
Semi-automatic SAR scene interpretation:

Examples using Intermap data

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January 19, 2007



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Outline

- The Remote Sensing Group at the University of Pavia has performed a rapid, first analysis of Intermap radar data samples, producing interesting results.
- At this point, very basic cartographic features are detected and discriminated, and this is the first step towards a more refined extraction.
- Samples were chosen to be representative of both rural and urban areas.
- The approach followed for the analysis is semi-automatic, i.e. it defines a sequence of operation which is basically the same for any scene, but whose parameters need to be tuned by a human operator to achieve the best possible results.



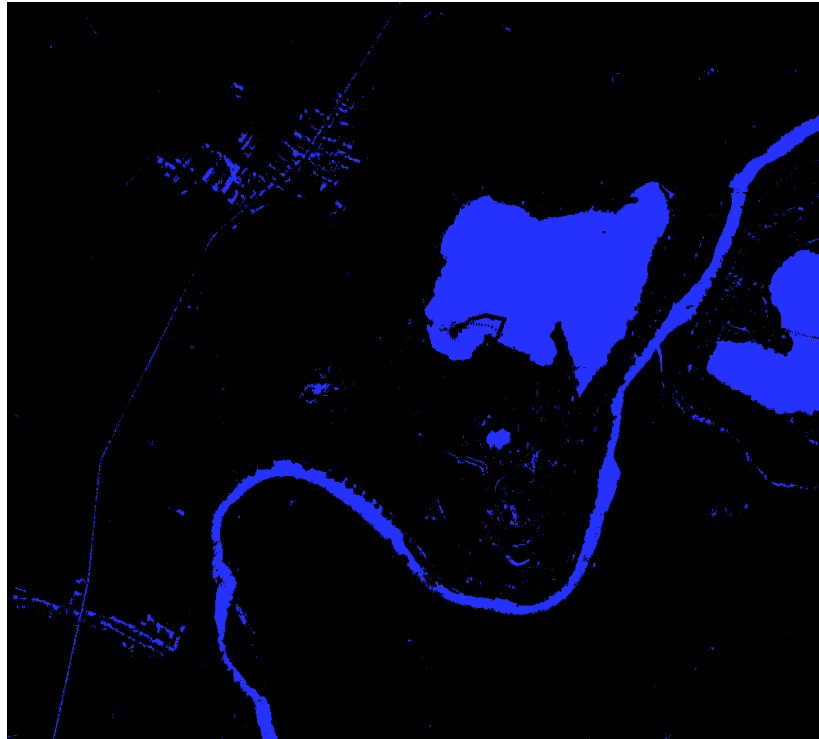
Two examples



- A rural & an urban scene



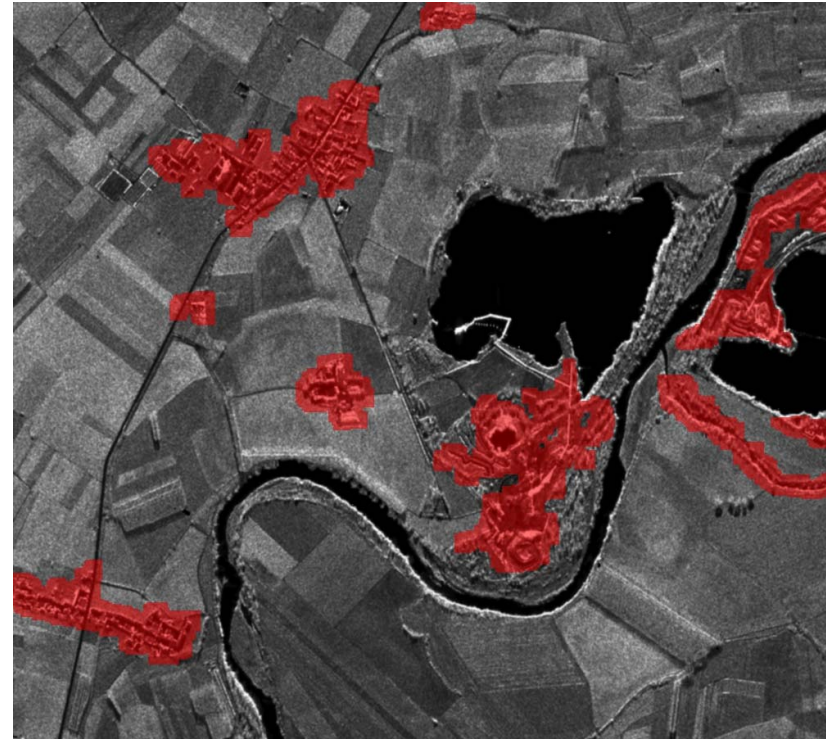
Rural scene: water bodies



- Water bodies are extracted thanks to a threshold operation over the original SAR image, followed by selective suppression of blobs and smart correction of contours



Rural scene: artificial structures



- Clues on the presence of man-made objects are given by textural features in the images, while geometrical constraints in addition to location and orientation help locating them and outlining them precisely.



