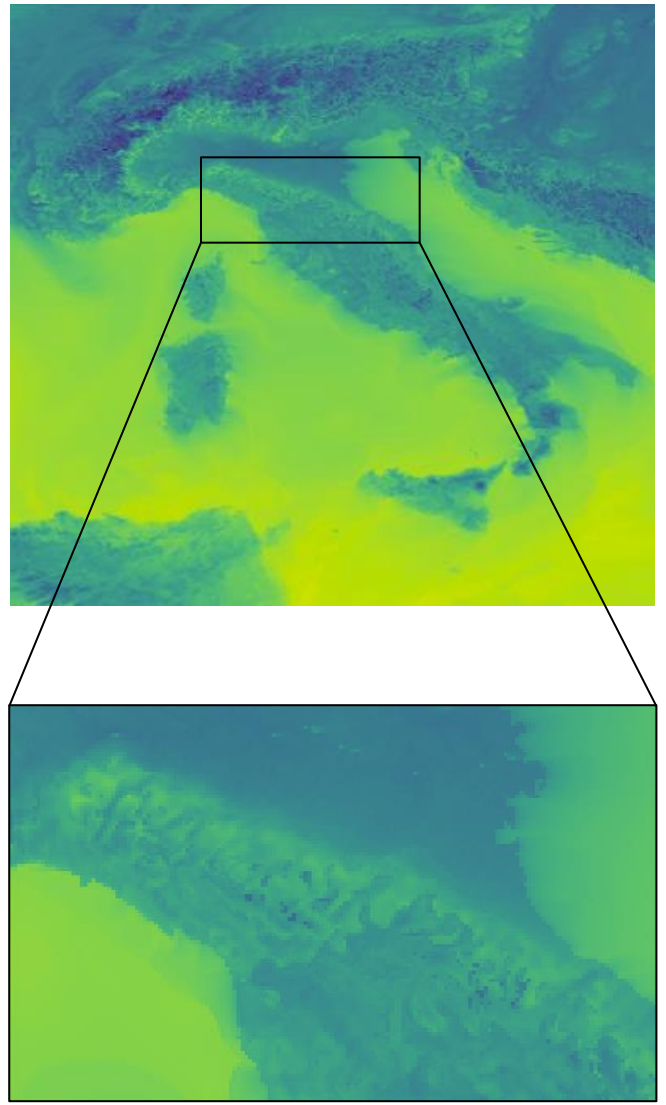

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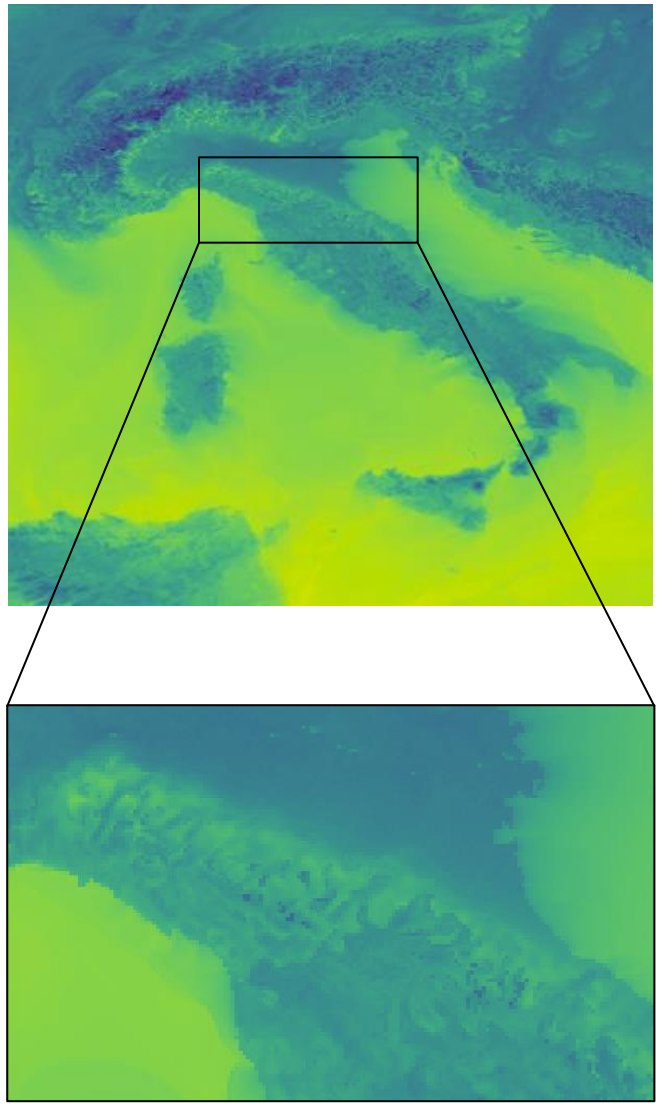

