



TOLOMEO

TOoLs for Open Multi-risk
assessment using Earth Observation data

TOLOMEO – WP4 – Protocol

Road Extraction/Crossing Detection Chain

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1. Introduction

The project “Tools for Open Multi-Risk Assessment using Earth Observation Data” (TOLOMEO) is funded under the Marie Curie International Research Staff Exchange Scheme (PIRSES-GA-2009) with the ultimate goal to establish an international cooperation between partners in Europe and South-America focused on the development of free tools for remotely sensed data analysis.

The TOLOMEO project is composed by eight different work packages (WP). The WP 4, named ‘Earthquake Physical Vulnerability’ (ERVU), has the aim to define a tool for the extraction of the physical vulnerability of building structures using Earth Observation data sets with different spatial resolution, recorded by optical and SAR instruments.

In this framework, a method was developed to extract roads and detect road crossings on Remote Sensing (RS) images. The next section describes the steps to perform the road extraction and road crossing detection.

2. Methodology - Road Extraction

The software used for this protocol is InterIMAGE v1.41. The method that will be described in the first part of this document allows the extraction of roads.

New Project

First of all, it is necessary to define a new project:

- 1) Start InterIMAGE.
- 2) In the toolbar click on *File/New Project*.
- 3) In the ‘Project’ section, type a name for the project, then click the *Browse Folder*  icon and set a folder.

NOTE: Make sure the keys, names and paths in your project don’t have white spaces or non-ASCII characters, otherwise InterIMAGE won’t run properly.

- 4) In the ‘Resources’ section, click the *Browse Resources*  icon and select the input image, then type ‘image’ as the name that will identify it in ‘key’. Check the box  named ‘Default Image’. Once complete click the *Add* icon  in ‘Resource List’.

5) Click 'OK'.

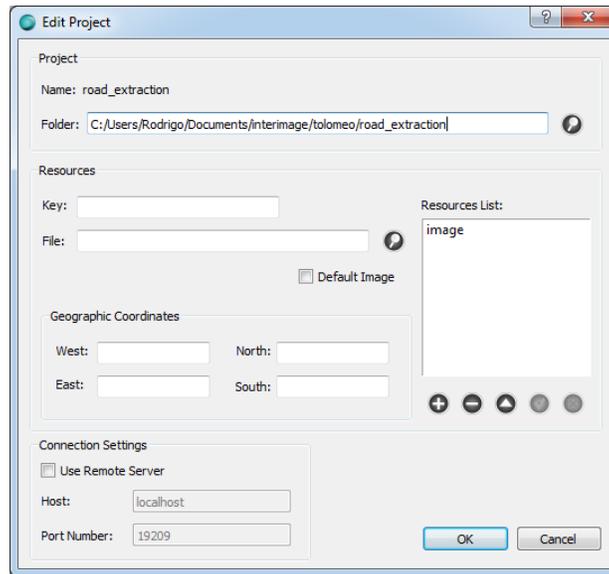


Figure 1. 'New Project' window.

Define the Semantic Network - 'Roads' node

Now that the project is defined, we can define the semantic network. Firstly, we set up the 'Roads' node:

- 1) In the 'Semantic Net' window, right click on the 'Scene' block Scene and select *Insert Child/Node*.
- 2) Select the node just created with the left mouse button.
- 3) In the 'Node Editor' window, type 'Roads' as the name for the 'Class' and select the red color in 'Color'.
- 4) Select the 'BREC Road Extraction' operator from the 'TopDown Operator' list.
- 5) In the 'TopDown' sub-section of the 'Semantic Net' section must be defined the parameters of the operator:
 - a. Select 'image' as 'Input Image';
 - b. Type '5' for 'Min. Radius';
 - c. Type '40' for 'Max. Radius';
 - d. Type '5' for 'Step Radius'.

NOTE: The parameter values are optimized for the example data. For different sensors, different values must be searched.

