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LabCD: An annotation tool for remote sensing change detection

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Software

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Introduction

Remote sensing change detection is a way to obtain dynamic changes of various surface information by comparing and processing the information reflected by multiple static remote sensing images (include satellite and unmanned aerial vehicle (UAV) image) (Zhao, 2013). The working objects of remote sensing change detection are the images of the same region in different periods.

It is usually used evaluating natural disaster, change detection of the land use / cover, change detection of architectural areas, and etc. An area where a 6.3-magnitude earthquake has occurred in February 2011 and rebuilt in the following years (Ji et al., 2018) in Figure 1.

Figure 1: Building change detection

Capturing and annotating remote sensing images is the first step in this work, and LabCD is an annotation tool for remote sensing change detection.

Statement of need

In recent years, with the development of deep learning, more and more data needs to be annotated. There are many annotation tools we can choosed, like labelme (Russell et al., 2008) or labelimg (*Labellmg*, 2015). They support multiple categories of annotation tasks, such as image classification, segmentation or detection, but can't work in remote sensing change detection. So in this field, usually we use ArcGIS, QGIS (QGIS Development Team, 2009) or ENVI, and etc. They are great software about remote sensing / geographic information science (GIS), but as an annotation tools, they are big and complex. By the way, they are not efficient for annotation for remote sensing change detection.

For example, ArcGIS and QGIS can't create two synchronized windows, so it is necessary to switch back and forth between the displays of two images and use shapefiles for annotation. Finally, the shapefile needs to be rasterized into an image. Of course, ENVI can be used to open synchronized interfaces for change detection annotation, either with its own software or IDL. However, it is larger than 3GB and requires a license.

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LabCD is developed based on C++17. It has a graphical user interface (GUI) developed in Qt6 and depends on OpenCV (Bradski, 2000), JsonCpp, GDAL (GDAL/OGR contributors, 2022) and Eigen (Guennebaud et al., 2010) and it provides project files including Visual Studio and Qt Creator, as well as CMakeLists files. It was designed with reference to EISeg (Hao et al., 2021, 2022), but it is mainly used for remote sensing change detection.

	Open source / Free	Simple	GeoTiff IO	Dual-window synchronization
labelme	√	√		
labelimg	√	√		
ArcGIS			√	
QGIS	√		√	
ENVI			√	√
LabCD	√	√	√	√

LabCD provides left-right synchronization of the canvas, and support GeoTiff split and IO with coordinate reference systems (CRS). Above all, LabCD is a convenient and fast data annotation tool for remote sensing professional fields.

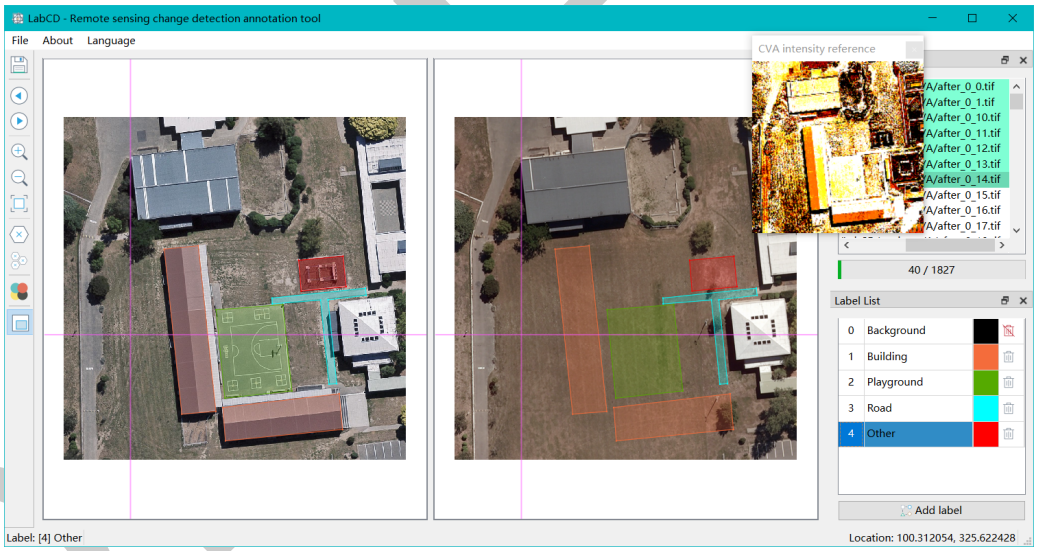

Figure 2: A screenshot of LabCD. Two images are being annotated.

Audience

LabCD is intended for students and researchers who engaged in remote sensing change detection and deep learning research. This tool will help them annotation data quickly. And they will have more time to train their AI models based on some geoscience deep learning tools, like PaddleRS.

Functionality

LabCD has complete functions on annotation for remote sensing change detection. A screenshot of LabCD is provided in Figure 2. This screenshot shows the capabilities of LabCD in a single image. The main features of LabCD are:

- Support GeoTiff split / merge and IO with CRS.

- Support left-right synchronization of the canvas and cross, it is more intuitive than roll-up canva.
- Provide change vector analysis (CVA) (Jensen & Cowen, 1999) reference.
- Automatically calculate optimum index factor (OIF) (Chavez Jr, 1988) during the first loading for multispectral data.
- Friendly label and file / process management.

Some of the annotated results are shown below, including masks, pseudocolored images for visualization, and JSON files for loading annotations.

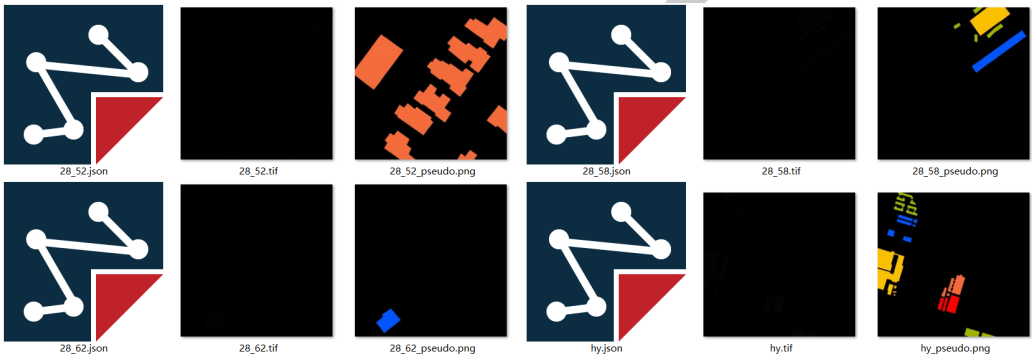

Figure 3: Some annotated results output.

Tutorials

Some documentation and videos are available for using LabCD, including:

- Download and usage
- Keyboard shortcuts
- Usage tutorial

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