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UniHD at TSAR-2022 Shared Task: Is Compute All We Need for Lexical Simplification?

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Current Simplification Systems



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Complex Word

*: requires external knowledge/tooling

Source: Qiang et al., 2020: LSBert: A Simple Framework for Lexical Simplification

Aumiller and Gertz: "UniHD at TSAR-2022: Is Compute All We Need for Lexical Simplification?"

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Complex Word



Stemming*

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Complex Word



Stemming*



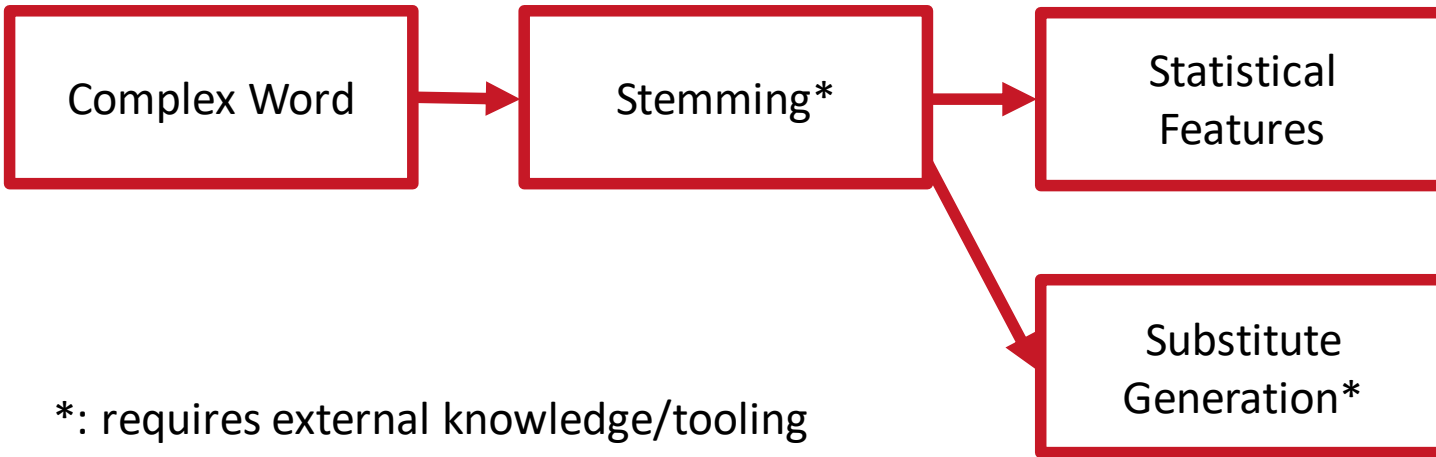
Substitute
Generation*

*: requires external knowledge/tooling