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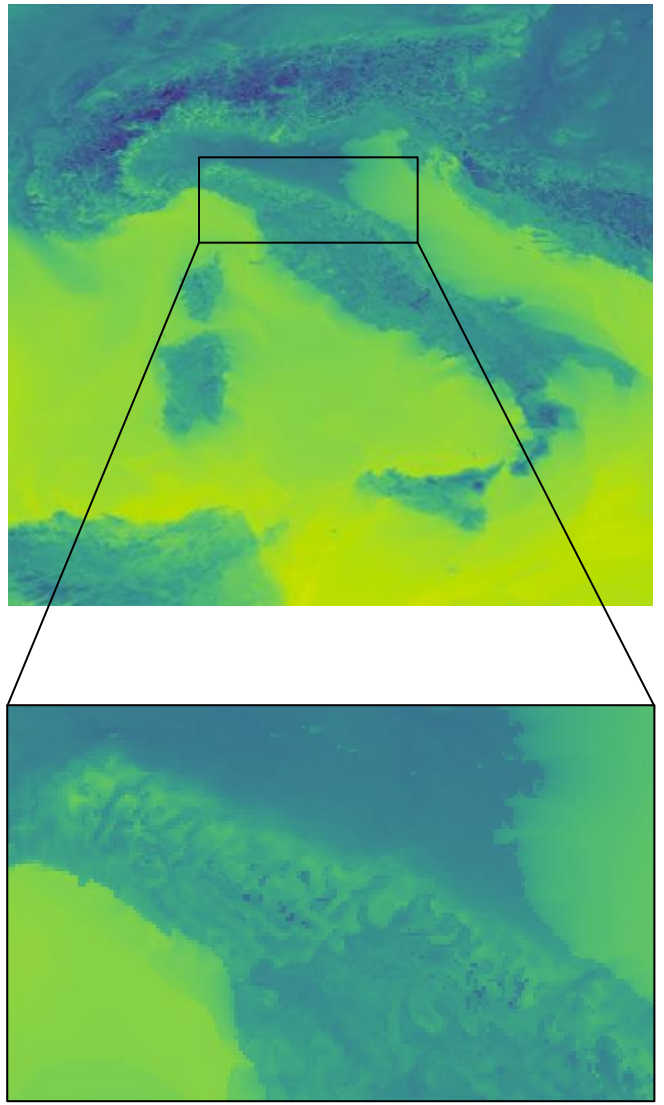