Rural scene: trees



- Trees are recognized thanks to their textural properties and to their location with respect to other trees or to other elements in the scene such as water bodies.



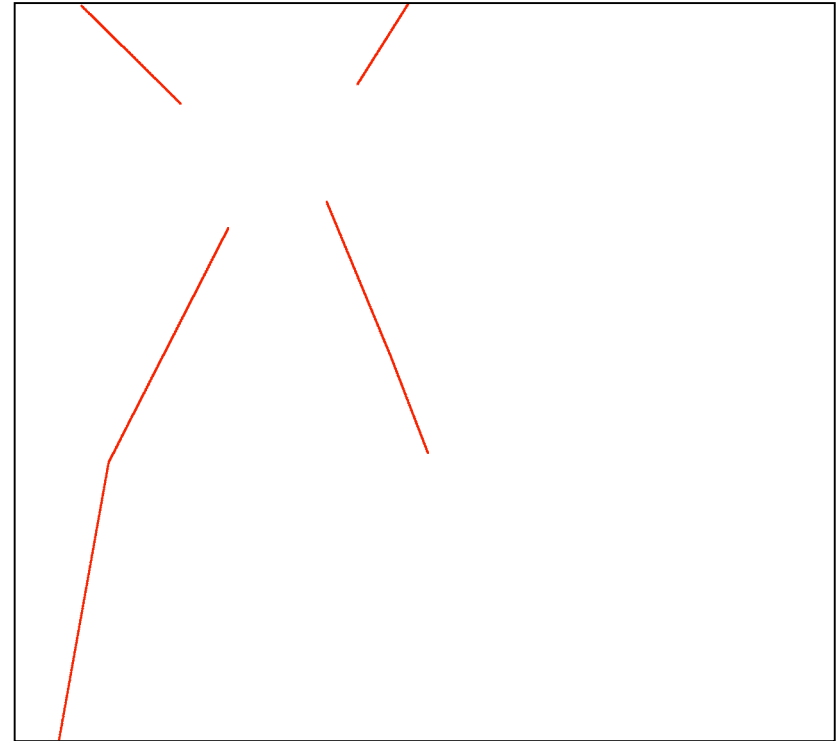
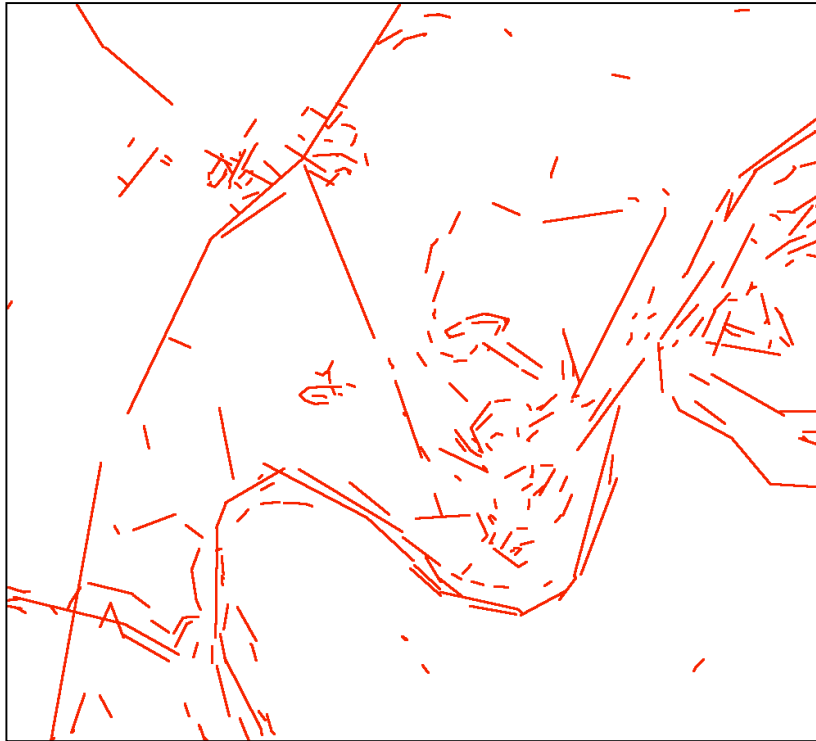
Rural scene: field boundaries



- Classification and segmentation provides a first subdivision of the fields in the rural area according to their backscattering behaviour.



