DetectionEvaluationJ: a tool for measuring the goodness of object detection algorithms*

C. Domínguez, M. García, J. Heras, A. Inés, E. Mata, and V. Pascual

Department of Mathematics and Computer Science of University of La Rioja, Spain

1 Extended abstract

Object detection algorithms are applied in diverse computer vision applications; for instance, surveillance, traffic monitoring or melanoma detection. Recent advances in this area have been leaded by the availability of open-source datasets (e.g. the PASCAL VOC 2012 [1], the MS COCO datasets [2], or the ILSVRC competition [3]) and the application of deep learning techniques [5].

In order to evaluate the quality of object detection algorithms, the regions of interest (ROIs) located by such algorithms are compared against the regions manually annotated by experts (such regions are known as the *gold standard* or *ground truth*) using different metrics. Some of the most widely employed measures in this context are the area of intersection-over-union between two detections [1], and pixel-level specificity, precision, and recall [7].

Since the task of comparing the detected regions against a gold standard is necessary to measure the quality of object detection algorithms, we have developed a tool, called *DetectionEvaluationJ*, that facilitates such a process and avoids reinventing the wheel. DetectionEvaluationJ is an ImageJ plugin [4] that has been designed to evaluate the goodness of object detection algorithms using several metrics. DetectionEvaluationJ takes as input a set of images, the gold standard associated with such images, and the detected regions obtained by the detection algorithm; and, it generates as output a report that summarises the quality of the detection algorithm based on the available measures. This workflow is depicted in Figure 1.

DetectionEvaluationJ can handle different kinds of regions (including rectangles, circles, polygons, points, and other geometrical figures) both for the gold standard and the detected regions. Such regions can be loaded in DetectionEvaluationJ using either the internal representation employed in ImageJ or a new format called ROIXML. The ROIXML format is based on the XML format and is therefore independent of any particular computer system and extensible for future needs. The structure of XML files following the ROIXML format is fixed by an XML schema, that not only determines the structure of XML files but also specifies and restricts the content of their elements. This schema has been developed taking into account the information that is needed to encode different kinds of ROIs. The ROIXML format simplifies interoperability since it allows

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users from systems like OpenCV or Matlab to generate files that can be read by DetectionEvaluationJ.

Once the gold standard and the detected regions are loaded in DetectionEvaluationJ, the user can measure how good are the detected regions using the following pixel-level metrics: area of intersection-over-union, accuracy, precision, recall, fallout, sensitivity, specificity, negative predictive value, false discovery rate, false negative rate, LR+, LR-, and F-measure ($\alpha = 0.5, 1$ and 2). In addition, the user can load the output of several detection algorithms and compare their quality using the aforementioned metrics and the ROC space. Analogously, this plugin can also be applied to study inter-rater agreement among experts [6].

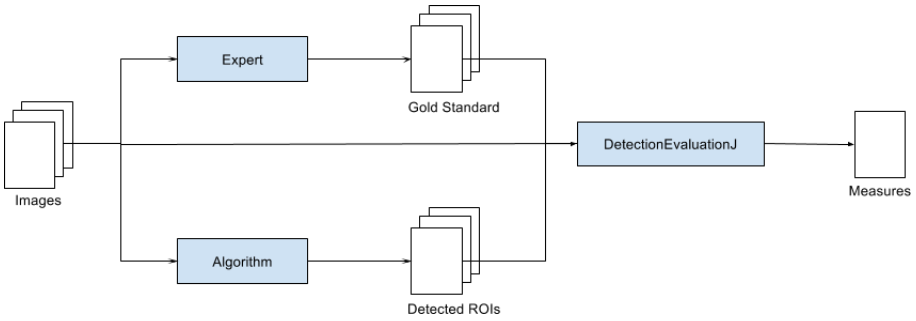

Fig. 1. Workflow of DetectionEvaluationJ

DetectionEvaluationJ is available at joheras.github.io/DetectionEvaluationJ/ together with the installation instructions and usage examples.

References

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