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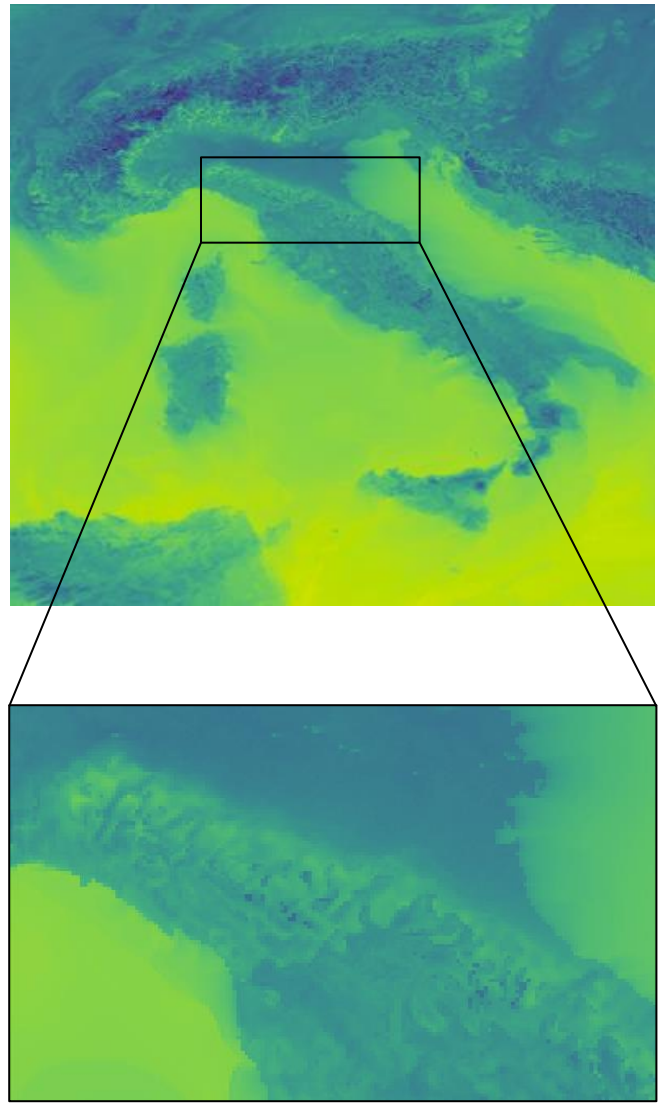

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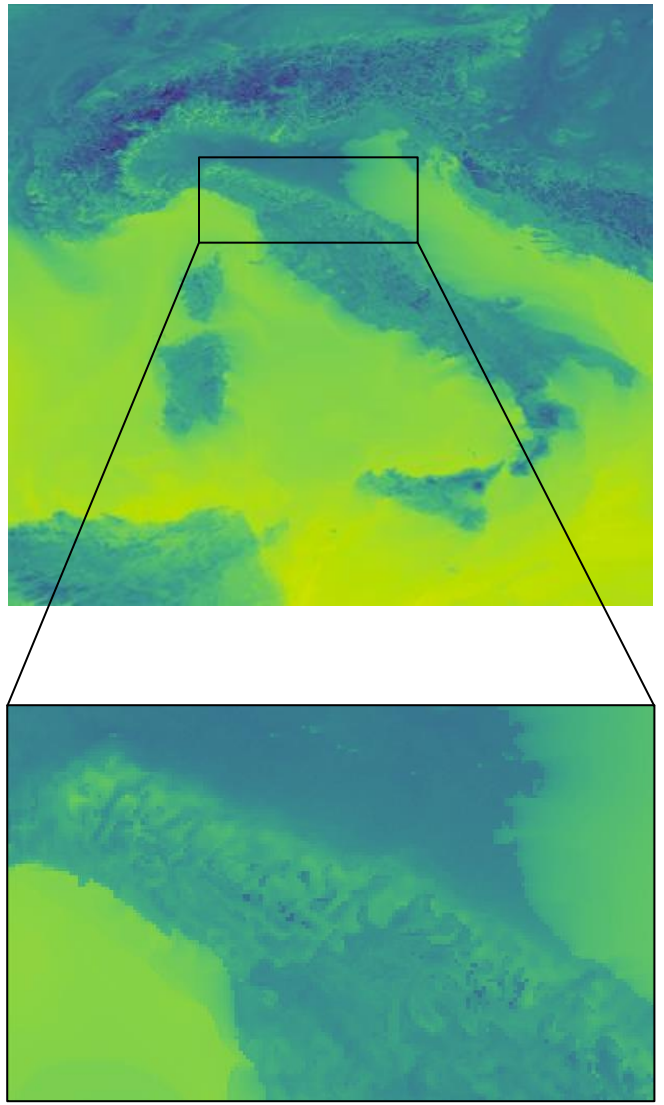
- **Output**: Probabilistic weather impact assessment system.