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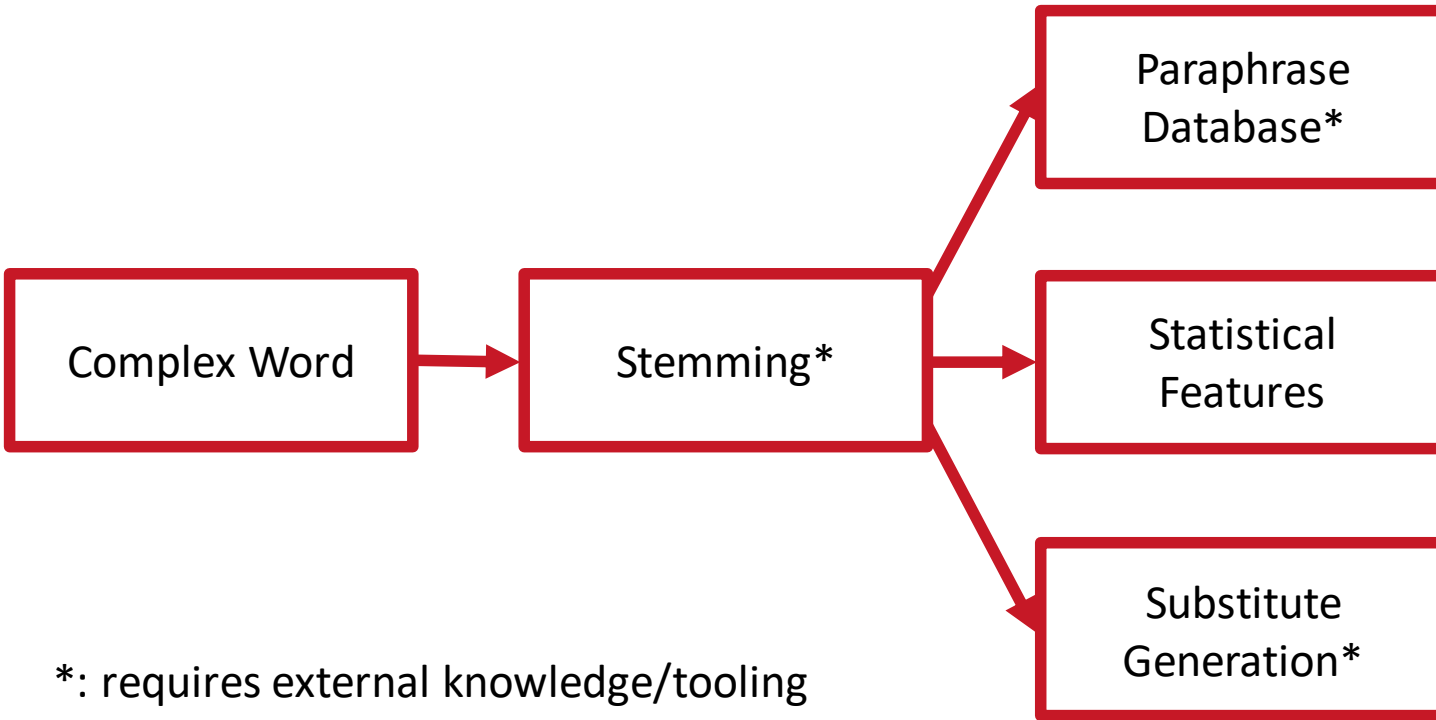
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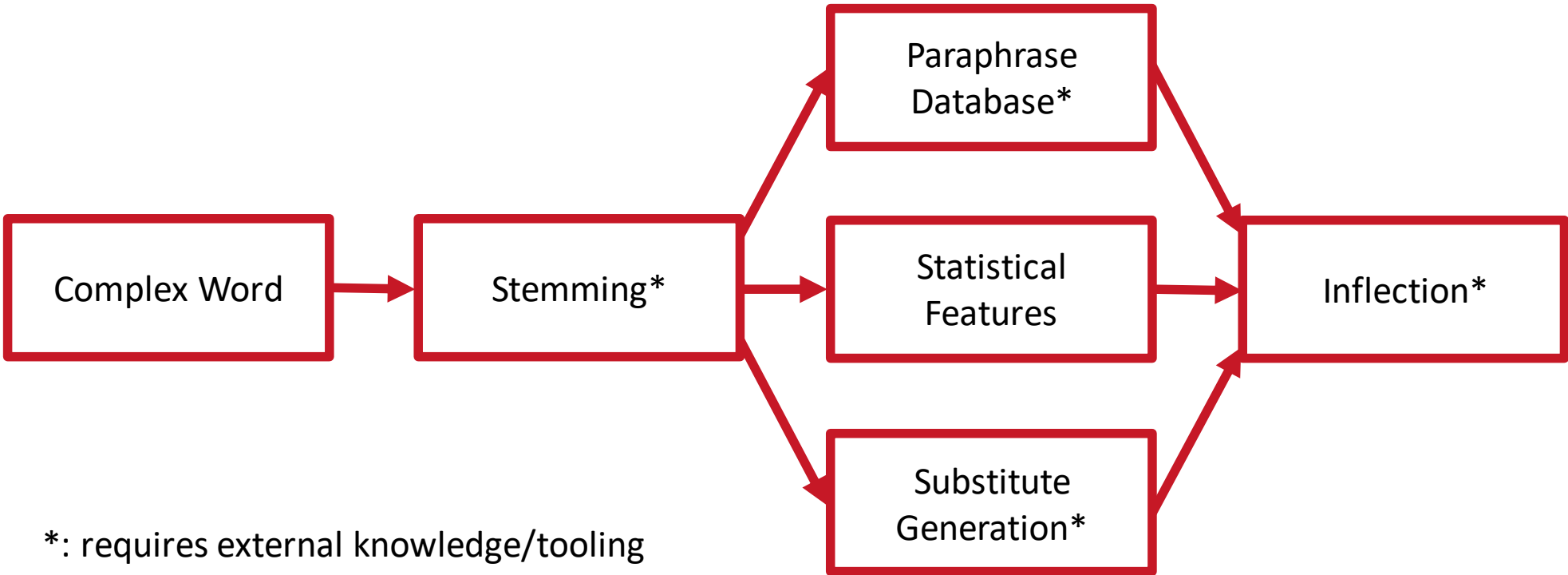
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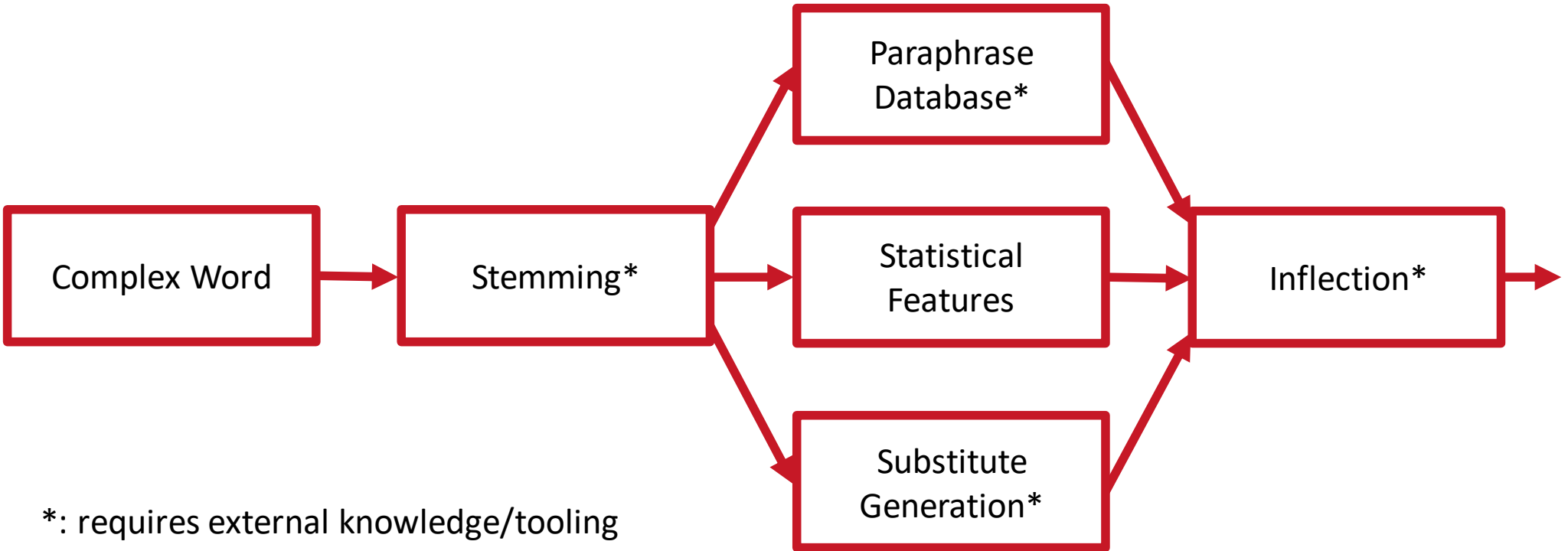
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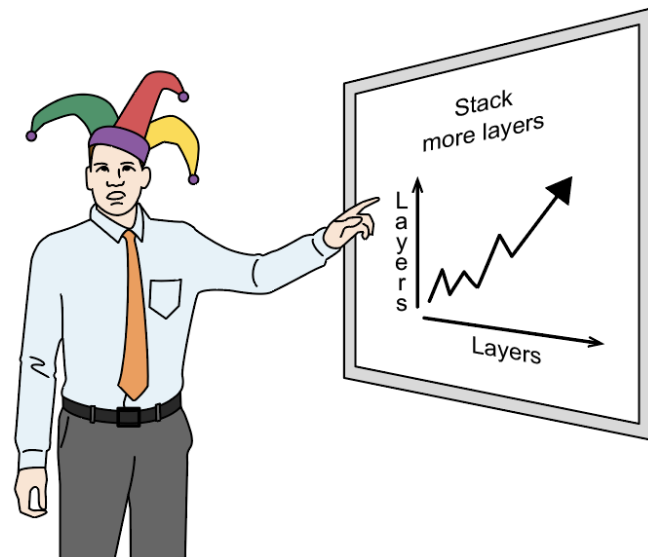


