Road Network Library v1.0

Road Network is a library consisted of efficient, automatic methods for extrapolating a road map from a GIS database to automatically create a geometrically correct and topologically consistent 3D model of large-scale road network to be readily used in a real-time traffic simulation, interactive visualization of virtual world, and autonomous vehicle navigation. The resulting model representation also provides important road features for traffic simulations, including smoothly connected ramps, highways, overpasses, legal merge zones, and intersections with arbitrary states and is independent of the simulation methodologies. Currently the Road Network Library is running on Linux system only.

1. Library Dependencies

System:

GLib - low-level libraries useful for providing data structure handling for C

https://developer.gnome.org/glib/2.44/

GLibmm - set of C++ bindings for GLib

<https://developer.gnome.org/glibmm/2.44/>

Utilities:

CMake - cross-platform build system.

http://www.cmake.org/

Tvmet - Tiny Vector Matrix library using Expression Templates

http://tvmet.sourceforge.net/

PROJ.4 - Cartographic Projections Library

https://trac.osgeo.org/proj/

LibXML++ - C++ wrapper for the libxml XML parser library

http://libxmlplusplus.sourceforge.net/

Libxml2 - XML C parser and toolkit

<http://www.xmlsoft.org/>

Graphics:

OpenGL - fundamental graphics library

https://www.opengl.org/

GLEW - cross-platform open-source C/C++ extension loading library

http://glew.sourceforge.net/

FLTK - cross-platform C++ GUI toolkit

http://www.fltk.org/index.php

Cairo - 2D graphics library

http://cairographics.org/

Note: Find modules are provided in cmake/ and by default of the CMake (check the modules provided by CMake: $cmake –-help-module-list). However some times these find modules don't work or certain versions of CMake don't provide necessary find modules, in such a case you could manually specify include directories and library paths in the CMakeLists.txt.

2. Install instructions

Go to build/ and execute following commands in the terminal:

$cmake ../

$make

3. Executables

Once the library is compiled, three executables will be generated in build/Tools:

*import-osm*: take a OSM network file and a configuration file, output the HWM network file.

*export-obj*: take a HWM network file and export the corresponding obj model.

*view-network*: view a HWM network.

Some data are provided in the Data folder for experimenting.

4. OSM network and Configuration

Currently the library only interprets the highway class of the openstreetmap. Specific types of road within the highway class can be found at http://wiki.openstreetmap.org/wiki/Key:highway. For detail information about the OSM file format, please refer to openstreetmap.org.

The OSM configuration file is required to interpret any OSM file. An example config.xml is provided in Data/osm and some terms are explained below:

*lane\_width*: each road is consist of multiple lanes, this value specifies the lane width.

*road\_remove\_threshold*: a value for removing small roads.

*node\_culling\_threshold*: a value for removing nodes that are close to other nodes.

*type*: road types listed at <http://wiki.openstreetmap.org/wiki/Key:highway>.

*speed*: speed limit set by the user.

*lanes*: number of lanes that the user would like to generate for associated road types.

5. HWM network

HWM network [1] is the interpreted result of an OSM network in a form of AN XML file. The file specifies several entities including:

*road*: represented by arc roads (arc roads specification can be found at section 6 of [1]) which consists of successive points and radius between successive line segments (see [1] section 4.3).

*lane*: generated lanes associated with a road. Each lane includes references to roads, intersections and its left or right adjacent lanes.

*intersection*: generated intersections. An intersection consists of incoming lanes and outgoing lanes, and states which specify the pairing information of incoming and outgoing lanes. Each state also has a duration value indicating the lasting duration before advancing to the next state.

Reference

[1] Transforming GIS Data into Functional Road Models for Large-Scale Traffic Simulation. Daivd Wilkie, Jason Sewall, and Ming C. Lin, IEEE TVCG 16(5), 2010.