Annotationsaurus: A Searchable Directory of Annotation Tools

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Abstract

Manual annotation of textual documents is a necessary task when constructing benchmark corpora for training and evaluating machine learning algorithms. We created a comprehensive directory of annotation tools that currently includes 93 tools. We analyzed the tools over a set of 31 features and implemented simple scripts and a Web application that filters the tools based on chosen criteria. We present two use cases using the directory and propose ideas for its maintenance. The directory, source codes for scripts, and link to the Web application are available at: https://github.com/mariananeves/annotation-tools

1 Introduction

Annotation tools are important resources for building customized corpora for the most various purposes, ranging from document classification (Baker et al., 2016) to discourse relations (Yang and Li, 2018). When choosing an annotation tool for a particular project, researchers should consider the task at hand, the particularities of their system environment and the expertise of the annotators. Frequently, it is necessary to experiment with tools, even with the burden of installing them, before finding the one that best fits their needs.

This is, however, a demanding task, given the high number of available tools. Usually, while choosing an annotation tool, users ask for advice in forums and mailing lists, look at previous surveys of annotations tools, e.g. (Neves and Ševa, 2019), (Neves and Leser, 2012) and (Fort, 2016), and check the tools that have been used in recently published corpora. As far as we know, there is no comprehensive and searchable directory of annotation tools.

We recently defined a set of 31 criteria and carried out hands-on experiments with 15 selected annotation tools from a total of 93 tools (Neves and Ševa, 2019). As an extension to this survey, we now created a directory of annotation tools, evaluated the remaining (non-selected) tools based on many of these criteria and developed scripts and a Web application to allow searching for tools. In the next section we describe our directory, discuss how to search for annotation tools, and present two use cases.

2 Directory of annotation tools

We created a directory of annotation tools and evaluated the tools over some desirable criteria. This work considers the tools that we previously collected during the preparation of a survey (Neves and Ševa, 2019), extended with the ones that we have recently found. Currently, the directory contains a total of 93 tools, as listed in our GitHub repository

https://github.com/mariananeves/annotation-tools

2.1 List of attributes

We considered both the so-called requirements and criteria (hereafter called only as criteria) that we defined in our survey (Neves and Ševa, 2019). There, we defined five requirements for selecting tools for hands-on experiments and 26 criteria which we used for the evaluation. The criteria are related to the tool’s publications, technical attributes, data format, and functional properties (cf. Table 1). The chosen 31 criteria, including the possible values that each criterion can take, as defined in our survey, is available in our GitHub repository

https://github.com/mariananeves/annotation-tools/blob/master/schema

2.2 Evaluation of tools

Besides the evaluation for the 15 tools previously considered in (Neves and Ševa, 2019), we also

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1https://github.com/mariananeves/annotation-tools
2https://github.com/mariananeves/annotation-tools/blob/master/schema
| Criteria                                      | Values                  | Filter               |
|----------------------------------------------|-------------------------|----------------------|
| Availability of the tool                     | yes, no                | available            |
| Type of installation                         | web-based, stand-alone, plug-in | type               |
| Installation successful                      | yes, no                | installable          |
| Annotation successful                        | yes, no                | workable             |
| Ability to configure a schema                | yes, no                | schematic            |
| Year of the last publication                 | -                      | -                    |
| Number of citations for publication          | -                      | -                    |
| Number of citations for corpora             | -                      | -                    |

| Technical                                    |                         |                      |
|----------------------------------------------|-------------------------|----------------------|
| Year of the last version                     | -                      | -                    |
| Availability of source code                  | yes, no                | source_code          |
| Availability of online tool                  | yes, no                | online_available     |
| Easiness of installation                     | easy, medium, hard      | installation         |
| Quality of the documentation                 | good, poor, none        | documentation        |
| License of the tool                          | full, partial, none     | license              |
| Free availability                            | yes, partial, no        | free                 |

| Data format                                  |                         |                      |
|----------------------------------------------|-------------------------|----------------------|
| Format of the schema                         | XML, JSON, GUI, other   | format_schema        |
| Format i/o of documents                      | XML, JSON, TXT, other   | format_documents     |
| Format i/o of annotations                    | XML, JSON, TXT, other   | format_annotations   |