Wishful Thinking

- A **simple pipeline**, that could do all of that (but better)?
 - No domain-specific resources required
 - No tedious adaptation to new domains/languages

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Source: <https://freecontent.manning.com/neural-network-architectures/>



Contributions

- Consider very large Language Models (LMs) as zero-shot recommenders for (contextualized) Lexical Simplification
- Improve prediction diversity and coverage by sampling from multiple system prompts



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The Magical World of Prompt Design

Task Setup



- Shared task trial data: only 10 labeled samples
 - Require very good zero-shot performance
- Post-filtering as quality control



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- Post-filtering as quality control





Model Considerations

- Large enough to exhibit emergent behavior
 - >60B parameters
- Provide reasonable API or inference endpoints
- Explicitly trained on (at least) one shared task lang
 - Consider “parameters per language” in train data



Model Considerations

- Large enough to exhibit emergent behavior
 - >60B parameters
- Provide reasonable API or inference endpoints
- Explicitly trained on (at least) one shared task lang
 - Consider “parameters per language” in train data
- Went with GPT-3 (*text-davinci-002*)



Play around, Find out

- Finding the “best” prompt is difficult
 - No observable gradients
 - Inference costs
- Bigger models -> higher prompt tolerance



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Give me five easier to understand synonyms for the following word: instilled

A: imparted, injected, infused, permeated, steeped



Play around, Find out

- Finding the “best” prompt is difficult
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Give me five easier to understand synonyms for the following word: instilled

A: imparted, injected, infused, permeated, steeped

Give me five easier to understand synonyms for the following word: instilled

1. implanted
2. inserted
3. infused
4. permeated
5. saturated



Play around, Find out

- Finding the “best” prompt is difficult
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Ensuring Structured Outputs



- “Exam question trick”
 - Adding explicit cues improves consistency
 - Still no guarantee for consistency!

Question: List ten alternatives for the word "instilled" that are easier to understand.

Answer:

1. Taught
2. Trained
3. Educated
4. Instructed
5. imparted
6. conveyed
7. communicated
8. imparted
9. introduced
10. implanted



Incorporating Context

Context: Rajoy's conservative government had instilled markets with a brief dose of confidence by stepping into Bankia, performing a U-turn on its refusal to spend public money to rescue banks.

Question: Given the above context, list ten alternative words for "instilled" that are easier to understand.

Answer:

1. planted
2. sowed
3. introduced
4. infused
5. instilled
6. imparted
7. injected
8. communicated
9. conveyed
10. transferred

- Downside: More context -> higher inference cost



Filtering

- Merge different output formats
- Filter identity predictions & repetitions
- Remove verbose substitutes

Question: List ten alternatives for the word "maniacs" that are easier to understand.

Answer:

1. people who are out of control
2. people who are crazy
3. people who are insane
4. people who are demented
5. people who are deranged
6. people who are disturbed
7. people who are erratic
8. people who are wild
9. people who are uncontrolled
10. people who are unhinged



Official Results

- Particularly impressive @1 & @3 performance
- @10 performance drops of

Run	ACC@1	Acc@k@Top1			MAP@k			Potential@k		
		$k = 1$	$k = 2$	$k = 3$	$k = 3$	$k = 5$	$k = 10$	$k = 3$	$k = 5$	$k = 10$
Single (Ours)	0.7721	0.4262	0.5335	0.5710	0.5090	0.3653	0.2092	0.8900	0.9302	0.9436
MANTIS-1	0.6568	0.319	0.4504	0.5388	0.473	0.3599	0.2193	0.8766	0.9463	0.9785
UoM&MMU-1	0.6353	0.2895	0.4530	0.5308	0.4244	0.3173	0.1951	0.8739	0.9115	0.9490
LSBert	0.5978	0.3029	0.4450	0.5308	0.4079	0.2957	0.1755	0.8230	0.8766	0.9463
TUNER	0.3404	0.1420	0.1689	0.1823	0.1706	0.1087	0.0546	0.4343	0.4450	0.4450



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Improving Coverage of Predictions



Improving Coverage

- Filtering removes “too many” candidates
- Candidate sets can be homogenous
- Order of candidates suboptimal



Improving Coverage

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Idea: Query with multiple (different) prompts!

