Inclusion and Exclusion Criteria for Automating Adherence to Scope of Conference Calls for Papers*

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Abstract

To conduct a well-designed and reproducible study, researchers must define and adhere to clear inclusion and exclusion criteria for subjects. Similarly, a well-run journal or conference should publish easily understood inclusion and exclusion criteria that determine which submissions will receive more detailed peer review. This will empower authors to identify the conferences and journals that are the best fit for their manuscripts while allowing organizers and peer reviewers to spend more time on the submissions that are of greatest interest. To provide a more systematic way of representing these criteria, we extend the syntax for concept-validating constraints of the Nexus-PORTAL-DOORS-Scribe cyberinfrastructure, which already serve as criteria for inclusion of records in a repository, to allow description of exclusion criteria.

Keywords

Concept validation, knowledge engineering, information sciences, libraries and data repositories, scholarly communications, metadata publishing, description discovery, automatic assessment tools, non-numerical algorithms.

Contents

Introduction

In human subjects research, inclusion criteria serve to define the population from which the researchers will sample, but exclusion criteria are equally important, both because they protect the validity of the study by excluding members of the population likely to drop out or bias the results due to comorbidities, and because they protect those for whom participation poses excessive risk Patino and Ferreira (2018). Analogously, researchers compiling a systematic review of the literature must define inclusion criteria that establish the scope of studies to compare and exclusion criteria to focus on those of sufficient quality and similar enough design to permit comparison Meline (2006).

While a conference or journal usually collects a much broader range of literature than what the authors of a single review article would select, they still set standards for not only for quality but how well a work fits their themes Galer-Unti and Tappe (2009). If the founders of such a platform do not define its scope clearly enough, it may suffer from "creeping parochialism", narrowing the domain of topics permitted without any explicit change in editorial policy Daft and Lewin (2008). By contrast, a venue with a well-defined scope may intentionally adjust its policies to remain relevant as knowledge, methodology, and ontology in a field change, as happened when the *Journal of Autism and Childhood Schizophrenia* became the *Journal of Autism and Developmental Disorders* Schopler et al. (1979).

Given that a 2018 survey found that the median time between submission of an article to a biomedical journal and notification of acceptance was 5 months Wallach et al. (2018), clarifying to authors whether an article meets the basic requirements to receive more in-depth peer review before they submit could empower them to choose the most suitable journal instead of waiting weeks or months for a rejection from a poorly chosen one. Furthermore, considering that the percentage of invited reviewers who submitted reviews to six journals dropped from 56% in 2003 to only 37% in 2015 Fox et al. (2017), it is important to decrease the number of irrelevant submissions to make better use of the time and effort reviewers do give.

An automated system that quickly checks the suitability of a submitted manuscript serves both of these goals. We here describe such a system built on the Nexus-PORTAL-DOORS-Scribe (NPDS) cyberinfrastructure Dutta et al. (2020). In previous work, we defined concept-validating constraints as a way of systematically representing the criteria for inclusion of a record in a NPDS repository Taswell (2010a). We here extend that definition with syntax for describing exclusion criteria. Using a Scribe registrar to manage descriptions of submissions, as Brain Health Alliance has done with the Brainiacs Journal (*www.brainiacsjournal.org*) Taswell et al. (2020), allows authors to create metadata records describing their articles, which they can then check for suitability using the automatic concept-validation function of the registrar.

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Methods

The NPDS concept-validation method searches the Entity Name, Entity Nature, Supporting Tags, and Supporting Labels infosubsets of a metadata record for relevant concepts Taswell (2010a). Entity Name, Entity Nature, and Supporting Tags are human-readable free-text fields comprising a name, a description, and keyword or key phrases, respectively Taswell (2010a). Supporting Labels are URIs or IRIs representing terms from controlled vocabularies, including formal ontologies Taswell (2010a). For example, the Entity Name for this paper is "Inclusion and Exclusion Criteria for Automating Adherence to Scope of Conference Calls for Papers", and a suitable Entity Nature is "a 4-page short paper describing an automated approach to validating the relevance of submissions to a conference using inclusion and exclusion criteria." Some possible Supporting Tags for this paper are "automated reasoning", "NPDS", "concept-validating constraints", "inclusion criteria", "exclusion criteria", "conference organizing", "scholarly publishing", "information science", and "knowledge engineering". An example of a supporting label is the class label "http://npds.portaldoors.net/nexus/pdp-dream/Publication" from the PDP-DREAM ontology Craig and Taswell (2021).

