
CDTStudio Documentation

Release 0.3

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CDTStudio is an open-source and cross-platform desktop software in object-based image analysis (OBIA or GeoOBIA). The first version of it is written by Chen Guanzhou ([English](#),).

CDTStudio is based on Qt4 framework, in which most algorithms are in the form of plugins. **CDTStudio** can be run in Windows & Ubuntu (Other linux distributions and MacOS have not been tested).

It contains the following GeoOBIA framework:

- Remote sensing image segmentation
- Object-based image analysis (OBIA) & Object-based image classification (OBIC)
- Pixel-based change detection (PBCD) & Object-based change detection (OBICD)
- Semi-automatic feature extraction by Snakes

1.1 Application Frameworks

- Image segmentation framework
- Object-based feature extraction framework
- Object-based image classification (OBIC) framework
- Object-based image feature fusion framework
- Semi-automatic feature extraction framework
- Object-based change detection framework
- Pixel-based change detection framework

1.2 Visualization & Interaction

- Contrast enhancement visualization for images
- RGB band visualization for multispectral data
- Transparent for layers
- Object-based feature management
- Histogram for features

1.3 Algorithms

1.3.1 Image segmentation

- Graph-based minimal-spanning-tree segmentation

1.3.2 Feature extraction

- Spectral features
- Spatial features

- Texture features (GLCM & GLDV)

1.3.3 Supervised-classification

- KNN
- Bayes
- AutoSVM (Cross-validation)
- SVM
- ANN
- RT
- ERT

1.3.4 vector-based change detection

- Overlay analysis

1.3.5 Pixel-based change detection

- Difference method

1.3.6 Feature decision

- Majority-voting

1.3.7 Semi-automatic feature extraction

- Snakes

Under construction!

3rdParty

Name	Version	Link
Qt	4.8	http://qt.io/
QGIS	2.16	http://qgis.org
GDAL	2.0	http://gdal.org/
OpenCV	2.3	http://opencv.org/
Boost	1.55	http://www.boost.org/
Log4Qt	0.3	http://log4qt.sourceforge.net/
Qwt	4.8	http://qwt.sourceforge.net/
wwWidgets	1.0	http://www.wysota.eu.org/wwwwidgets/
STXXL	1.4.1	http://stxxl.sourceforge.net/
QPropertyEditor	0.4	https://github.com/chenguanzhou/QPropertyEditor

Build on Windows

4.1 1. OSGeo4W

`OSGeo4W` is a binary distribution of a broad set of open source geospatial software for Win32 environments (Windows XP, Vista, etc).

To build CDTStudio on Windows, we need to install 3rdParty libraries including QGIS, GDAL, OpenCV and Qt4.8.5 from the advanced mode of OSGeo4W.

PS: Please build CDTStudio and its dependent libraries in 64bit (x64) environment.

4.2 2. Build STxxL

The core of `STxxL` is an implementation of the C++ standard template library STL for external memory (out-of-core) computations, i. e., STXXL implements containers and algorithms that can process huge volumes of data that only fit on disks. While the closeness to the STL supports ease of use and compatibility with existing applications, another design priority is high performance.

Due to limitations of OSGeo4W on Windows, STxxl must be built by VS2010 with Boost. This is the stxxl build documentation.

4.3 3. QWT6.0

The `Qwt` library contains GUI Components and utility classes which are primarily useful for programs with a technical background. The build tutorial is [here](#).

4.4 4. Environment variable configuration

Create new environment variables:

- `OSGEO4W_ROOT`
- `BOOST_LIBRARYDIR`
- `BOOST_ROOT`
- `QGIS_ROOT`

- QWT_ROOT
- STXXL_ROOT

The value of each variable is the root directory of the library. (e.g., OSGEO4W_ROOT=C:\OSGeo4W64)

Then, create a new environment variables QT_PLUGIN_PATH, whose value is the plugins directory of Qt. (e.g., C:\OSGeo4W64\apps\Qt4\plugins)

In addition add the bin directory of each library to Path environment variable. (e.g., C:\OSGeo4W64\bin;C:\OSGeo4W64\apps\qgis\bin;C:\qwt6\bin;C:\boost_1_55_0\lib64-msvc-10.0;)

4.5 5. Build

Build CDTStudio in Release mode in [Qt Creator](#). (Debug mode has not been supported yet)

4.6 6. Copy the plugins of QGIS

Copy gdalprovider.dll and ogrprovider.dll (in plugins dir of QGIS, e.g., C:\OSGeo4W64\apps\qgis\plugins) to build_path/bin/Plugins of CDTStudio.

4.7 7. Run

Write custom plugin in CDTStudio

5.1 Create a interface (pure virtual base class) based on QObject

- Create a c++ class (PlugInterface), which contains a pure virtual function (interface).
- Add the macro `Q_DECLARE_INTERFACE` at the end of the class file. The first parameter of the macro is the name of class PlugInterface. The second parameter is the description and version number.

5.2 Implement interface

- Create a plugin class (PluginInstance)which implement the interface in PlugInterface.
- Add macro `Q_OBJECT` and `Q_INTERFACES` in header file.
- At the end of the cpp file, add macro `Q_EXPORT_PLUGIN2`, whose first parameter is the name of plugin and the second one is the name of the class name of the plugin.

5.3 Invoke in main app.

- Load plugins by QPluginLoader class.
- Invoke functions in plugins.

Screenshots

The screenshot displays the CDTStudio software interface. The main window shows a map with red segmentation lines overlaid on a satellite-style image. The interface includes several panels:

- Project Tree (Left):** Shows a hierarchy for 'MyProject' with folders for 'Images', 'Extractions', 'Segmentations', and 'Classification'. Specific items like '0902', 'seg09', '0804_1w_mosaic_21', and 'seg08' are visible.
- Layer Information (Bottom Left):** A table showing properties for the current layer:

Name	数值
Basic infor...	
Name	seg09
Segmentat...	
Border...	#ff0000
Method	mst
Mini...	100
Shiel...	false
Thre...	20
- Object Properties Table (Bottom Center):** A table with columns: ObjectID, area, asymmetry, border_index, border_length, compactness, elliptic_fit, and elongatic.

ObjectID	area	asymmetry	border_index	border_length	compactness	elliptic_fit	elongatic
0	6812.5	5.75803e+10	0.910951	375	1.5268	0.87156	1.30938
1	12312.5	1.58232e+11	1.14139	730	1.88508	0.795431	1.87167
2	73706.2	4.99131e+10	1.06234	1530	1.61041	0.845162	1.81898
3	13731.3	1.71774e+11	0.911008	680	2.17644	0.661356	2.20782
- Training and Validation Sample Sets (Right):** Two panels for managing sample sets. The 'Training sample sets' panel shows a list with 'sample09'. The 'Validation sample sets' panel shows a 'New Sample' button.
- Geometry: border_index Histogram (Bottom Right):** A histogram showing the distribution of the 'border_index' property. The x-axis ranges from 0.5 to 3, and the y-axis ranges from 0 to 60. The distribution is unimodal and centered around 1.0.
- Legend (Bottom Left):** A legend with columns 'name' and 'color'. It lists '水' (blue), '植被' (green), '建筑' (red), and '裸地' (brown).
- Coordinate and Scale (Bottom):** Displays 'Coordinate: 87702.3222884, 296487.906907' and 'Scale: 1:332,858,115'.

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```
<one line to give the program's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>

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```

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```
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This program comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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About

CDTStudio is an open-source and cross-platform desktop software in object-based image analysis (OBIA or GeoOBIA). The first version of it is written by Chen Guanzhou ([English](#),).

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