- Add few-shot examples
- With/Without context sentence

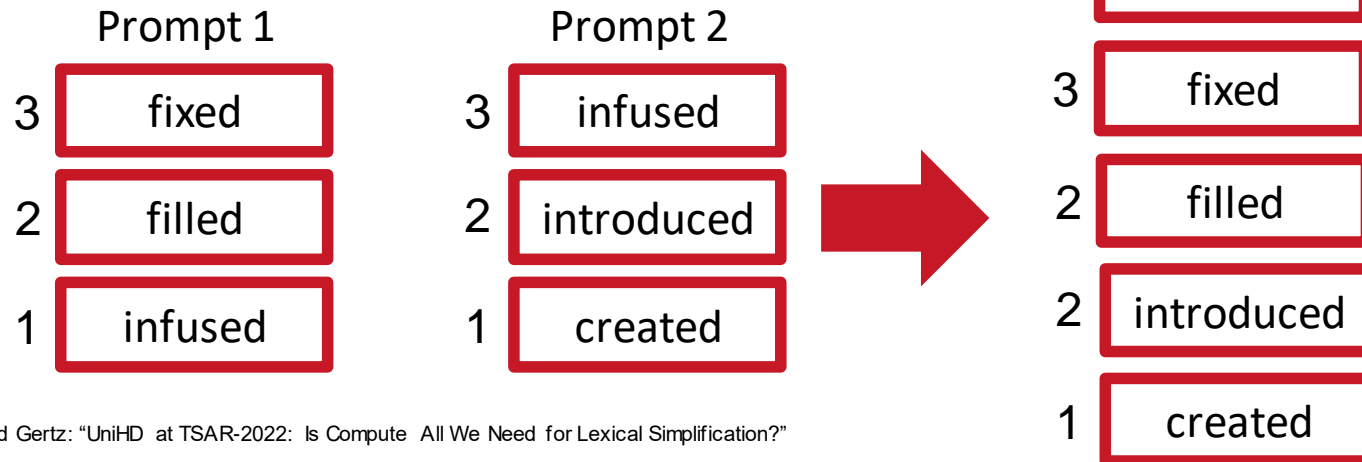
Merging Predictions

- Assign scores to each prompt-specific result set
- Aggregate & re-rank based on total score
- Cut down to k predictions

Prompt 1	Prompt 2
3 fixed	3 infused
2 filled	2 introduced
1 infused	1 created

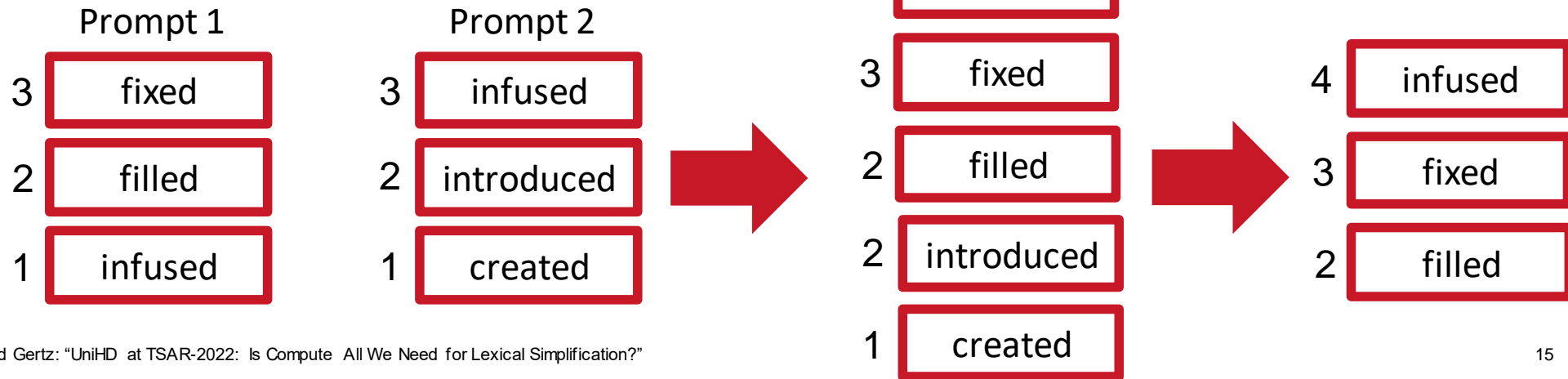
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Updated Results