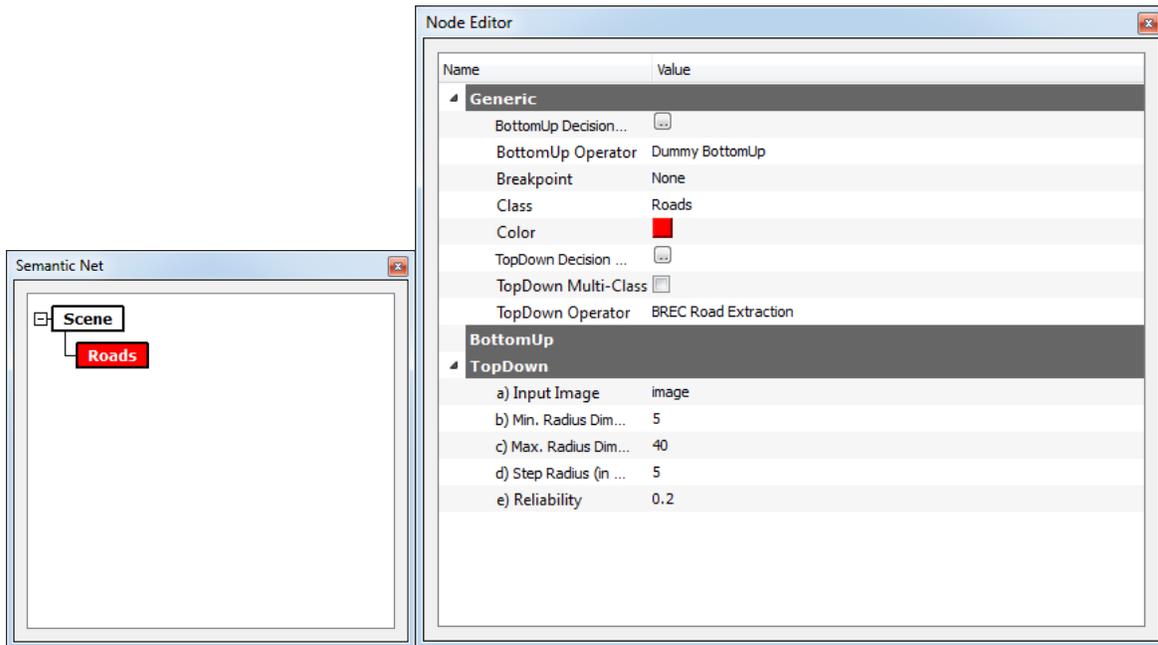


Figure 2. 'Semantic Net' and 'Node Editor' windows.

To the 'Roads' semantic node was associated the 'BREC Road Extraction' operator that extracts roads based on spectral data.

Execute the Project

Finally, the project can be executed:

1) In the toolbar click on *File/Save Project*.

2) Click the 'Execute' icon  (Top-Left) to run start the processing.

The result show the polygons that represent the roads extracted.

Export the Result

The result of the processing could be exported as ESRI Shapefile:

- 1) In the 'Layers' window, select the 'Result' layer with left click.
- 2) Click the 'Export' icon . A new window with name 'Export Shapefile' will pop-up.
- 3) Click the 'Class' block , then select 'All', then click 'OK'.
- 4) Click 'OK'. A new window with name 'Choose Shapefile' will pop-up.
- 5) Select the location and the name for the Shapefile that will be created.
- 6) Click 'OK'.

3. Methodology - Crossing Detection

In this second part we will describe the method that allows the detection of road crossings.

New Project

First of all, it is necessary to define a new project:

- 1) Start InterIMAGE.
- 2) In the toolbar click on *File/New Project*.
- 3) In the 'Project' section, type a name for the project, then click the *Browse Folder* icon  and set a folder.

NOTE: Make sure the keys, names and paths in your project don't have white spaces or non-ASCII characters, otherwise InterIMAGE won't run properly.

- 4) In the 'Resources' section, click the *Browse Resources* icon  and select the input image, then type 'image' as the name that will identify it in 'key'. Check the box  named 'Default Image'. Once complete click the *Add* icon  in 'Resource List'.
- 5) Click 'OK'.

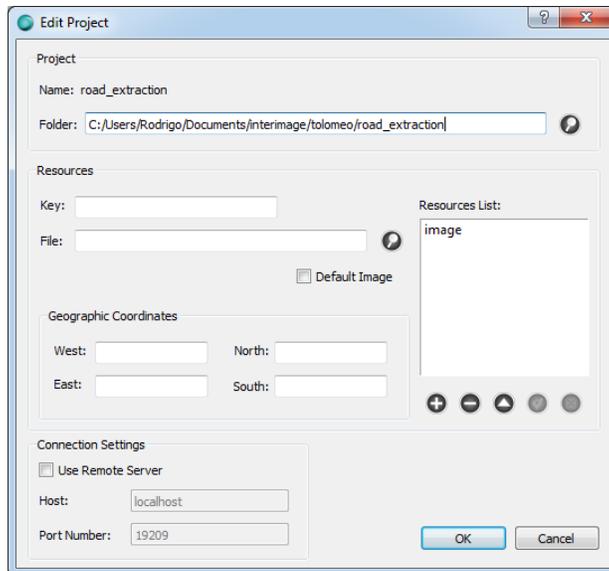


Figure 3. 'New Project' window.

