

IDENTIFICATION OF URBAN OBJECTS USING SPECTRAL LIBRARY COMBINED WITH AIRBORNE HYPERSPECTRAL IMAGING

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Context and goals

Context:

- Urban territories are highly **heterogeneous**.
- Different **materials**: roofing's, roads, urban vegetation, bare soils, etc.
- Different levels of **deterioration**.

Goals:

- The interest of hyperspectral imagery to: detect, recognize, and characterize urban objects.
- Characterize urban objects by radiometric information (high spectral resolution).

A composite image showing four trees in different stages of autumn foliage. The top-left tree has light green leaves, the top-right has bright green leaves, the bottom-left has bright yellow leaves, and the bottom-right has bare, brown branches. All trees are set against a plain white background.

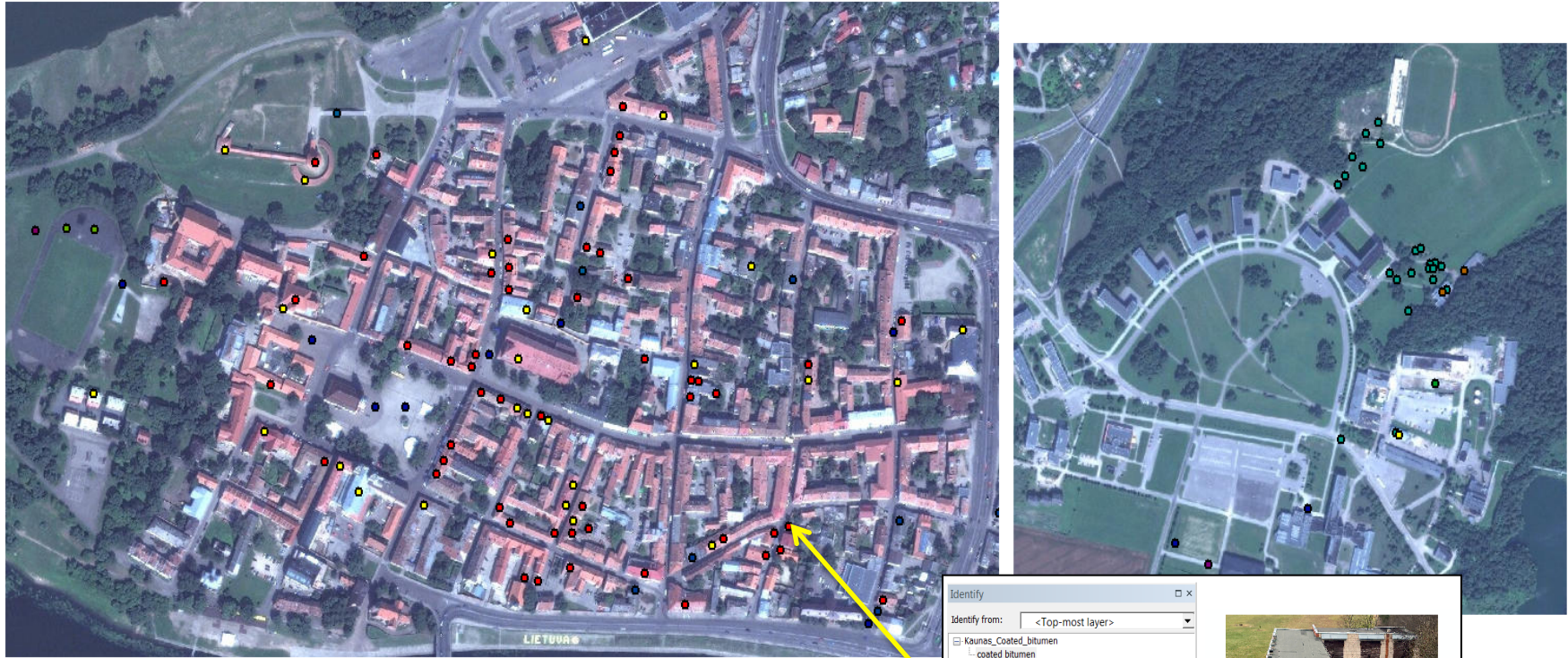


(3)

Urban Spectral Library (Kaunas, Lituanie)

- **Spectral library** acquisition (Vis-NIR) in July 2015 of various urban materials in the city of Kaunas (Lithuania) updated in April 2016.
- **Roofing's**: painted steel, asbestos, tile, fibre cement, aluminum, old steel, bitumen.
- **Roads** : asphalt (old and new), paved (new and old), bare soil.
- **Vegetation**: grass, and various trees species (deciduous and coniferous).
- At the moment around **fifty measured materials**.

