Multiresolution classification of COSMO-SkyMed images and its possible extension to multisensor data

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Problem

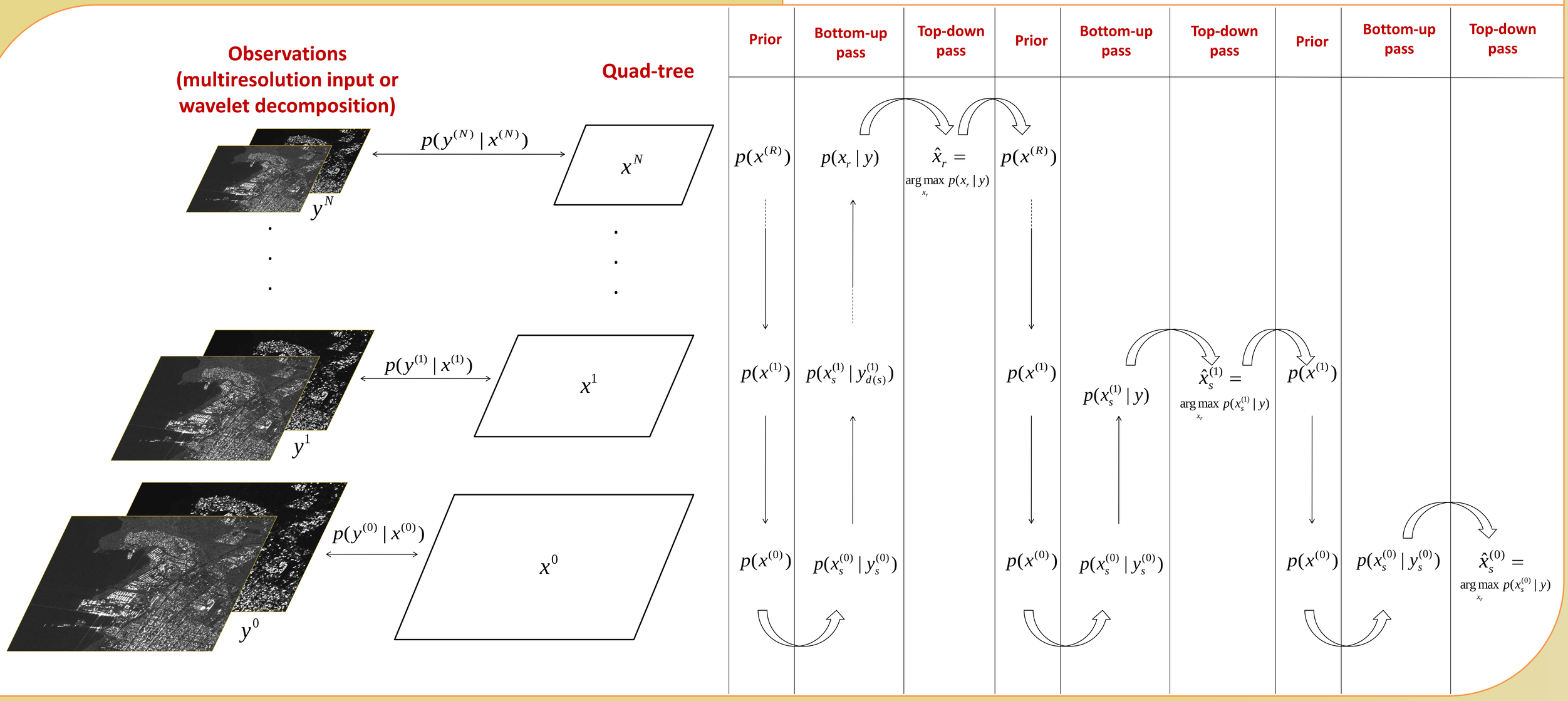
- Find a general classifier that deals with multiresolution, multisensor and multiband high resolution remote sensing images.
- Main application : Classification of urban areas in a context of natural risks.
- Main difficulties:
  - Heterogeneity of urban areas for VHR data
  - Speckle noise for SAR imagery
  - Generality of the model

