Idiomify: Building a collocation-supplemented reverse-dictionary of English idioms for L2 learners of English

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0. **abstract**
1. **Introduction**

- what was the main aim?
- broken down into two aims: idiomify & idiom2collocations

- the controlling idea.

2. **Motivation**

- Why build a reverse dictionary of idioms?
- Why supplement it with collocations of idioms?

3. **Related Work**

- reverse-searching idioms
  - why?
    - well, for the reasons stated above, really.
  - related work. how have people done it?
  - the method. how are we doing it? (just a summary, more on this is discussed in the next section.)
- modeling collocations
  - why?
  - related work. how have people done it?
  - the method. how are we doing it? (just a summary, more on this is discussed in the next section.)
- identifying idioms
  - why?
  - related work. how have people done it? ()
  - the methods. how are we doing it?
    - as for the vocabulary of idioms - SLIDE.
    - how would you go about handling the patterns?: get use of the linguistic feature of idioms.

    - at the time I set out the development,

5. **Implementations** - as for this, do this in a chronological order.

- The subaims restated
  - with a big figure!
- 5.1. identifying idioms
  - what infrastructure did I use?: SpaCy.
  - provide some examples: (the readme page of `identify-idioms`)
- 5.2. preprocessing data
  - what infrastructure did I use?: `identify-idioms`, with multiprocessing.
  - provide some examples: all the tsv files.
- 5.3. modeling & extracting collocations of idioms.
  - what infrastructure did I use?: just pure python.
  - provide some examples: just a couple of results you've got. The big table will come up in the results section.
- 5.4. training idiom2vec
  - what infrastructure did I use?: `gensim`.
  - provide some examples - an example of the synonym search of idioms.
- 5.5. reverse-searching idioms
  - what infrastructure did I use?: `identify-idioms`
  - provide some examples - going back to the first figure. (e.g. `with bated breath`)

6. **Evaluations**

- 6.1. Identifying idioms.
  - just present some examples.
  - evaluation (the test I wrote for this)
    - ∗ good side
    - ∗ bad side
- 6.2. Modeling and extracting collocations
  - just present some examples
  - Evaluation (this has to be qualitative.).
  - improvement (how could we improve upon what we currently have?)
- 6.3. Reverse-searching idioms
  - Evaluation
    - ∗ a quantitative analysis (evaluation metrics indicating how well it performs.)
    - ∗ what's the good side of this?
    - ∗ what's the bad side of this?
  - improvement (how could we fix this?)

7. **Conclusion**
8. **References**

1. Introduction

State the main aim.

and also the sub-aims here. Do mention that they will be discussed in a different section.

but first, we will cover why want to achieve the main aim.

2. Motivation

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3. Related Work

3.1. Reverse-searching Idioms

3.2. Modeling collocations of Idioms

3.3. Identifying Idioms

- Do mention the three cases.
- you may want to mention that you came up with the first three cases, but as for the remaining three, you referenced Hughess et. al (2021).
- the remaining three - were not taken into account, because the paper was published after I finished `identify-idioms`.

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4. Implementations

Restate the subaims (that you mentioned in the introduction), with a big figure!

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5. Evaluations

5.1. Identifying idioms

5.1.1. Measures We evaluate the flexibility of the idiom-matching patterns by testing them on six variation cases: optional hyphen, inflection, alternatives, modification, openslot and passivisation. We test if the patterns can identify an idiom from an exemplar sentence for each case. For instance, as for testing for the alternatives case, we test if the patterns can identify *add fuel to the fire* from *others in the media* ***threw gasoline on the fire*** *by blaming farmers*, where *throw gasoline on the fire* is an alternative form to *add fuel to the fire*. The results of the tests are presented in **Table C** and **Table D** below.

5.1.2. Results & analysis

Table 1: The test results of the three positive cases: optional hyphen, inflection and alternatives.

case	sentence	filtered idiom lemma
optional hyphen(hyphenated)	*in terms of rhyme, meter, and* ***balls-out*** *swagger.*	`['balls-out']`
optional hyphen(hyphen omitted)	*in terms of rhyme, meter, and* ***balls out*** *swagger.*	`['balls-out']`
inflection(someone's)	*they were* ***teaching me a lesson*** *for daring to complain.*	`['teach someone a lesson']`
inflection(one's)	*Jo is a playwright who has always* ***been ahead of her time***	`['ahead of one's time']`
alternatives(original)	*others in the media have* ***added fuel to the fire*** *by blaming farmers*	`['add fuel to the fire']`
alternatives(1)	*others in the media have* ***added fuel to the flame*** *by blaming farmers*	`['add fuel to the fire']`
alternatives(2)	*others in the media have* ***poured gasoline on the fire*** *by blaming farmers*	`['add fuel to the fire']`
alternatives(3)	*others in the media have* ***threw gasoline on the fire*** *by blaming farmers*	`['add fuel to the fire']`
alternatives(4)	*others in the media have* ***threw gas on the fire*** *by blaming farmers*	`['add fuel to the fire']`