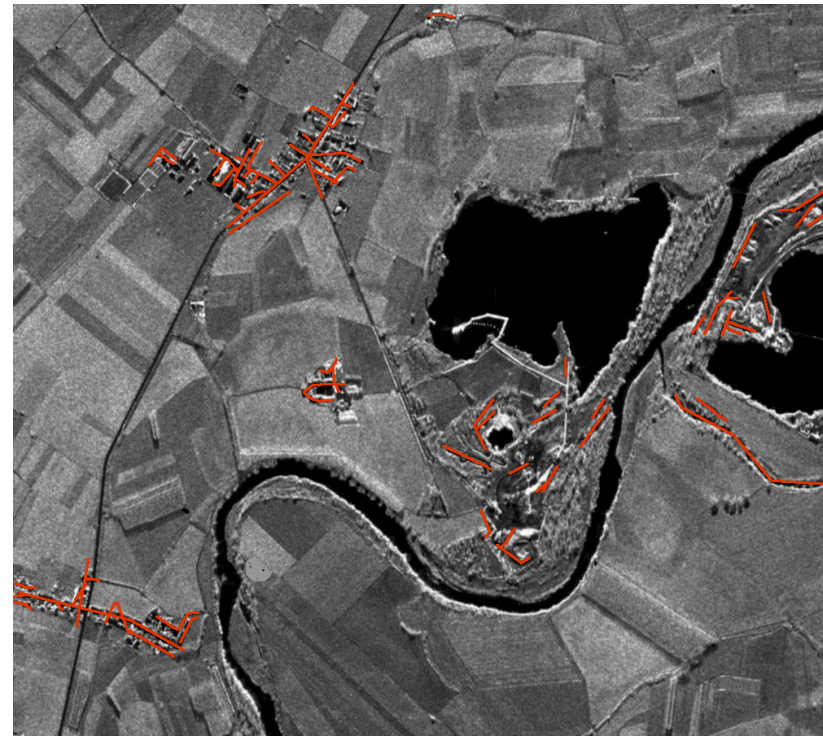
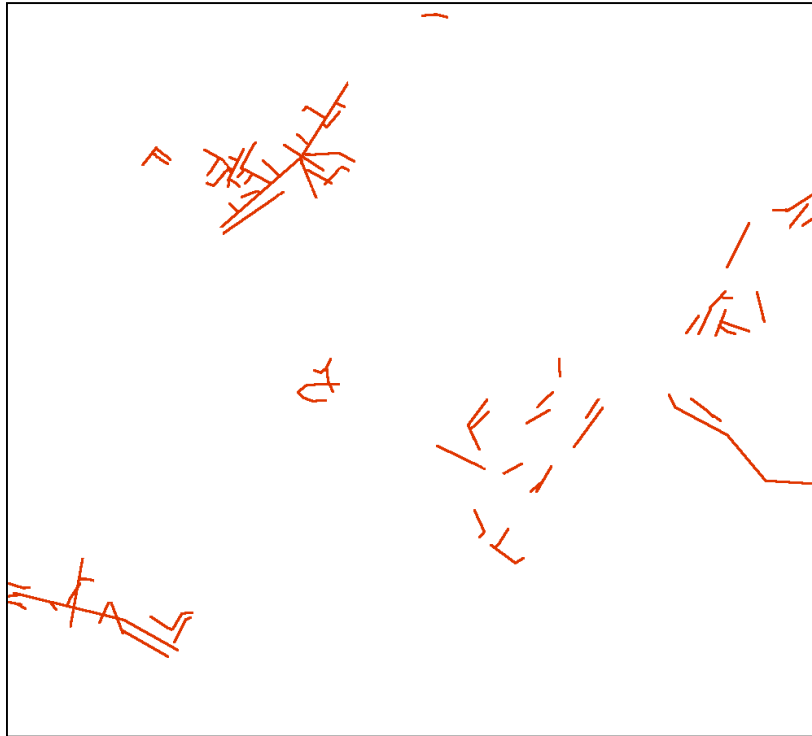
Rural scene: Outer roads



