ROI Picker: 오픈소스 영상 ROI 편집 도구

ROI Picker: An Open-source ROI Editor on Images

응우옌 콩꾸이[1], 최성록[1†]

Quy Nguyen Cong[1] and Sunglok Choi[1†]

Abstract: The paper introduces a simple but reconfigurable open-source tool to simplify the process of identifying and modifying region-of-interests (ROIs) in digital images. ROIs play a crucial role in tasks such as object detection, tracking, camera calibration, and feature extraction within the domains of image analysis, image processing and computer vision, and machine learning applications. Our developed tool what we call *ROI Picker* provides developers, and researchers with a simple, efficient, and intuitive GUI working with ROIs in various programming languages. A special feature of ROI Picker is that it supports drawing, modifying, and removing various ROIs shapes, including points, lines, or polygons. It is an uncomplicated open-source that users can quickly customize file formats, ROI types, visualization and keyboard shortcuts to their preferences. Additionally, users can inherite and extend ROI Picker to support their own file format.

Keywords: Regions-of-Interest, Open-Source, Computer Vision, Image Processing

1. Introduction

Numerous libraries dedicated to ROIs have been developed in the rapidly changing fields of computer vision, and image processing such as labelme [1], labelImg [2], Labelbox [3], CVAT [4], which are the open-source data labeling tools for images, audio, video and time-series data annotation. However, some libraries [2, 3] only support annotation with either rectangle box, mask or polygon and do not support a wide range of geometric shapes. There are also many frameworks that support a variety of shapes [1, 4], but they do not support users to modify file formats, ROIs type, visualization and keyboard shortcuts or inherit and extend to suit their intended use.

In this work, we introduce a basic tool called *ROI Picker* with a simple GUI for adding, modifying, and removing ROIs. ROI Picker is created in OpenCV and Python and can be easily operated with just one command line without having to install any complex programs or libraries other than OpenCV. Additionally, the library would serve the needs of beginners and experts by enabling users to quickly customize file formats, ROI types, visualization and keyboard shortcuts to their preferences. Furthermore, our ROI Picker encourages community contributions and inheritance, enabling the library to expand in response to user demands.

ROI Picker now supports the following ROI shapes. Users can easily modify or inherit to extend their functionality.

- A set of points.
- A set of line segments.
- A polygon.

The above shapes are all represented as:

$$[(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)]$$

2. ROI Picker

2.1 Console Command

The requirements for running ROI Picker are minimal since installing OpenCV is the only prerequisite. Users only need to execute the command line as follows to launch this tool:

```
python roi_picker.py image_file [-r roi_file.json]
                                [-c config_file.json]
```

Where:

- **`-r (or --roi_file`**): Specify an ROI file containing essential properties of each ROI, such as the ID number to identify ROI, the type of ROI (point, line, or polygon), color (RGB or BGR color), and the coordinates of points.

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1. Computer Science and Engineering Department, Seoul National University of Science and Technology (SEOULTECH) Seoul, Korea, (nguyencongquy.ncq@gmail.com, sunglok@seoultech.ac.kr)

† Corresponding author

- `-c (or --config_file):` Specify a configuration file that can modify the GUI and visualizations. Users are free to make changes according to their wishes.

If a default file does not exist, ROI Picker will start either with an empty ROI or with its initial configuration. Users have the flexibility to expand ROI Picker to support additional file formats. Users are able to do this by inheriting ROI Picker and modifying two functions to construct their own class. As an instance, the file is a CSV file that only has points in the form of a series of id, x, and y. A distinct id may exist for a point. This indicates that each ROI is comprised of a single point.

2.2 GUI Usages

Our picker is simple to use and comprehend. For simplicity, it has a minimal GUI with no menu or buttons. Its GUI inputs are totally based on mouse action and keyboard.

[Mouse actions]

- Click: to choose a ROI. A click at an existing point selects the ROI that includes the selected point.
- Double Click: add or delete a point. If user double click at an existing point, this point will be removed. If user double click on an existing line (for line segment or polygon), a new point will be inserted on this line. If user double click on an empty space, a new point will be added.
- Ctrl + Drag: to move the clicked point.

[Keyboard shortcuts]

- ESC: Terminate ROI Picker tool.
- Tab: Switch to the following ROI.
- Ctrl + **P**: Add a new set of **P**oints.
- Ctrl + **L**: Add a new set of **L**ine segment.
- Ctrl + **G**: Add a new poly**g**on.
- Ctrl + **R**: **R**enew ROI Picker (clear all ROIs).
- Ctrl + **D**: **D**elete the selected ROI.
- Ctrl + **I**: **I**mport ROI data from the ROI file.
- Ctrl + **E**: **E**xport ROI data to the ROI file.
- Ctrl + **F**: Export con**f**iguration to a JSON file.
- Ctrl + **Z**: Show and hide the image **z**oom.
- Ctrl + **T**: Show and hide the s**t**atus of the selected ROI.
- +: Zoom up the image.
- - : Zoom down the image.

Users can zoom in and out of images with our tool, and it also shows important details about the selected ROI such as ID, coordinate values,... Additionally, the tool shows a magnified image and the mouse cursor center, allowing for more precise point selection at coordinates. These features enhance the utility of ROI Picker, and what sets it apart is the ability for users to customize file format, keyboard shortcuts and visualization based on their own configuration file.

3. Applications and Conclusion

Our ROI Picker is extremely helpful and convenient for some computer vision tasks since it supports a wide variety of shapes, allows users to change the file format or ROI type, visualization or keyboard shortcuts and encourages users to inherit and extend. It can be used in a variety of fields and applications such as in computer vision for tracking and object detection, in transportation systems for traffic management, ... ROI Picker can help systems focus on specific regoin of an image or video by specifying regions of interest, which improves the precision and effectiveness of object recognition systems, reduces false alarms, tracking individuals, and detecting intrusions. We have also used ROI Picker in many projects as shown in Fig. 1 and Fig. 2.

[Fig. 1] ROI editing and visualization example

[Fig. 2] ROI editing and visualization example with different style file

References

[1] labelme, https://github.com/wkentaro/labelme
[2] labelImg, https://github.com/HumanSignal/labelImg
[3] Labelbox, https://labelbox.com/
[4] CVAT, https://github.com/opencv/cvat