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Development of an automated pipeline for building feature extraction using Point Clouds and Street View Images for the city of Bologna

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1. **Point Clouds**:

- Apply **pre-trained semantic segmentation models** on city datasets
- Evaluate and adapt models to project-specific point cloud data

Work Package 4 Enhancements

Technical objective

Development of an automated pipeline for building feature extraction using Point Clouds and Street View Images for the city of Bologna

Methodology

1. **Point Clouds**:

- Apply **pre-trained semantic segmentation models** on city datasets
- Evaluate and adapt models to project-specific point cloud data

2. **Street View Images**:

- **Workflow** to extract building images:
  - Spatial data acquisition using OpenStreetMap (OSM)
  - Facade identification, orientation analysis, and panoramic image matching
  - Façade feature extraction (height, window-to-wall ratios etc.)

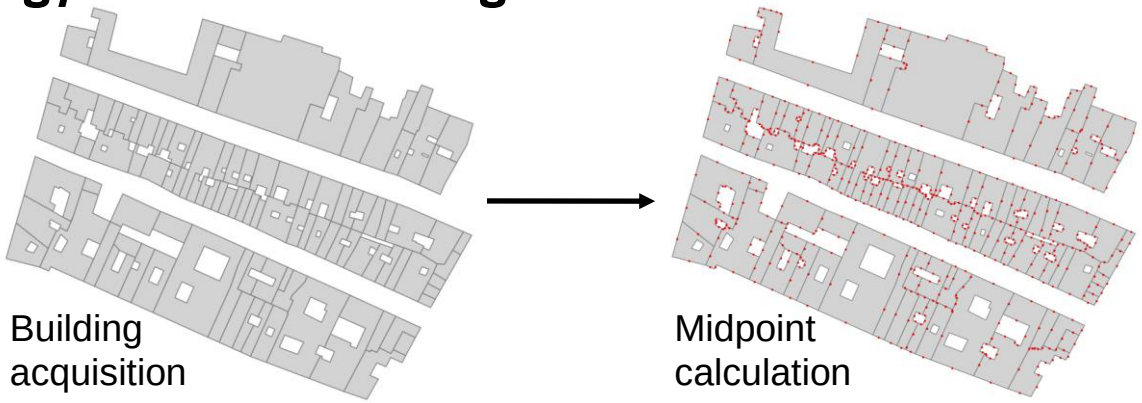
Work Package 4 Enhancements

Methodology – Street View Images in detail

Building acquisition

Work Package 4 Enhancements

Methodology – Street View Images in detail



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Methodology – Street View Images in detail