- Geometrical analysis helps in recognizing roads outside of man-made structures



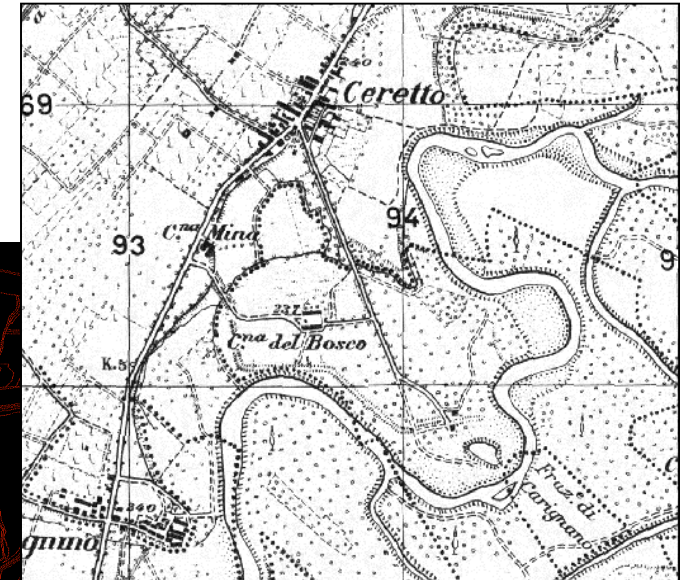
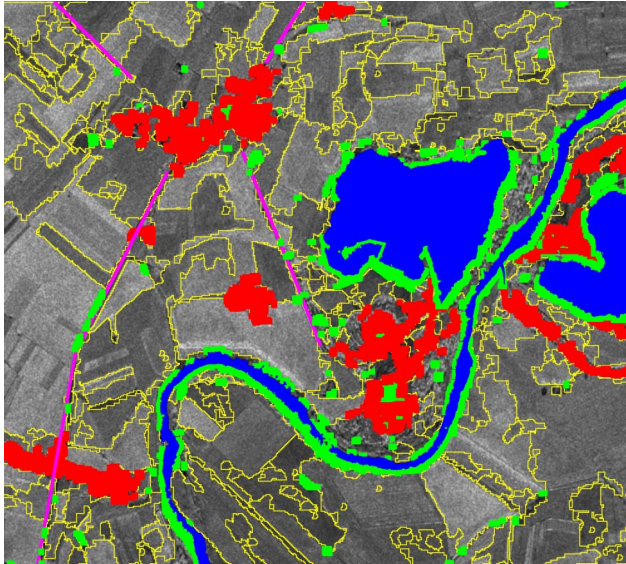
Rural scene: roads in artificial areas



- More precise knowledge of the urban road network structure improves road extraction inside recognized urban areas & man-made structures