When setting up a new NPDS repository (DOORS directory, PORTAL registry, or Nexus diristry), an administrator can set the concept-validating constraints by adding Restricted Supporting Tags (RSTs) and Restricted Supporting Labels (RSLs), grouping them into OR-groups, and grouping the OR-groups into AND-groups Taswell (2010a). The extended version of concept-validating constraints now allows the administrator to declare an AND group to be part of either the inclusion or exclusion criteria and either sufficient or non-sufficient. The NPDS software can then automatically validate any record against these concept-validating constraints.

The system produces three concept-validation results: In each validation, it first checks whether the infosubset contains a case-insensitive match for each individual concept-validating constraint of the appropriate type: 1) *Entity Name and Nature*: A RST for the repository is a match if it is a substring of the Name and Nature concatenated into a single string. 2) *Supporting Tags*: A RST for the repository is a match if it is a substring of any Supporting Tag of the record. 3) *Supporting Labels*: A RSL for the repository is a match if the entire URI or IRI matches any Supporting Label of the record.

This gives us a list of individual boolean values, one for each constraint. We can then take the disjunction of the values in the same OR-group and take the conjunction of the resulting values for the individual OR-groups in the same AND-group to get a single value for each AND-group. Let V_A be the evaluation result of an AND-group, a set $A = \{A_1, \dots, A_{|A|}\}$ in which each OR-group is a set $A_i = \{A_{i,1}, ..., A_{i,|A_i|}\}$. Each member $A_{i,j}$ of the OR-group is an individual match result, and $|\cdot|$ is the cardinality of a set. We can then express the evaluation logic in conjunctive normal form (Equation 1).

$$V_A = (A_{1,1} \vee \dots \vee A_{1,|A_1|}) \wedge \dots \\ \wedge (A_{|A|,1} \vee \dots \vee A_{|A|,|A_{|A|}|}) \tag{1}$$

A record meets the inclusion criteria if any sufficient inclusion AND-group is TRUE or all non-sufficient inclusion AND-groups are TRUE. A record meets the exclusion criteria if any sufficient exclusion AND-group is TRUE or all non-sufficient exclusion AND-groups are TRUE. Let V be the validation result, W be the set of evaluation results of sufficient inclusion AND-groups, X be that of sufficient exclusion AND-groups, Y be that of non-sufficient inclusion AND-groups, and Z be that of non-sufficient exclusion AND-groups. We then have Equation 2.

$$V = ((W_1 \vee \dots \vee W_{|W|}) \vee (Y_1 \wedge \dots \wedge Y_{|Y|})) \\ \wedge \neg((X_1 \vee \dots \vee X_{|X|}) \vee (Z_1 \wedge \dots \wedge Z_{|Z|})) \tag{2}$$

See Figure 1 for a representation of this logic as a decision tree.

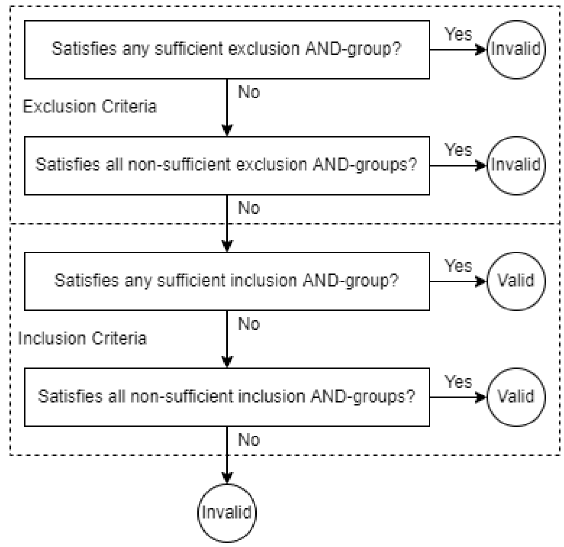

Figure 1: Validation logic for sufficient and non-sufficient inclusion and exclusion criteria.