The matching patterns are able to identify idioms with an optional hyphen, those with inflecting words and those in their alternative forms. As can be seen from the first two rows of **Table C**, the patterns can correctly identify *balls-out* regardless of whether the hyphen is omitted or not. The patterns can also handle the case of inflections; they can identify *teach someone a lesson* from *teaching me a lesson* (personal pronoun inflection, the third row) and *ahead of one's time* from *ahead of her time* (possesive pronoun inflection, the fourth row). Lastly, we see that the patterns can identify *add fuel to the fire* from its four alternative forms: *add fuel to the flame*, *pour gasoline on the fire*, *throw gasoline on the fire*, *throw gas on the fire*.

Table 2: The test results of the three negative cases: modification, open slot and passivisation.

case	sentence	filtered idiom lemma
modification	*He* ***grasped at straws*** - *He* ***grasped desperately at the floating straw.***	`['grasp at straws']` - `[]`
passivisation	*And with him gone, they* ***opened the floodgates.*** - *And with him gone,* ***the floodgates were opened.***	`['open the floodgamtes]` - `[]`
open slot	*They preferred to persist in* ***keeping them at arm's length****.* - *They preferred to persist in* ***keeping both Germans and Russians at arm's length.***	`['keep someone at arm's length']` - `['at arm's length']`

Despite the three positive cases, the idiom-matching rules are unable to cover the case of modification, passivisation and open slot. Although idioms could be modified with modals, be passivised, and their open slots, i.e. *one's* and *someone's*, could be replaced with a set of words (Hughes et al., 2021), the patterns do not take into account all the three cases. For instance, as can be seen in **Table D**, The patterns can no longer identify *grasp at straws* when it is modified to *grasped desperately at the floating straw* (the first row). Likewise, they can no longer identify *open the floodgates* when it is written in a passive tense, as in *the floodgates were opened*(the second row). While they can identify *at arm's length* from *...keeping both Germans and Russians at arm's length*, the identified idiom is nonetheless not the correct idiom at use (the third row); It should identify *keep someone at arm's length*, not just *at arm's lenth.*

5.1.3. Improvement

Table 3: A summary of ElasticSearch query generation for retrieving idioms (Adapted from: Hughes et al., 2021)

variation	solution	Example ElasticSearch query
modification	slop	`{"query": "call someone's bluff", "slop": 4}`
open slot	wildcard + slop	`{"query": "call * bluff", "slop": 5}`
passivisation with modification	reordering + slop	`{"query": "someone's bluff * call", "slop": 5}`
passivisation with an open slot	reordering + wildcard + slop	`{"query": "* bluff * call", "slop": 6}`

We could improve the idiom-matching patterns if we incorporate slop, wildcard and reordering techniques into the patterns. This could have them cover modification, open slot and passivisation cases. **Table E** illustrates how Hughes et al. (2021) achieve this, with *call someone's bluff* as an example. Although they use ElasticSearch to implement their solutions, we could still adopt the techniques to address the three negative examples introduced in **Table D** above. For instance, we could match *grasped desperately at the floating straw* with "grasp (slop) at (slop) straws" as "slop" would allow rooms for any words in between the constituent words of an idiom, thereby addressing the modification case. We could also match *keeping both Germans and Russians at arm's length* with "keeping (slop) * (slop) at arm's length", as the wildcard would allow for the open slot to be substituted with any word. We should also be able to match *the floodgates were opened* with "* the floodgates * open" as the position of the main verb is now reordered to address the passivisation.

5.2. Modeling Collocations of Idioms

5.2.1. Measures

Table 4: used for testing both idiom2collocations & idiomify

idiom	frequency/group	definition
bite off more than one can chew	1/A	To try to do too much
touch and go	1/A	uncertain

idiom	frequency/group	definition
installed base	2/A	The number of units of a system or product that are currently in use
spectator sport	77/B	Something, especially a process or activity, which is a popular object of observation
sweeten the pot	77/B	To make something more desirable
talk is cheap	78/B	used to mean that it is easy to say that one will do something
on one's bill	195/C	On the list of items one is expected to pay for.
muddy the waters	197/C	to make something unclear and difficult to understand
offer one's condolences	199/C	To offer sympathy to someone who has recently experienced the loss of a loved one
have one's hands full	555/D	To be busy or thoroughly preoccupied.
lift a finger	563/D	To help with something.
in black and white	567/D	In writing
tell you what	23115/E	used to introduce a suggestion
you know what	135422/E	used to get someone's attention
let someone go	142905/E	fire, discharge someone

How did I evaluate this?