Proposed solution

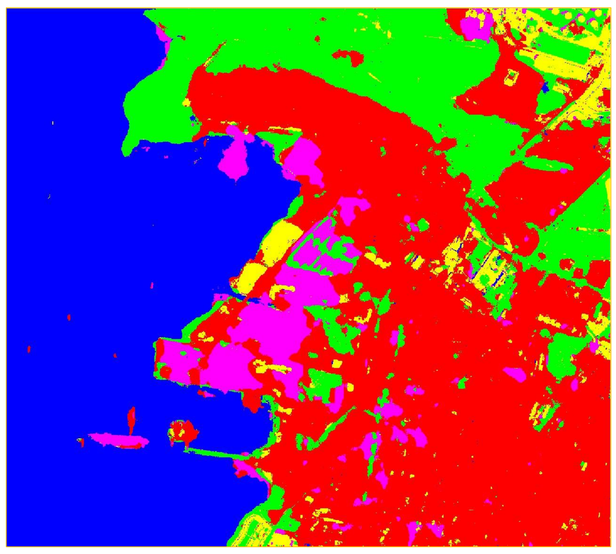
- Joint statistical modeling by using multivariate copulas: Each input band is modeled by a finite mixture (Gaussian mixtures for optical data and generalized gamma mixtures for SAR). For each class, we use copulas to model a joint PDF (probability density function). Bivariate case:

$$p_m(y^{(n)}|x_m^{(n)}) = p_{1m}(y_1^{(n)}|x_m^{(n)}).p_{2m}(y_2^{(n)}|x_m^{(n)})\frac{\partial^2 C_m^*\left(F_{1m}(y_1^{(n)}|x_m^{(n)}), F_{2m}(y_2^{(n)}|x_m^{(n)})\right)}{\partial y_1^{(n)}\partial y_2^{(n)}}$$

- Hierarchical Markovian model: use a MPM (marginal posterior mode) criterion with a prior update applied to a quad-tree.

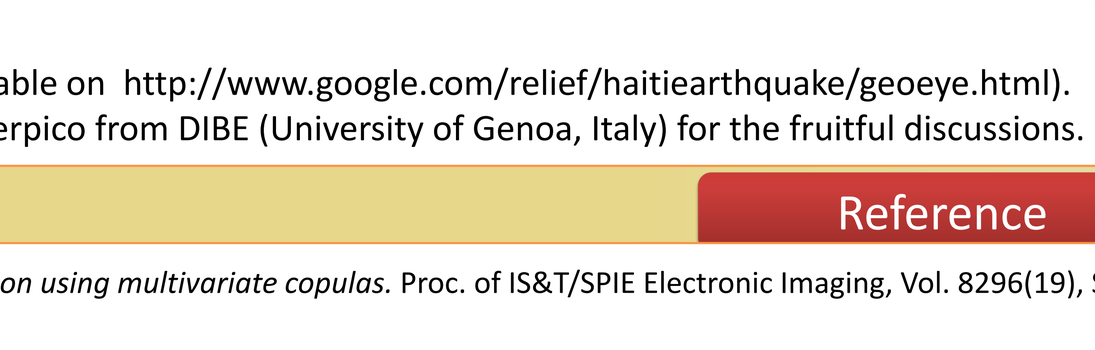


Classification map obtained with the proposed method for the Port-au-Prince quay (Haiti). Input: Coregistered panchromatic (©GeoEye, 2010) and SAR (COSMO-SkyMed, ©ASI, 2010) images. The decomposition is obtained by wavelet transform on 2 levels.



5 classes:
- Urban areas in red
- Containers in pink
- Sand in yellow
- Vegetation in green
- Water in blue

Classification map obtained with the proposed method for the area of Amiens (France). Input: Coregistered multiresolution single-pol COSMO-SkyMed images (©ASI, 2011) (Stripmap and PingPong acquisitions). 4 classes are considered here: water (in blue), urban areas (in red), vegetation (in green) and trees (in yellow).



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Reference

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