Results

As a test case, consider the Brainiacs journal, the scope of which translates straight-forwardly to concept-validating constraints. Its full title is "Brainiacs Journal of Brain Imaging And Computing Sciences". The editors take an inclusive view of both brain imaging and computing and will consider works addressing any imaging modality or computer science topic. Thus, they can group the constraints into a single inclusion AND-group with one large OR-group containing all the tags and labels related to computing and brain imaging, e.g., those from the MeSH thesaurus Taswell (2010b).

While these constraints are highly inclusive, the themes for Transdisciplinary AI 2022 (TransAI), as described on *www.transai.org* (retrieved 2022-06-30) are even broader: "It consists of themes that each addresses the applications of AI to a specific research discipline as well as how domain specific applications may advance the research on AI." This page also defines AI very generally: "Artificial Intelligence (AI) is concerned with computing technologies that allow machines to see, hear, talk, think, learn, and solve problems even above the level of human beings." It then gives a non-exhaustive list of other disciplines to which relevant work could apply AI: computer science, education, humanities, medicine, agriculture, sciences, engineering, law, and business. Taken literally, this description indicates that the organizers will consider any use of AI in the sense of machine learning, semantic reasoning, or any other algorithm that can solve some problem at least as effectively as a human can to solve any real-world problem.

To comprehensively define concept-validating constraints, one would need to define an inclusion AND-group with two OR-groups: one consisting of "AI" and various synonyms and subclasses of it, such as "machine learning", "expert systems", and "automated reasoning" and one consisting of terms for every conceivable application area. To illustrate this, we have created a TransAI Nexus diristry at *www.portaldoors.net* with two non-sufficient inclusion AND-groups, each with a single OR-group: ("artificial intelligence" OR "expert systems" OR "decision trees" OR "automated reasoning" OR "neural networks" OR "signal denoising" OR "feature abstraction" OR "knowledge engineering") AND ("computer science" OR "software engineering" OR "conference organizing" OR "scholarly publishing" OR "information science" OR "education" OR "humanities" OR "medicine" OR "physical science" OR "chemical science"). This paper satisfies the first OR-group by having the tag "automated reasoning" and the second by having the tags "conference organizing" and "scholarly publishing" (See Figure 2). Alternately, the administrator could define an inclusion AND-group with a single OR-group for AI terms and an exclusion OR-group with a tag or label that indicates the absence of relevance to any non-AI problem domain, such as "pure AI research", but this puts the onus on the submitting author to tag the work to indicate what it does not cover rather than what it does.

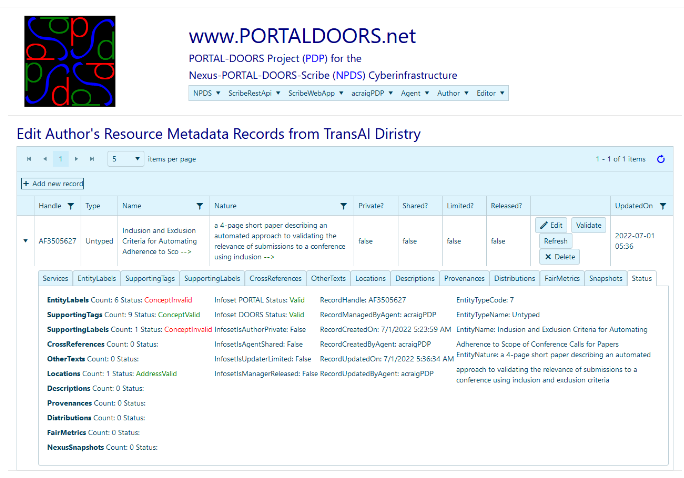

Figure 2: Validation status report for a record of an example publication in the TransAI Scribe registrar UI. The record passes the supporting tags concept-validation due to having RSTs "automated reasoning", "conference organizing", and "scholarly publishing" but lacks suitable entity or supporting labels and so fails entity label and supporting label concept-validation.