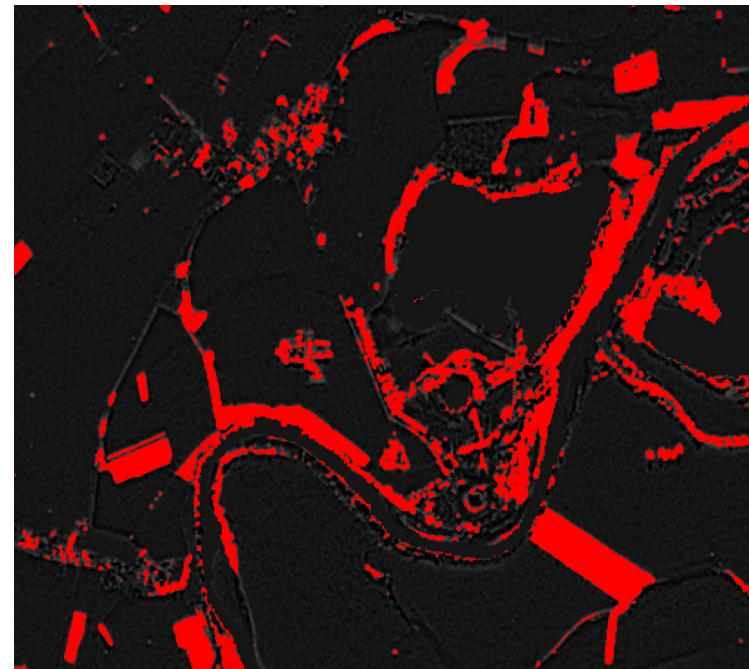
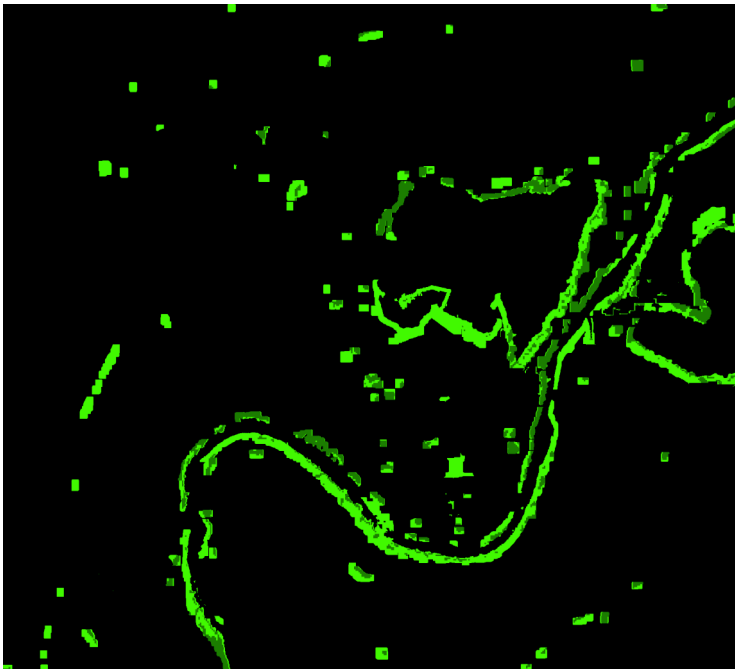
Rural scene: final comparison



- Quick outlook of the extracted features compared with the Piemonte Region cartographic maps for the same area.



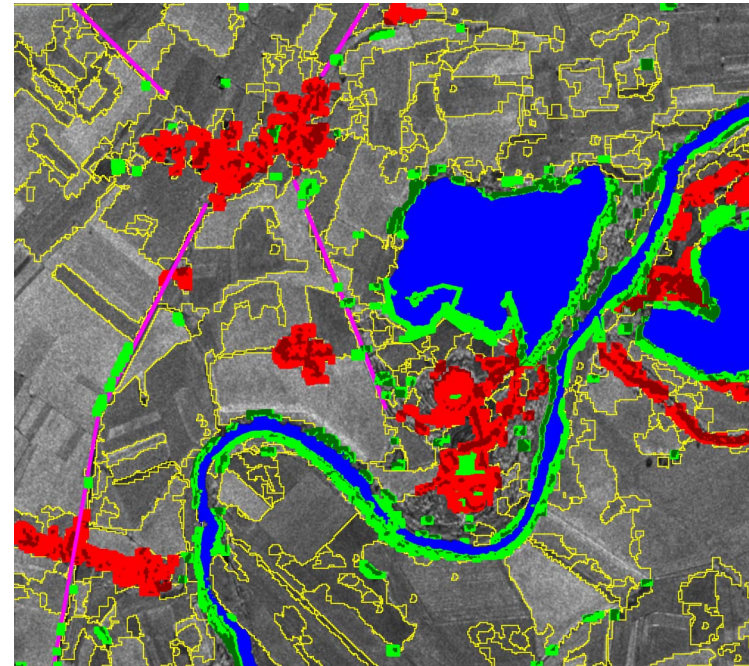
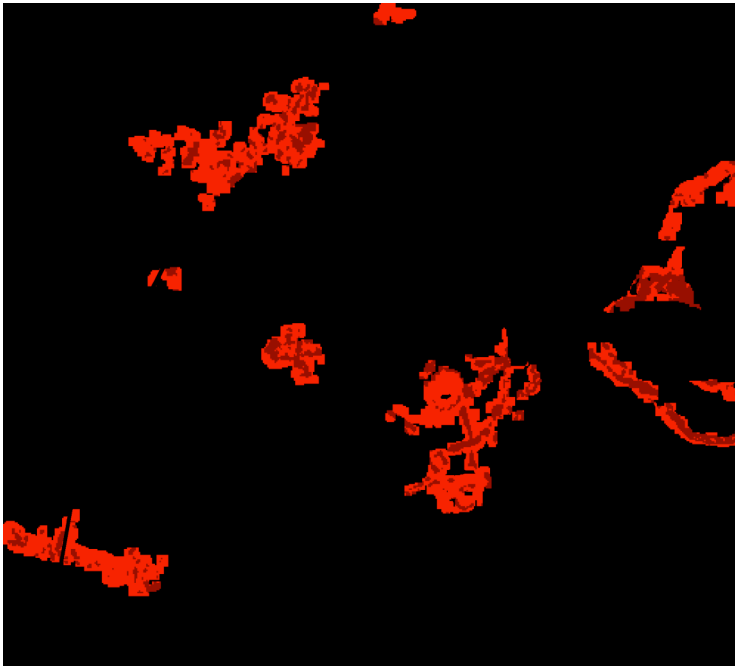
Rural scene: 3D refinement