Geographic Information System (GIS)



Sample n° xx:

- Coordiantes
- Common name
- Color
- State
- Ground picture (dated)

Sample n° xx

Identify

Identify from: <Top-most layer>

Kaunas_Coated_bitumen
coated bitumen

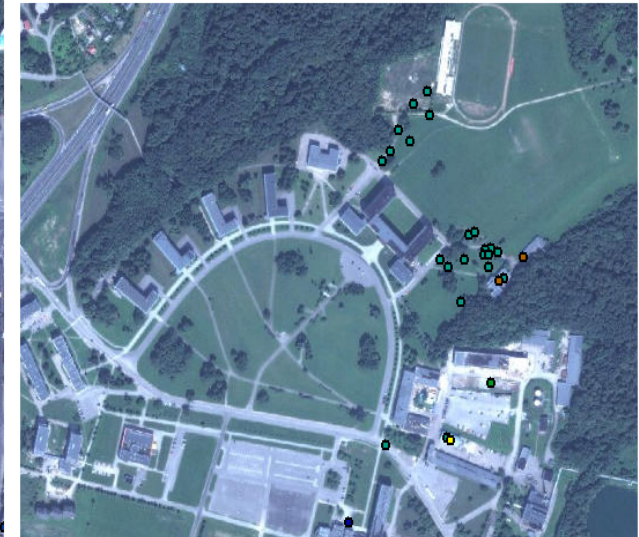
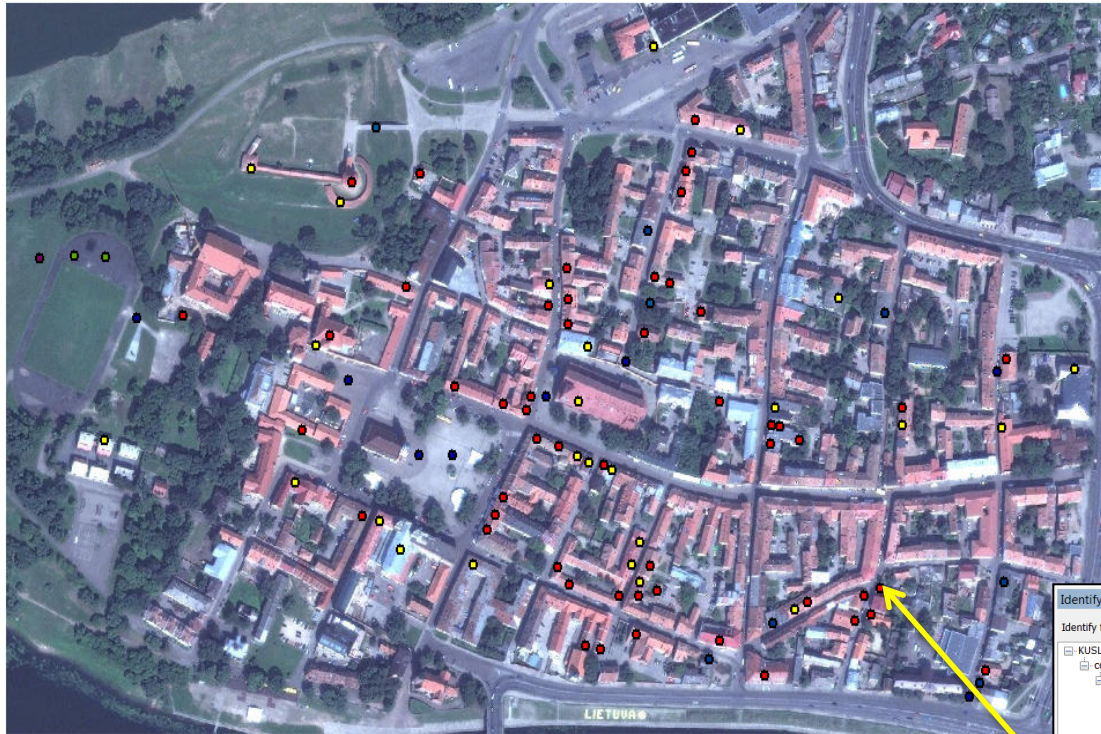
Location: 489 642,739 6 084 190,004 Meters