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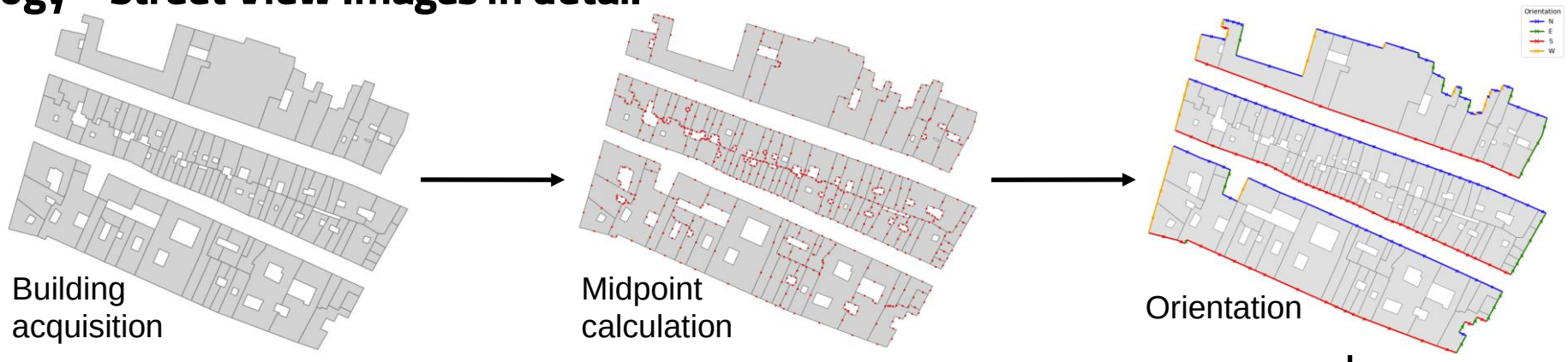

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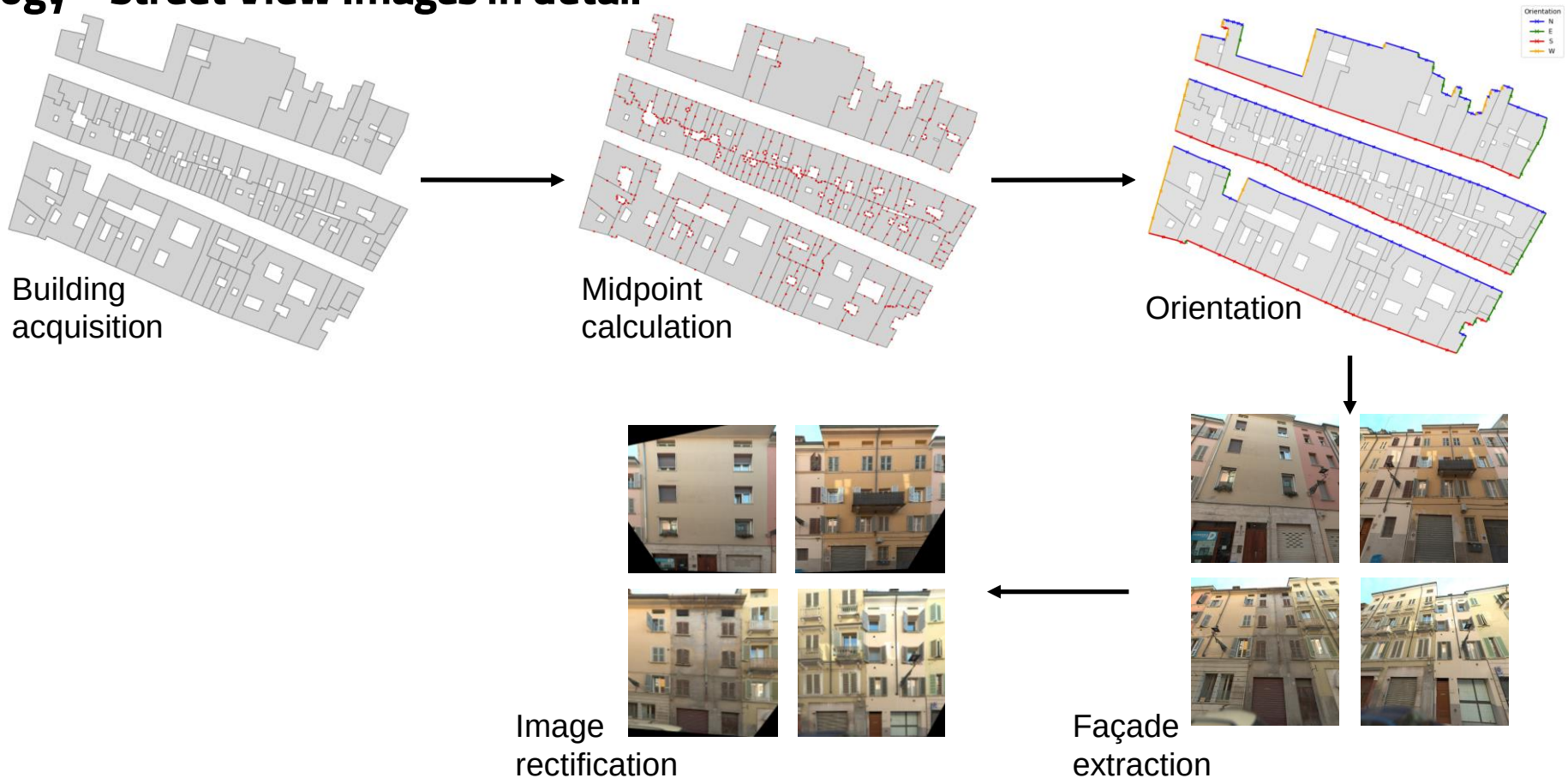