| Functional                                   |                         |                      |
|----------------------------------------------|-------------------------|----------------------|
| Annotation with multiple labels              | yes, no                | multilabel           |
| Annotation on document level                 | yes, partial, no        | document_level       |
| Annotation of relations                      | yes, partial, no        | relationships        |
| Annotation based on ontologies               | yes, no                | ontologies           |
| Support for pre-annotations                 | yes, partial, no        | preannotations       |
| Integration with PubMed/PMC                  | yes, partial, no        | medline_pmc          |
| Support for full texts                       | yes, partial, no        | full_texts           |
| Support for partial saving                   | yes, partial, no        | partial_save         |
| Support for highlighting                     | yes, no                | highlight            |
| Support for users and teams                  | yes, partial, no        | users_teams          |
| Support for IAA                              | yes, partial, no        | iaa                  |
| Annotation of private data                   | yes, no                | data_privacy         |
| Support for various languages                | yes, partial, no        | multilingual         |

Table 1: List of criteria, their possible values, and corresponding filters (if available) in the Web application.
carried out an evaluation for the remaining 78 tools discarded in said survey. However, given the large number of tools, our evaluation was restricted to the tools’ publication and documentation, i.e., we could not perform hands-on experiment with all of mentioned tools.

We present each tool’s evaluation (cf. “tools” folder) in a semi-structured text file (evaluation file) for each tool. This makes the evaluation file both human- and machine-readable. When evaluating a tool, we created a copy of the “schema” file and checked each criterion by assigning the appropriate value, depending of it being multiple choice or not. If we were not able to evaluate a certain criterion, we used the # symbol in the corresponding line in the evaluation file. Currently, we only assign one value to criteria that might accept multiple values, e.g. the data format criteria.

We obtained a total of 2,270 evaluations for all criteria over all tools, in contrast to 2,883 possible criteria (93 tools x 31 criteria). This discrepancy is contributed to our inability to evaluate all tools across all defined criteria. This covers 78.7% of all possible evaluations.

Regarding the evaluation of each criteria, the coverage ranges from 38 for the most exclusive criteria to 93 covered tools for most inclusive criteria. Five criteria were evaluated for all tools, namely “available”, “online_available”, “last_publication”, “citations_corpora” and “citations”. The criteria that we most missed were “workable” (38 evaluations), “multilingual” (38 evaluations), and “installation” (41 evaluations). Additionally, some of there criteria require hands-on experiments with the tools, which was not possible for all tools.

We could evaluate all 31 criteria for 15 tools, as already reported in (Neves and Ševa, 2019), and the average number of evaluated criteria was 24. RAD was the tool for which we assessed the fewest number of criteria (only 8). Further tools with less than 20 evaluated criteria were: Analuc (13), AWOCATo (14), eHost (15), Hexatomic (16), SFA (17), OLLIE (17), Coco (18), Cas Editor (18), Slate (18), KAFnotator (18), and Serengueti (19).

### Addition of new annotation tools

New annotation tools can be added simply by placing its evaluation file, with matching file name to the tools name, in the “tools” folder of the repository. Requests for new additions can be performed by creating an issue in the GitHub repository. Removing a tool is then, in contrast, simply a matter of removing its evaluation file from the “tools” folder of the repository. We cannot, however, envisage a reason why a certain tool should be removed from the repository. As already stated above, we currently include all tools that we found. Although some tools are no longer available, we include them for the sake of completeness.

### Addition of new criteria

A new criterion should first be inserted in the “schema” file and then replicated for each tool’s evaluation file (“tools” folder). Adding the additional criterion (line) for each tool’s file could be carried out either manually or automatically via a script, for instance, by setting a default value or leaving the corresponding criterion (line) commented out. However, a missing criterion for a particular tool does not cause a problem for neither the scripts nor the Web tool.

### Changes to a criterion for a tool

Due the number of tools and criteria, coupled with the manual nature of the evaluation, we keep the possibility of a faulty evaluation open. In such situations updating the evaluation is a matter of changing the appropriate line(s) in the relevant evaluation file. We are glad to receive feedback from the community regarding our evaluation.

### 3 Scripts and Web application

We implemented a Web application for searching among the tools. The system is implemented two fold. We use Python/Flask for the server side logic which consists of reading all evaluation files and serving them to the interface. The interface was, in turn, implemented in AngularJS JavaScript framework as was designed as a responsive, single-page web application. It supports searching by all non-numerical criteria, omitting e.g. last publication year, through a dynamic side navigation bar (cf. Figure 1). Initially all tools are presented in a tabular way, with configurable pagination functionality. By choosing at least one of the possible filters the list will be filtered to tools matching selected criteria.