Field	Value
OBJECTID	2
Shape	Point
MATERIAL_1	coated bitumen
colour	grey (dark)
STATE	new
IMAGE	<Raster>
image_date	december 2015

Identified 1 feature

Table Of Contents Identify

Geographic Information System (GIS)

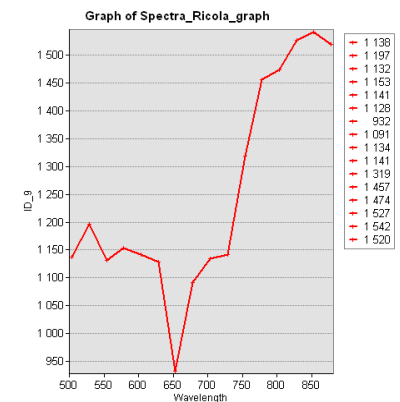


Sample n° xx:

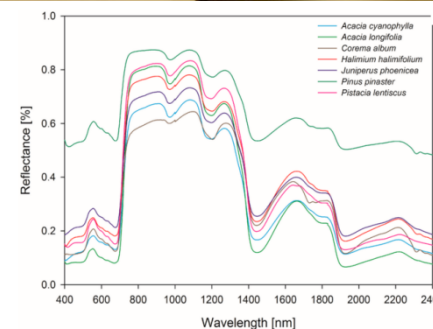
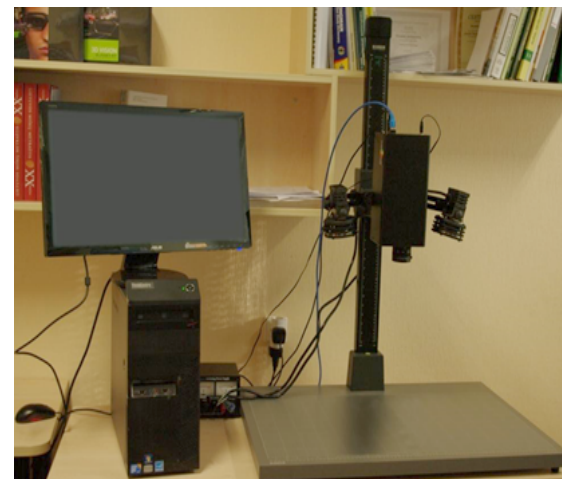
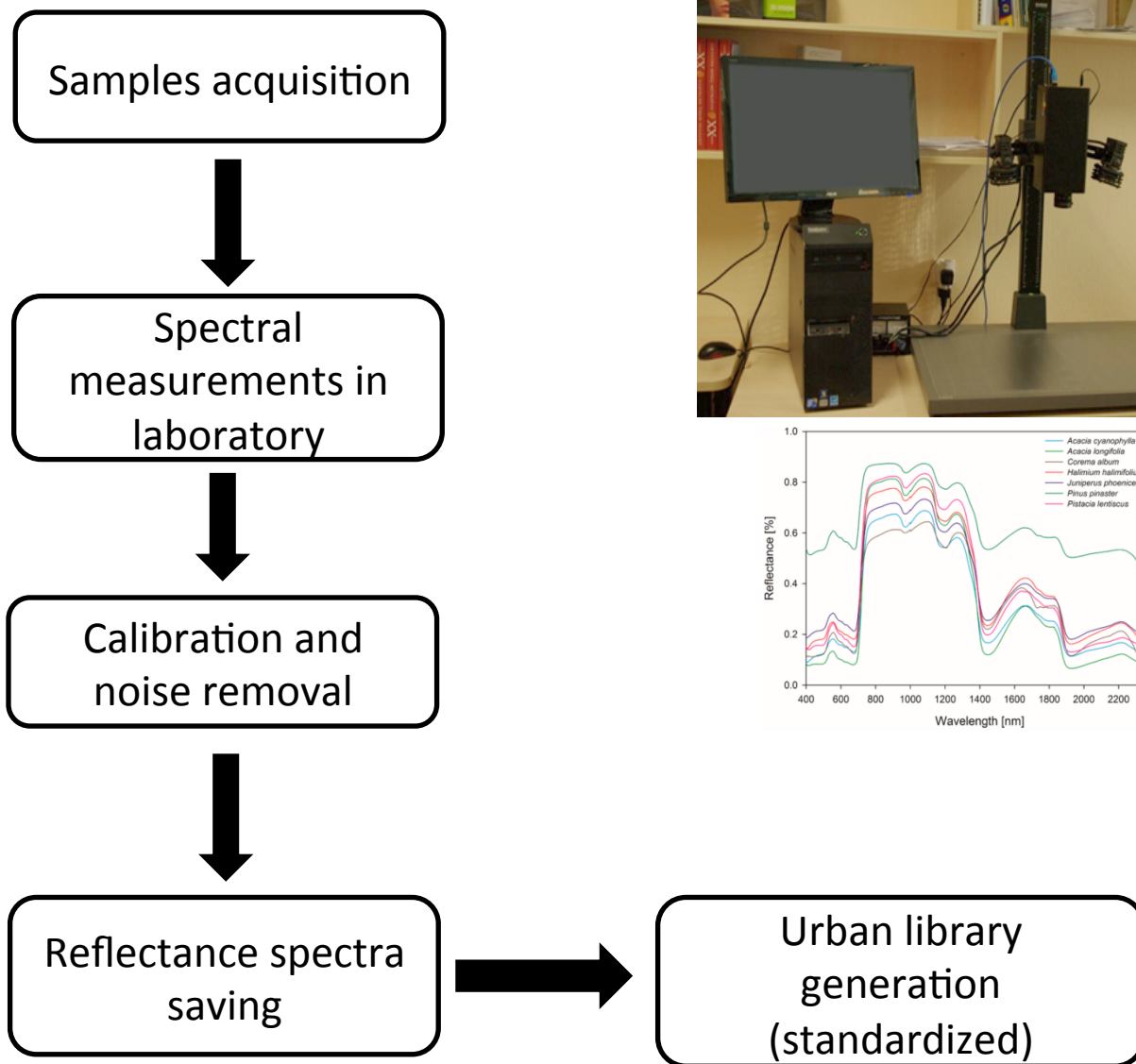
-spectral signature