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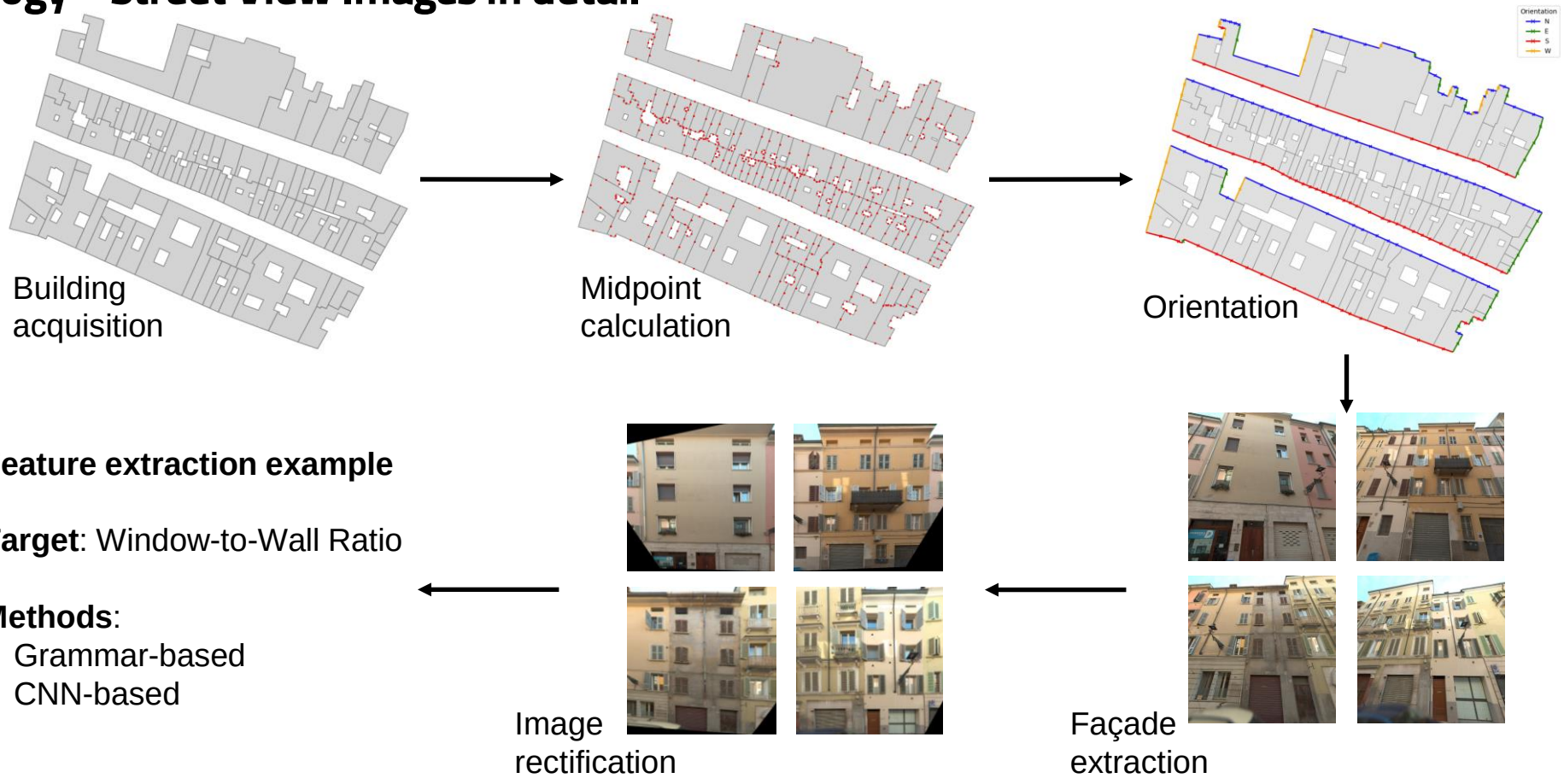

