Master's Thesis

Semantic approaches to citation recommendation

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Declaration

I hereby declare, that I am the sole author and composer of my thesis and that no other sources or learning aids, other than those listed, have been used. Furthermore, I declare that I have acknowledged the work of others by providing detailed references of said work. I hereby also declare, that my Thesis has not been prepared for another examination or assignment, either wholly or excerpts thereof.

Place, Date

Signature

Abstract

foo bar

Zusammenfassung

fu bar

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1 Introduction

1.1 Motivation

Citations are a central building block of scholarly discourse. They are the means by which scholars relate their research to existing work—be it in backing up claims, criticising, naming examples or engaging in any other way. Citing in a meaningful way requires an author to be aware of publications relevant to their work. Here, the ever increasing amount of new reseach publications per year poses a serious challenge. Even with academic search engines like Goolge Scholar and CiteSeerX at our disposal, identifying publications that are worthwhile to examine and appropriate to reference remains a time consuming task.

It is therefore not suprising that methods to aid researchers in these tasks have been and still are being actively researched.

While systems for recommending papers have existed since 1998 [1, 2]. The closely related field of citation analysis has an even longer history that spans multiple disciplices including applied linguistics, history and sociology of sience and information science [3, 4].

It is therefore not suprising that efforts to aid researchers in these tasks are no novelty. Systems for recommending papers have existed since 1998 [1, 2]. The closely related field of citation analysis has an even longer history that spans multiple disciplices including applied linguistics, history and sociology of sience and information science [3, 4].

there's peripheral fields like citation context analysis[5], using citations for document exploration[6], citation function[7, 8, 9, 10], citation based plagiarizm detection[11]

also there's different approaches to it (collab.fil. / content based fil.(input=paper / input=sentence / input=sentence+one citation[12] / input=abstract[13]) / graph based)

also there are efforts/ideas/... for using explicit semantic representations for scholarly discours[14, 15, 16]

therefore investigate how they can be applied to citation recommendation

1.2 Problem setting

1.3 Method

generate a data set fit for investigation of citation recommendation employing named entities and claims

devise citation recommendation approach implement and evaluate

1.4 Document structure

foo bar

1.5 Example Section

Copypasta of useful stuff below.

- Put a tilde (nbsp) in front of citations [7].

- **(TODO: Do this!)**
- **(EXTEND: Write more when new results are out!)**
- **(DRAFT: Hacky text!)**
- Chapter 1
- the colors of the Uni
  - UniBlue
  - UniRed
  - UniGrey
- a command for naming matrices $\mathbf{G}$, and naming vectors $\mathbf{a}$. This overwrites the default behavior of having an arrow over vectors, sticking to the naming conventions normal font for scalars, bold-lowercase for vectors, and bold-uppercase for matrices.
- named equations:

$$d(a, b) = d(b, a) \tag{1}$$

symmetry

- Use “these” for citing, not "these"
- If an equation is at the end of a sentence, add a full stop. If it’s not the end, add a comma: $a = b + c \quad (1)$,
- `https://en.wikipedia.org`
- Do not overuse footnotes[1] if possible.

[1] `https://en.wikipedia.org`

2 Related Work

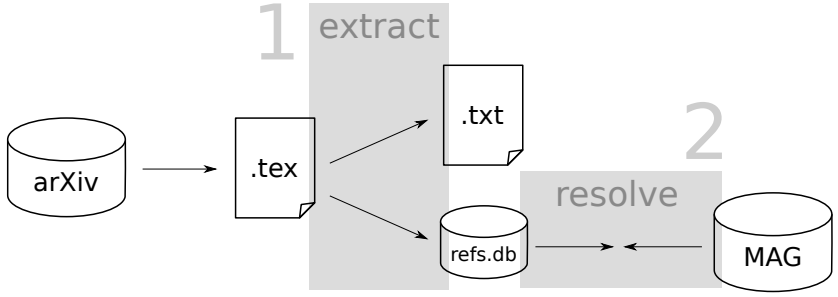
lots. pick wisely.

Leveraging Semantic Annotations to Link Wikipedia and News Archives[17]

Using NEL + dependency trees for music recommendation[18]

3 Background

explain all the things.



(a) subfloat

Figure 1: Caption that appears under the fig—do I want this in bold tho?