Define the Semantic Network - 'Crossings' node

Now that the project is defined, we can define the semantic network. Firstly, we set up the 'Crossings' node:

- 1) In the 'Semantic Net' window, right click on the 'Scene' block Scene and select *Insert Child/Node*.
- 2) Select the node just created with the left mouse button.
- 3) In the 'Node Editor' window, type 'Crossings' as the name for the 'Class' and select the red color in 'Color'.
- 4) Select the 'BREC Cross Detection' operator from the 'TopDown Operator' list.
- 5) In the 'TopDown' sub-section of the 'Semantic Net' section must be defined the parameters of the operator:
 - a. Select 'image' as 'Input Image';
 - b. Type '5' for 'Min. Radius';
 - c. Type '40' for 'Max. Radius';
 - d. Type '5' for 'Step Radius';
 - e. Select 'all' for 'Junction Typology';

- f. Type '10' for 'Angle Threshold';
- g. Type '3' for 'Max. Stem';
- h. Type '10' for 'Max. Gap';
- i. Type '3' for 'Min. Junction';
- j. Type '10' for 'Angle Tolerance';
- k. Type '6' for 'Max. Number of Roads'.

NOTE: The parameter values are optimized for the example data. For different sensors, different values must be searched.

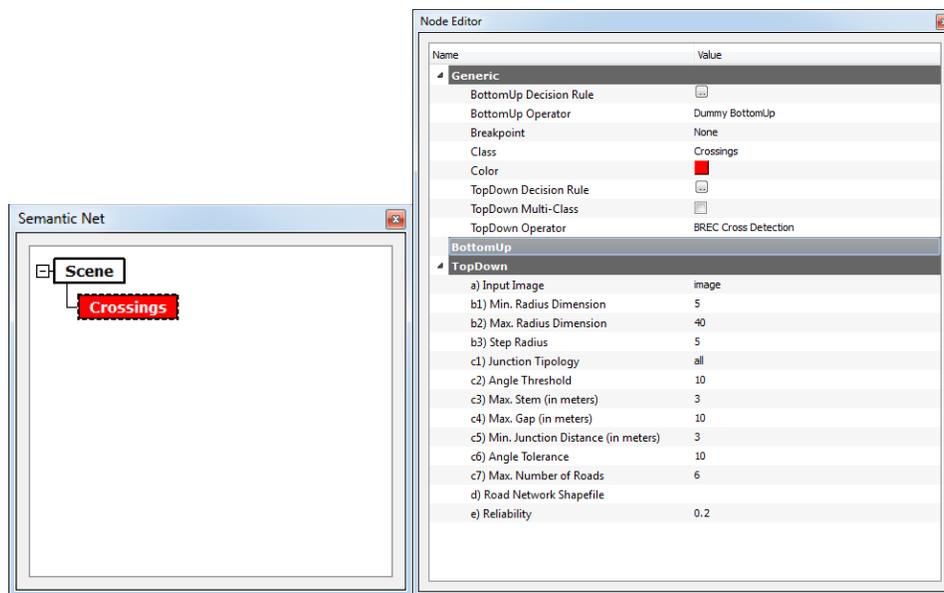


Figure 4. 'Semantic Net' and 'Node Editor' windows.

To the 'Crossings' semantic node was associated the 'BREC Cross Detection' operator that detects road crossings based on spectral data. In this operator, firstly a road extraction procedure is executed and then the crossings are detected. Another possibility is to provide a road network shapefile setting the 'Road Network Shapefile' parameter where the operator would skip the road extraction procedure and detect the crossings based on the shapefile provided.

Execute the Project

Finally, the project can be executed:

- 3) In the toolbar click on *File/Save Project*.

- 4) Click the 'Execute' icon  (Top-Left) to run start the processing.

The result show the polygons that represent the road crossings detected.

Export the Result

The result of the processing could be exported as ESRI Shapefile:

- 7) In the 'Layers' window, select the 'Result' layer with left click.

- 8) Click the 'Export' icon  . A new window with name 'Export Shapefile' will pop-up.

- 9) Click the 'Class' block  , then select 'All' , then click 'OK'.

- 10) Click 'OK'. A new window with name 'Choose Shapefile' will pop-up.

- 11) Select the location and the name for the Shapefile that will be created.

- 12) Click 'OK'.

4. Conclusions

This protocol described two methods that permit to extract roads and detect road crossings using the InterIMAGE software.