- By combining the thematic maps in the previous slides with 3D data, it is possible to refine the characterization of some land use classes, notably vegetation, and detect soil areas at different heights.



Rural scene: 2D & 3D fusion



- Exploiting 2D and 3D information a more precise scene characterization is obtained, and some errors may be recovered.



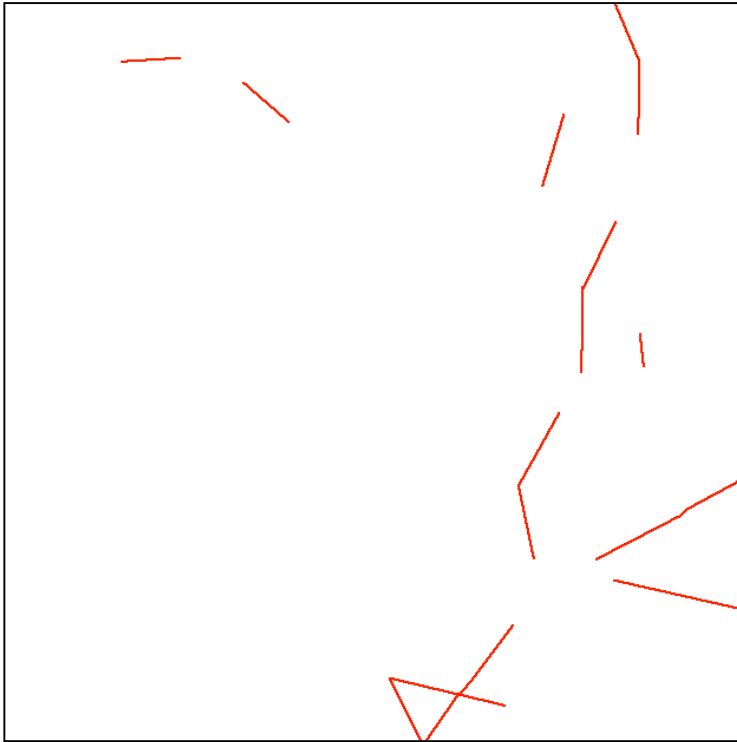
Urban scene: artificial structures



- Clues on the presence of man-made objects are given by textural features in the images, while geometrical constraints in addition to location and orientation help locating them and outlining them precisely.