Sample n° xx

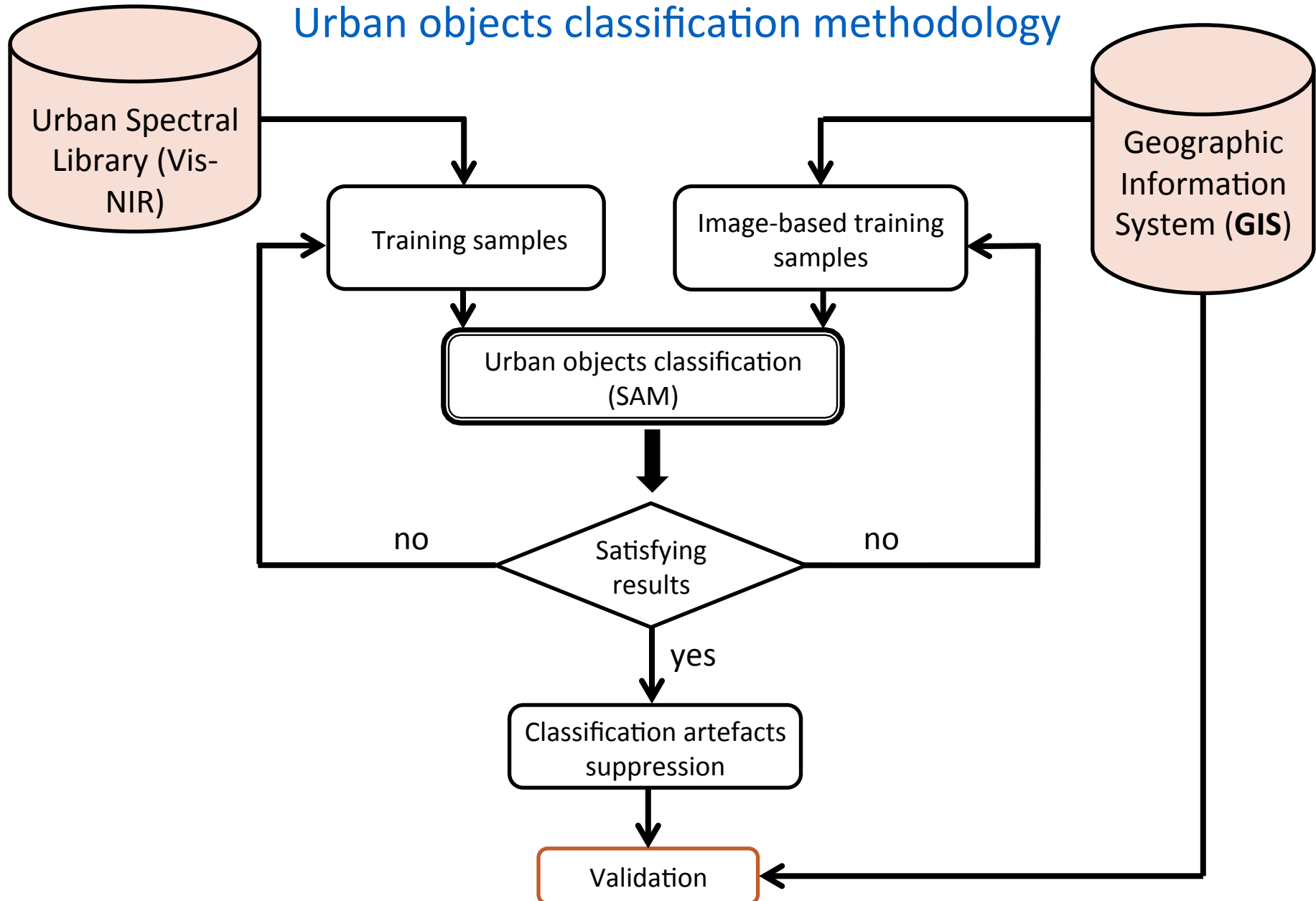
Identify	
Identify from: <Top-most layer>	
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Location: [All]	
Field	Value
OBJECTID	9
ID	8
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BAND_2	1697
BAND_3	1563
BAND_4	1558
BAND_5	1511
BAND_6	1579
BAND_7	1509
BAND_8	1616
BAND_9	1574
BAND_10	1725
BAND_11	1901
BAND_12	2035
BAND_13	2227
BAND_14	2128
BAND_15	2241
BAND_16	2284
Identified 1 feature	



Urban Spectral Library (Kaunas, Lithuania)



Urban objects classification methodology



Urban objects classification 1 (SAM)



Original test zone (True colors, Kaunas)

Urban objects classification 1 (SAM)



■ Asphalt and shade	■ Trees (coniferous)
■ Tile	■ Pavements
■ Red painted steel	■ Clear painted steel
■ Grass	■ Dark painted steel/bitumen
■ Trees (deciduous)	

Urban objects classification (SAM)

- Accurate identification of tile roofing's (accuracy of 75%).
- Accurate identification of steel painted roofing's (accuracy of 70%)
- Accurate identification of grass and trees (accuracy of 80%), differentiation between deciduous and coniferous seems consistent but lack of validation zones at this moment.
- Moderately accurate identification of pavements (45%), existence of spectral correlation with roads.
- Bitumen roofing's were not detectable; high correlation with roads and dark steel roofing's.