Algorithm 1 Stochastic Gradient Descent: Neural Network

Create a mini batch of m samples $\mathbf{x}_0 \dots \mathbf{x}_{m-1}$
foreach sample $\mathbf{x}$ **do**
  $\mathbf{a}^{\mathbf{x},0} \leftarrow \mathbf{x}$ ▷ Set input activation
  foreach Layer $l \in \{1 \dots L-1\}$ **do** ▷ Forward pass
    $\mathbf{z}^{\mathbf{x},l} \leftarrow \mathbf{W}^l \mathbf{a}^{\mathbf{x},l-1} + \mathbf{b}^l$
    $\mathbf{a}^{\mathbf{x},l} \leftarrow \varphi(\mathbf{z}^{\mathbf{x},l})$
  end for
  $\boldsymbol{\delta}^{\mathbf{x},L} \leftarrow \nabla_{\mathbf{a}} C_{\mathbf{x}} \odot \varphi'(\mathbf{z}^{\mathbf{x},L})$ ▷ Compute error
  foreach Layer $l \in L-1, L-2 \dots 2$ **do** ▷ Backpropagate error
    $\boldsymbol{\delta}^{\mathbf{x},l} \leftarrow ((\mathbf{W}^{l+1})^T \boldsymbol{\delta}^{\mathbf{x},l+1}) \odot \varphi'(\mathbf{z}^{\mathbf{x},l})$
  end for
end for
foreach $l \in L, L-1 \dots 2$ **do** ▷ Gradient descent
  $\mathbf{W}^l \leftarrow \mathbf{W}^l - \frac{\eta}{m} \sum_{\mathbf{x}} \boldsymbol{\delta}^{\mathbf{x},l} (\mathbf{a}^{\mathbf{x},l-1})^T$
  $\mathbf{b}^l \leftarrow \mathbf{b}^l - \frac{\eta}{m} \sum_{\mathbf{x}} \boldsymbol{\delta}^{\mathbf{x},l}$
end for

4 Data set

approach approach.

4.1 Existing data sets

and why a new one was necessary

MAG[19] (use/analysis: [20, 21, 22])

use of PMC OAS[23, 24, 25, 26] (PMC OAS problems: [23])

4.2 Data set creation

foo

survey paper on extraction of meta data (author, year, ...) and classification of sentences (method, goal, ...) from publications[27]

evaluation of reference string parsers[28], a dataset for reference string parsing[29]

4.3 Data set evaluation

bar

5 Semantic approaches to citation recommendation

types of citations (naming an entity, backing up a claim, etc.)

how citations are embedded in sentences (integral/non-integral[30, 31, 32, 33, 34])

5.1 Fields of Study as names entities

name name

5.2 Claims

5.2.1 Tools for extracting claims

tools tools

also: Survey on open information extraction[35]

context specific claim detection[36]

if only papers where semantically annotated as proposed in [14]

5.2.2 A model of aboutness closely tied to claim structure

unfeasibility of use of PredPatt output as is

resulting compromise model

predpatt[37, 38]

alternative view: model gives a very selective citation context derived from claim structure (cf. concept of reference scope as sub part of citation context sentence[39, 40]

6 Evaluation

evaluate evaluate

implemetation pain and bad evaluation scores[41]

6.1 Special considerations for citation recommendation

train/test splitting (per cited doc, temporal, ...), re-recommendation, number of contexts describing a recommendation item, ...

a cited doc's role (how it is cited) can develop over time[3, 42]

relevance of time[43]

candidates are only citations within current paper[44]

6.2 Offline evaluation

pre-filtering experiments (knn[26], lsi, lda, fos, ...)

different evaluation settings (all, CSonly, comparison to MAG, ...)

FoS alone, restrictively combined w/ BOW, only directly preceeding, ...

PP model alone, combined, ...

6.3 Online evaluation

Data set	#Papers	Cit. context	Disciplines	Full text	Ref. IDs
arXiv CS	90K	1 sentence	CS	yes	DBLP
CiteSeerX /RefSeer	1M	400 chars	all	no	no
PubMed Central OA[1]	2.3M	extractable	Biomed./Life Sci.	yes	mixed
Scholarly v2[2]	100K	extractable	CS	yes	no
ACL-ARC	11k	extractable	CS/comp. ling.	yes	no
ACL-AAN	18k	extractable	CS/comp. ling.	yes	no

Table 1: Table caption. foo bar...

[1] `https://www.ncbi.nlm.nih.gov/pmc/tools/openftlist/`
[2] `http://www.comp.nus.edu.sg/~sugiyama/SchPaperRecData.html`

7 Conclusion

conclude conclude.

8 Future work

As a first step identify types of citations more systematically.

For different types, different models.

Proper claim model. (that could also include assessing credibility[45])

Argumentative structures. (Argumentation mining[46, 47, 48])

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