Urban scene: outer roads



- Geometrical analysis helps in recognizing roads outside of man-made structures



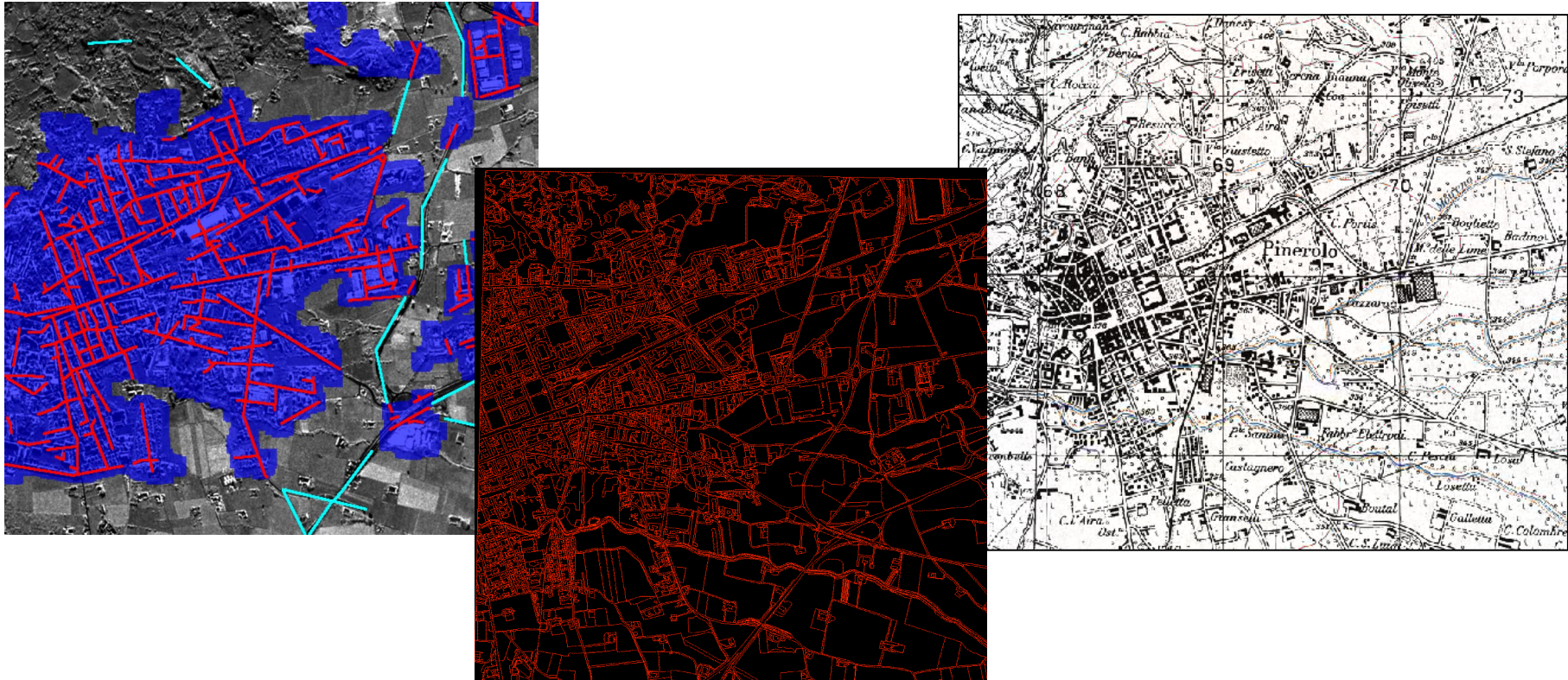
Urban scene: urban road network



- More precise knowledge of the urban road network structure improves road extraction inside recognized urban areas



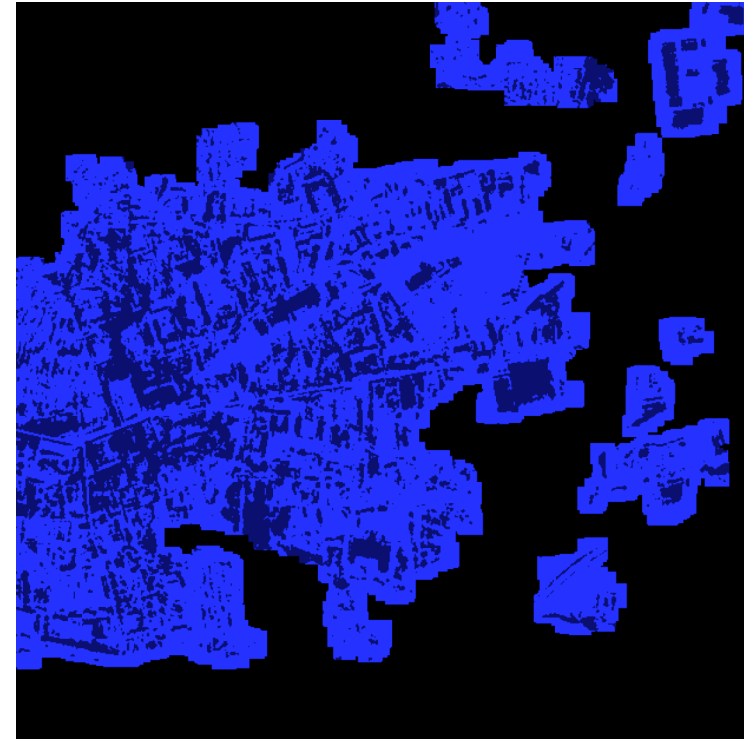
Urban scene: final comparison



- Quick outlook of the extracted features compared with the Piemonte Region cartographic maps for the same area.



Urban scene: 3D characterization



- The extraction of the most significant objects in 3D may be obtained by suitable thresholding of the Digital Building Model, DBM (DSM-DTM) inside the urban area. Because of the “spatial mean” effect of the IfSAR DSM and the slant to ground projection operation, only medium to large structures can be identified.