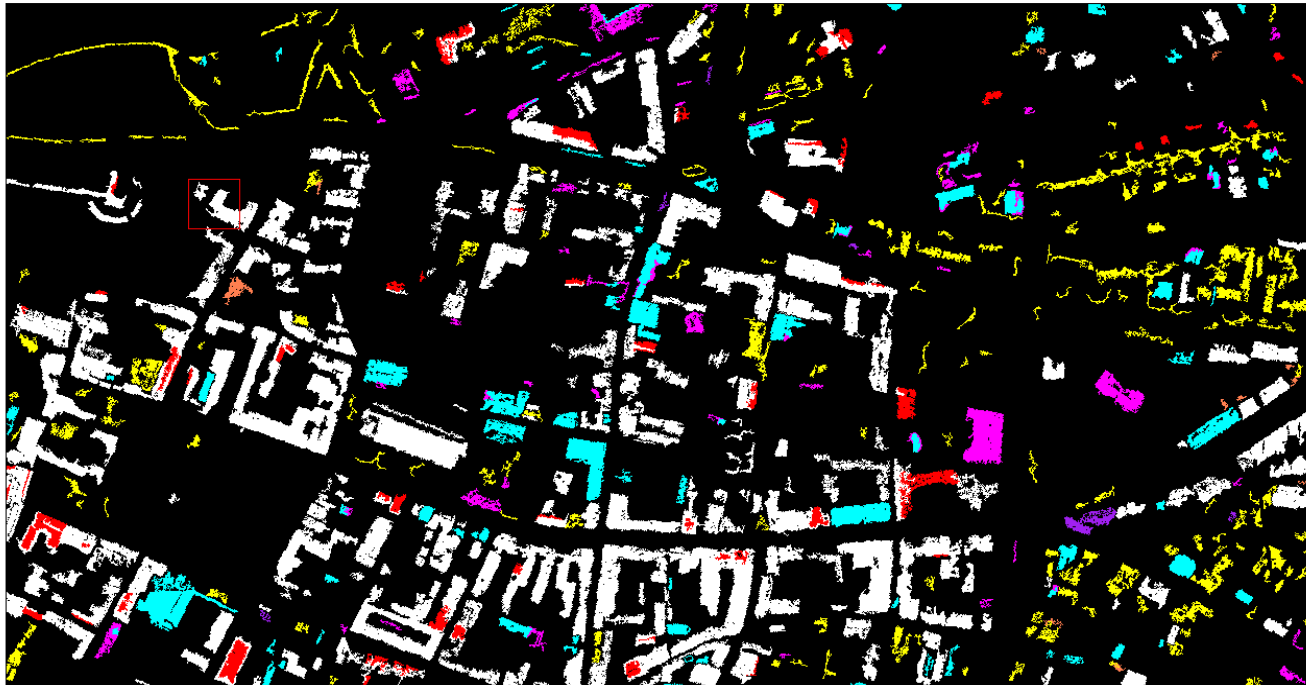
→ overall accuracy : 67%

Urban objects classification (SAM)



Original test zone (True colors, Kaunas)

Urban objects classification (SAM)



- Tile
- Painted metal (dark)
- Painted metal (clear brown)
- Painted metal (red)
- Painted metal (clear)
- Painted tile (dark)
- Asbestos

Roofing's classification (SAM)

- Accurate identification of tile roofing's (accuracy of 75%).
- Accurate identification of steel painted roofing's (accuracy of 80%)
- Asbestos roofing's were hardly detectable due to their correlation with roads, recognition is possible if the training samples are representatives (accuracy of 60 %).
- Bitumen roofing's were not detectable; highly correlated with roads and dark steel roofing's.

→overall accuracy : 72%

Urban objects classification (Results)

- Generally **encouraging results** with fair recognition of urban materials (overall accuracy around 70 %).
- **Limits:**

Limited spectral resolution: 16 bands in Vis-NIR.

No SWIR bands available (Short Wave Infrared).

Enrichment of the spectral library is planned.

Futurs work

- Next hyperspectral campaign planned in Kaunas in august 2016.
- Increasing of the spectral bands number to 100 bands is planned (Vis-NIR).
- Acquisition of a SWIR sensor? to be discussed



Thank you for your attention

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