5.2.2. Results & analysis

Table 5: Top 5 collocations and use cases for *from a to z(freq 1, group A)*.

model	verb	noun	adj	adv
tf	scan(2)	-	-	-
tfidf	scan(1.0)	-	-	-
pmi	-	-	-	-

Table 6: The representative use cases of *from a to z(freq 1, group A)*.

oxford	cambridge	merriam webster
He knew his subject from A to Z	*This book tells the story of her life from A to Z.*	*The book is titled "Home Repairs From A to Z."*

Table 7: Top 5 collocations and use cases for *spectator sport(freq 77, group B)*.

model	verb	noun	adj	adv
tf	grow, know, fledge, die, mean	number, suit, form, courtesy, today	great, **popular**, complete, big, large	exactly, especially, fast, kind, long
tfidf	moneymake, fledge, grow, recommend, die	tutoring, form, courtesy, suit, spectacle	**popular**, anlocal, great, dry, mathematical	exactly, generally, especially, fast, definitely
pmi	grow, know	suit, form, number	**popular**, great	exactly

Table 8: The representative use cases of *spectator sport(freq 77, group B)*.

oxford	cambridge	merriam webster
*What is the country's most **popular** spectator sport?*	*Football is certainly the biggest spectator sport in Britain.*	*For many, politics has become a spectator sport."*

Table 9: Top 5 collocations and use cases for *best of both worlds(freq 195, group C)*.

model	verb	noun	adj	adv
tf	grow, know, fledge, die, mean	number, suit, form, courtesy, today	great, **popular**, complete, big, large	exactly, especially, fast, kind, long

model	verb	noun	adj	adv
tfidf	moneymake, fledge, grow, recommend, die	number, suit, form, courtesy, today	**popular**, anlocal, great, dry, mathematical	exactly, generally, especially, fast, definitely
pmi	grow, know	suit, form, number	**popular**, great	exactly

Table 10: The representative use cases of *best of both worlds(freq 195, group C).*

oxford	cambridge	merriam webster
What is the country's most ***popular*** *spectator sport?*	*Football is certainly the biggest spectator sport in Britain.*	*For many, politics has become a spectator sport.*

Table 11: Top 5 collocations and use cases for *have one's hands full (freq 555, group D).*

model	verb	noun	adj	adv
tf	gon, try, ve, think, know	today, gon, guy, **mother**, police	sure, **new**, private, separate, dear	right, **certainly**, kind, kinda, clearly
tfidf	gon, ve, try, deal, doubtless	gon, **at the moment**, police, **nurse**, journalist	sure, uterine, overloaded, **new**, liable	kinda, **certainly**, right, kind, clearly
pmi	investigate, ve, search, suspect, deal, gon	**at the moment**, gon,**nurse**, journalist, guard, bunch	sure, **new**	kinda, **certainly**, clearly, kind, obviously, right,

Table 12: The representative use cases of *have one's hands full (freq 555, group D).*

oxford	cambridge	merriam webster
*She **certainly** has her hands **full with four kids** in the house*	*I'm sorry I can't help you – I have my hands full **right now***	*She'll have her hands full **with the new baby.***

Table 13: Top 5 collocations and use cases for *tell you what (freq 23115, group E).*

model	verb	noun	adj	adv
tf	happen, **let**, want, gon, think	time, people, man, problem, guy	wrong, good, great, right, little	right, kind, maybe, actually, probably
tfidf	happen, **let**, gon, want, think	problem, wrong, relief, pleasure	wrong, great, good, right, able	right, kind, actually, maybe
pmi	**-i'll**, privilege, irk, do–, to_do_with, transpire	barbecu, technicality-, stooling, musve, mcmahon'll	DON'T, youtryto, uriel, cess, exploitable	montero, mackowes, it'about, vega, weenie

Table 14: The representative use cases of *tell you what (freq 23115, group E).*

oxford	cambridge	merriam webster
I'll *tell you what—* ***let's*** *stay in instead.*	***I'll*** *tell you what - we'll split the money between us.*	*(**I'll**) Tell you what—I'll* **let** *you borrow the car if you fill it up with gas.*

How are the results? - some good parts, qualitatively. will come back to this.

How are the results? - some bad parts, qualitatively. will come back to this.