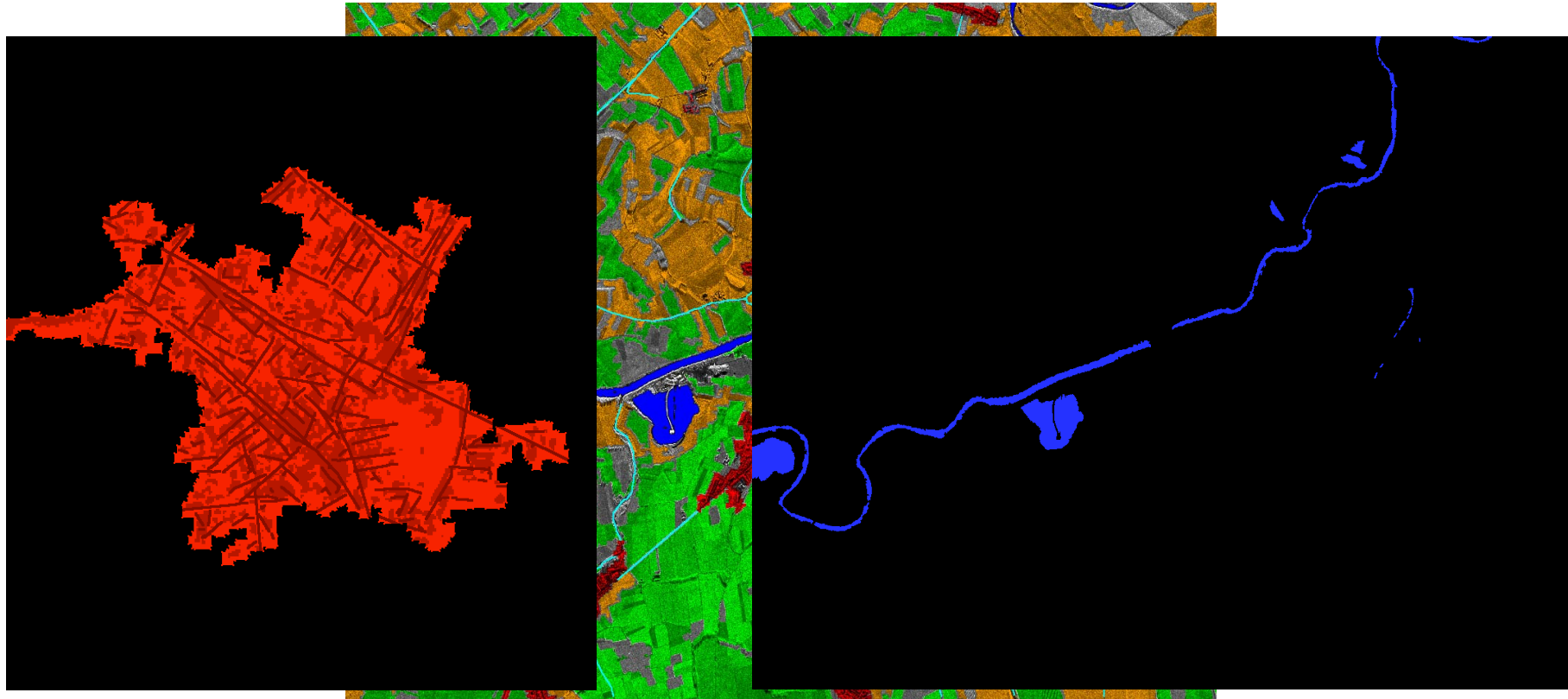
Urban scene: road network & 3D info



- It is possible to exploit the information on urban street height to improve the road network detection with respect to 2D-only characterization.



Intermap tile: full-scale analysis



- Semi-automatic approach, 1 working day, each object is saved and editable in vector format (.shp file)



Conclusions

- A first analysis of SAR scenes for the extraction of cartographic features is possible with appreciable results.
- A discussion with IGM is in order to find out which are the features of interest to focus on.
- At this point, a more precise definition of methods and resources for the cartographic feature extraction project needs to be carried out.
- A stronger connection with Intermap technical staff is required in order to obtain data not only in their final (IGM) version, but still in slant-range, with multiple views. This might bring to significant improvements in object detection and recognition, to our knowledge. Especially in urban areas,
- A very similar strict interaction would be required with respect to the flight planning of the NextMap Italy campaign. This would allow matching requirements by regional/local authorities or research institutes and possibly bring further funds to the campaign itself.