Feature extraction example

Target: Window-to-Wall Ratio

Methods:
- Grammar-based
- CNN-based

Main Results

The projects is slightly behind schedule due to time required to agree with partners on the activities, data availability and computational resources

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Activities completed: literature review, data collection and preprocessing (area of interest)
Delay reasons: time needed to define variable of interest and methodology in collaboration with partners, and computational resources not yet available

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Activities completed: literature review, data collection and preprocessing (area of interest)
Delay reasons: time needed to define variable of interest and methodology in collaboration with partners, and computational resources not yet available

Work Package 4: Built Environment Analysis
Activities completed: literature review, development of automatic workflow on sample dataset
Delay reasons: sample and study data provision delay time, hpc resources required to process large point cloud data

Next Steps

Computational Resources

- Resources will be available upon request to support the upcoming activities

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Work Package 3: Extreme Weather Events
- Finalize diffusion model architecture
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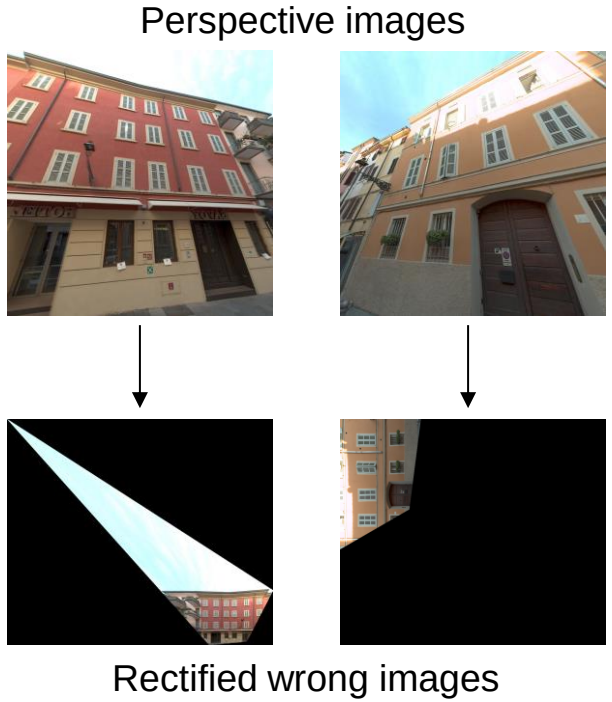
Work Package 4: Built Environment Analysis
- Refine **Street View image workflow** to address current limitations
- Develop workflow for **point clouds**
- Apply workflows to **case study datasets** for feature extraction



Thank you for the attention

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