However, if we take transdisciplinary AI to mean something beyond applied AI, then we need to choose a more detailed definition. The following is one of many in the literature: "Transdisciplinary research relates to three types of knowledge: systems knowledge, target knowledge and transformation knowledge, and reflects their mutual dependencies in the research process" Hadorn et al. (2008). This suggests that we should define an inclusion AND-group with one OR-group for the AI-related terms and three singleton OR-groups, one for each form of knowledge mentioned. However, these phrases may confuse some authors. For example, "system", "target", and "transformation" have other meanings in wavelet-based signal processing Riley and Devaney (1996)Novikov and Stechkin (1998). Using more specific terms can help authors choose the ones that best describe their work. We can select additional phrases for each consistent with usage in the source Hadorn et al. (2008): 1) *system knowledge*: cause of problems, future development 2) *target knowledge*: values, norms, goals, problem-solving process 3) *transformation knowledge*: situation improvement, situation transformation. We can then group each original phrase and its associated terms into an OR-group and put the OR-groups into an inclusion AND-group alongside the AI-related AND-group.

This approach tells authors that, while each element is flexibly defined, all three are necessary to make research transdisciplinary. An author who had not read Hadorn et al. (2008) might not know to tag a work with these terms even if they were applicable, but, because the concept-validating constraints are publicly visible, the author can check them before submitting and find the ones that accurately describe the research. In the case of this article, we describe in the introduction the state of the peer review system (overburdened with a high ratio of documents submitted relative to the available reviewer-hours), identify a target of interest to all stake-holders (clarity as to whether the author should be submitting to the journal or conference), and propose a transformation that would improve the situation (use of automated validation for an initial screening for relevance). Thus, we can safely tag the record for this document with tags from each OR-group, e.g., "future development" in the problem of reviewer fatigue, "norms" of relevance to conference themes, and "situation improvement" through introduction of a useful software tool.

Discussion

These examples illustrate that the extended definition of concept-validating constraints can handle diverse inclusion and exclusion criteria, making it applicable to almost any conceivable conference or journal. By making constraints publicly viewable, the organizer or editor provides a clearer definition of the scope. This transparency makes our method distinct from such approaches as Lee et al. (2021) or Koutsomitropoulos and Andriopoulos (2022) that rely on black-box methods to embed concepts in high-dimensional spaces. It is complementary to other tools, including data-driven approaches to choosing optimal keywords Grames et al. (2019) and designing an optimal query Badami (2021) for a systematic review, which editors or organizers could re-purpose to help design concept-validating constraints. Afterward, authors could use a tool like PubTator to automatically identify supporting tags and labels for their manuscripts Wei et al. (2019).

In the near future, we hope to add concept-validation of the semantic RDF Description infosubsets of records and a matching method that searches through a class hierarchy in a formal ontology or controlled vocabulary, allowing specific terms to match to the general classes to which they belong, e.g., allowing "PET imaging" to match "brain imaging". This will allow sets of constraints to be more concise, since general categories can replace long lists of closely related terms. We also plan to add the ability to impose concept-validating constraints on the Location infosubset. Since the goal of the PORTAL-DOORS Project is to manage descriptions of all kinds of entities, both online and off, including people, NPDS records can store both physical and online locations Taswell (2008). As an example use case, organizers of clinical trials of COVID-19 interventions often attempt to recruit patients from areas already over-represented in ongoing clinical trials, leading to competition for patients, smaller sample sizes, and neglect of under-represented, resource-poor areas Park et al. (2021). Tracking prospective participants in a NPDS repository and including in the concept-validating constraints inclusion criteria for under-represented locations and exclusion criteria for over-represented areas would allow new studies to remedy these issues.

Conclusion

The extension of concept-validating constraints in NPDS cyberinfrastructure to include exclusion criteria will allow it to better serve as a platform for managing journal or conference submissions. By allowing authors to quickly and automatically check whether their submissions meet the requirements for a conference or journal, this system can lead to greater productivity for authors, peer reviewers, editors, and conference organizers.

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