The matching tools are shown in the decreasing
order of the number of search criteria that were matched. For tools with the same number of matching criteria, alphabetical ordering is used. For each tool, we print the number of matched criteria and their name(s), as selected in the filtering options. Additionally, the search can be adapted to use OR and AND truth-functional operator against the selected criteria. Initially, OR is used. The Web application is currently running in Heroku.

4 Use Cases

We describe two use cases to illustrate how the repository (and search tools) could support finding the annotation tools that best fit one’s needs. For both use cases, we require annotation tools to be Web-based and freely available for research purposes (i.e. “type=web-based” and “available” in #requirements, and “free” in #technical) and that allow the definition of a schema (“schematic” in #requirements). Further, we experimented with two optional criteria, namely, whether the tools are installable and workable (in #requirements). We did not put any limitation for the availability of source code or format for schema, documents or annotations.

Use Case 1: Semantic annotation of entity and relations Our first scenario addresses a typical annotation project of semantic annotations. This is frequently necessary for construction of domain-specific corpora, e.g. (Ohta et al., 2012; Boyce et al., 2012). This use case requires tools for manual annotation of named-entities (i.e. highlighting of text spans) and for drawing relations between these. Therefore, we included the filters “highlight” and “relationships” (in #functional) as mandatory. Given the complexity and ambiguity of many domains, we expect the tool to be able to assign multiple labels to text spans (i.e. overlapping annotations), i.e., the “multilabel” criterion (in #functional). Finally, such annotation projects are demanding and might take some hours for a single (long) document, therefore, we also require the tool to be able to save documents partially (“partial-save” criterion in #functional).

Seven tools (brat, INCEpTION, Inforex, MAT, SANTO, TeamTat, and WebAnno) matched the eight mandatory criteria that we defined, i.e. the four general non-optional ones and the four specific ones. Further, when checking the two general optional arguments that require the tools to be

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3https://annotationsaurus.herokuapp.com/
installable and workable, we had only four tools matching all filters (brat, MAT, TeamTat, and WebAnno).

**Use Case 2: Document-level annotations for text classification**  For our second use case, we envisage the annotation of clinical data, e.g. pathology reports (Jouhet et al., 2012) or death certificates (Lavergne et al., 2016). Thus, we require the criterion “data-privacy” (in #functional) that assures that the tool can be locally installed. Further, we address the task of annotation on the document level (criterion “document-level” in #functional), such as carried out in (Baker et al., 2016). As optional additional criteria, we check whether these tools provide annotations based on pre-defined ontologies, i.e. by specifying the criteria “preannotations” and “ontologies” (in #functional).

Six tools (Bionotate, doccano, MAT, SMART, TALEN, and UniversalAnnotationTool) complied with the six mandatory filters that we defined, i.e., the four general ones and the two specific ones for the use case. When checking the other two optional filters for this use case, no tools could comply with all eight criteria, but 12 tools matched seven of these criteria. For instance, SANTO and WebAnno did not comply with the document-level annotation, while Bionotate and MAT do not support ontologies.

5 Conclusions

We described a directory of annotation tools with search functionality. It currently includes a total of 93 tools that were evaluated on many of the 31 criteria. We developed a simple Web application to search among the tools by filtering for chosen criteria. The tools’ evaluation files and the Web application are available in a GitHub repository and we welcome feedback from the community regarding missing tools, interesting new criteria, and corrections of our current evaluations.

In spite of covering a total of 93 tools and 31 criteria, our repository have many limitations. Our list of annotation tools is very comprehensive, but some tools might be missing and the links to tools’ publication and Web sites might become broken at any time. Although the evaluation (plain text) files are readable by both human and scripts, this also makes the process error-prone if the criteria name is not written exactly as defined in the schema file. Therefore, we provide a script for checking errors in the criteria names, as well as for printing statistics of the current state of the evaluation. For the sake of simplicity, we decided for a file-based approach in this first version of the directory. Later, if necessary, these files can be converted to a more
appropriate format or imported into a database.

We certainly missed some interesting criteria that could be useful for some domains or annotation projects, such as support for annotation layers, or tools suitable for annotation of messages from the social media when building specific corpora (O’Connor et al., 2014). Further, the definition of some criteria could be improved, such as specifying the corpora which were developed using a certain tool instead of simply informing how many were found.

We also envisage future work for supporting the automatic update of some criteria. For instance, the last version (year of publication or commit) of a tool could be automatically extracted from the GitHub repository (if available), the number of citations for a publication might be automatically retrieved from Google Scholar, and the corpora which were developed using a certain tool could potentially also be automatically extracted from publications.

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