Directional mathematical morphology and path openings
application to the analysis of satellite remote sensing images from urban areas.

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The new generation of satellites provide images with a very high spatial resolution, down to less than 1 meter per pixel. Such images feature fine structures and thus enable an accurate analysis of urban areas. Numerous applications require an automated classification (urban planning, change detection for disaster management...). Geometrical characteristics can be extracted using mathematical morphology [1][2][5]: the morphological profile is computed for each pixel. This vector characterizes the local neighbourhood of every pixel and is used for a pixel-wise classification. However, the prior choice of a reference shape (structuring element) introduces a shape-bias. On the other hand, shape-free operators, such as area openings, are too general.

For this Master Thesis, we propose to study recently proposed directional morphological operators [4] and advanced filters such as path openings [3] in order to focus on anisotropic features (mostly the street network on images from urban areas). These operators take some geometrical constraints into account but remain flexible enough to fit natural situations (roads and streets are fairly rectilinear features but they might be curved as well). These operators will be adapted for remote sensing images (panchromatic data, multi- or hyperspectral data, radar data, respectively). These data having different characteristics (noisy or not, scalar or vector data), some theoretical derivations will be required. A classifier dedicated to street and road network extraction will be designed. Eventually, this classifier will be incorporated in a decision fusion frame [6]: in this frame various classifiers, be they general or dedicated, are merged in order to provide a robust and reliable classification.

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