- why bad? for the same reason *the*, *can* would have no significaiton collocations. They are of little significance. They are "Stop Idioms", effectively.

- show the luhn's curve.

- as for the group A, B, C and D - the corpus is not huge enough to believe in their trend.
- but as for group E: - this could be reliable. (in effect, those idioms have multi-sense entries in the dictionaries.)
- now… hmm…

5.2.3. Improvement

how could you improve upon what you currently have? - one simple way - use a different model

how could you improve upon what you currently have? - one simple way - use a different model. - another way - you may not know what measures are the one. Maybe the right answer is a little bit of all of them. - this is a niche for machine learning. (cite that research.. right?)

5.3. Reverse-searching idioms

5.3.1. Measures

- Put the table of the test set that you used to evaluate the whole thing.

how did you evaluate it? **Quantitative analysis: by computing median rank over the test set above.** - why choose median rank? We could have used mmr (harmonic mean), ndcg, map, etc. - because we don't have labels other than the target idioms - but more because Cho et.al used this as the evaluation metric. need a research with which we can compare the performance of Iidomify.

5.3.2. Results & Analysis

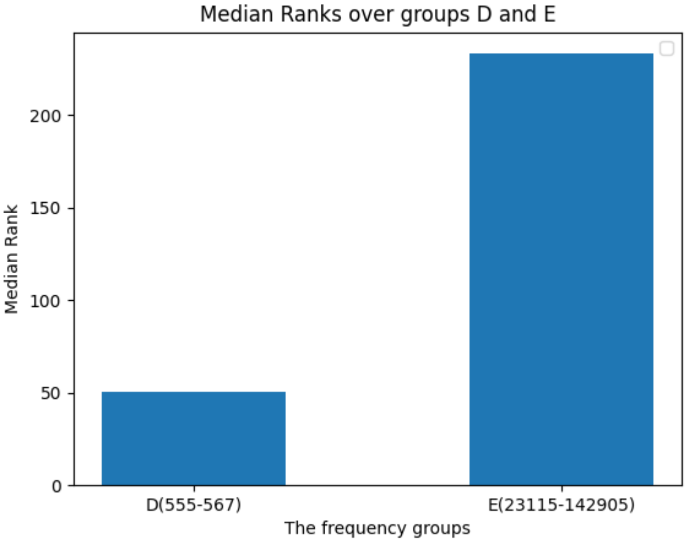
what did you learn from evaluation? - 1. we need a mixture of distributional semantics approach and inverted index approach.

Table 15: The test data for OneLook & RNN cosine is Cite it later.

model	method	median rank	variance
Idiom2Vec (Idiomify)	avg	128	4310
Word2Vec (Cho)	add	923	163
Word2Vec (Cho)	mul	1000	10
OneLook	-	0	67
RNN cosine (Cho)	-	12	103

From the quantitative analysis, we see that averaging Idiom2Vec embeddings is a decent baseline. - as the table above indicates, we could do with RNN. Word2Vec as the labels, and cosine similarity as the loss function. - we could continue improving the baseline using weighted average of vectors and truncating with SVD, as explained in "the formidable baseline" paper. - or even try using BERT, to get out of bow assumption. (the two BERT paper, which leverages of transfer learing.)
- but even if we do so, it seems apparent that distributional semantics approach alone is not a feasible solution. - what we need is a combination of inverted index & distributional semantics approach.

We could further improve Idiomify with a mixture of inverted index and distributional semantics approach. - why? - for unseen data. inverted index performs poorly . - cite the paper.



What did you learn from evaluation? -

We see that more data does not guraantee increase in performance.
- evidence? Look at the data above. Idiomify performs significantly worse on Group E than on Group D. - why? Don't know for certain, but this may be because Group E idioms are mostly . . . "Stop Idioms" (Need more research on this)
- evidence for the reason? e.g. - example for the reason? e.g. you know what? get out of here! - wrap it up.

So how? use lunn's curve to detect "stop idioms", don't apply distributional semantics score to them
- use that. . . lun's curve. - could we train ""

what did you learn from the evaluations? : 2

Table 16: Performance of idiomify by different versions of Idiom2Vec.

Idiom2Vec version	corpora	stopwords removal	lemmatisation	MRR
V1	COCA (spok)	not removed	lemmatised	276.5
V2	COCA (spok), Opensubtitles	not removed	lemmatised	128.0
V3	COCA (spok), Opensubtitles	removed	lemmatised	156.0

Lastly, we also see that stopwords should not be removed from the training set. - evidence?: - why? - example? - explanation? - wrap up.

5.3.3. Improvements

How could you improve upon what you currently have?

Conclusion

References

- Hughess, et al.