- Slight improvements @1
- Drastically improved @10 performance

Run	ACC@1	Acc@k@Top1			MAP@k			Potential@k		
		$k = 1$	$k = 2$	$k = 3$	$k = 3$	$k = 5$	$k = 10$	$k = 3$	$k = 5$	$k = 10$
Ensemble (Ours)	0.8096	0.4289	0.6112	0.6863	0.5834	0.4491	0.2812	0.9624	0.9812	0.9946
Single (Ours)	0.7721	0.4262	0.5335	0.5710	0.5090	0.3653	0.2092	0.8900	0.9302	0.9436
MANTIS-1	0.6568	0.319	0.4504	0.5388	0.473	0.3599	0.2193	0.8766	0.9463	0.9785
UoM&MMU-1	0.6353	0.2895	0.4530	0.5308	0.4244	0.3173	0.1951	0.8739	0.9115	0.9490
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Bonus: Multilingual Extension

Language Transfer with LLMs



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- What if we “ask nicely”?

Language Transfer with LLMs



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- What if we “ask nicely”?

Context: Además de partidos de fútbol americano, el estadio ha sido utilizado para una gran variedad de eventos, entre los que se destacan varios partidos de la selección nacional de fútbol de los Estados Unidos, y fue el hogar del ahora difunto club de la MLS, el Tampa Bay Mutiny.

Question: Given the above context, list ten alternative words for "difunto" that are easier to understand.

Answer:

1. deceased
2. late
3. departed
4. gone
5. lost
6. forgotten
7. unlamented
8. dead
9. defunct
10. extinct

Language Transfer with LLMs



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- What if we “ask nicely”?

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Question: Given the above context, list ten alternative Spanish words for "difunto" that are easier to understand.

Answer: 1. Fallecido

2. Difunto
3. Muerto
4. Falecido
5. Difunto
6. Fallecido
7. muerto
8. desaparecido
9. extinto
10. finado

Spanish and Portuguese Results



Spanish:

Run	ACC@1	Acc@k@Top1			MAP@k			Potential@k		
		$k = 1$	$k = 2$	$k = 3$	$k = 3$	$k = 5$	$k = 10$	$k = 3$	$k = 5$	$k = 10$
Ensemble (Ours)	0.6521	0.3505	0.5108	0.5788	0.4281	0.3239	0.1967	0.8206	0.8885	0.9402
Single (Ours)	0.5706	0.3070	0.3967	0.4510	0.3526	0.2449	0.1376	0.6902	0.7146	0.7445
PresiUniv-1	0.3695	0.2038	0.2771	0.3288	0.2145	0.1499	0.0832	0.5842	0.6467	0.7255
UoM&MMU-3	0.3668	0.1603	0.2282	0.269	0.2128	0.1506	0.0899	0.5326	0.6005	0.6929
LSBert	0.2880	0.0951	0.1440	0.1820	0.1868	0.1346	0.0795	0.4945	0.6114	0.7472
TUNER	0.1195	0.0625	0.0788	0.0842	0.0575	0.0356	0.0184	0.144	0.1467	0.1494



Spanish and Portuguese Results

Spanish:

Run	ACC@1	Acc@k@Top1			MAP@k			Potential@k		
		$k = 1$	$k = 2$	$k = 3$	$k = 3$	$k = 5$	$k = 10$	$k = 3$	$k = 5$	$k = 10$
Ensemble (Ours)	0.6521	0.3505	0.5108	0.5788	0.4281	0.3239	0.1967	0.8206	0.8885	0.9402
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TUNER	0.1195	0.0625	0.0788	0.0842	0.0575	0.0356	0.0184	0.144	0.1467	0.1494

Portuguese:

Run	ACC@1	Acc@k@Top1			MAP@k			Potential@k		
		$k = 1$	$k = 2$	$k = 3$	$k = 3$	$k = 5$	$k = 10$	$k = 3$	$k = 5$	$k = 10$
Ensemble (Ours)	0.7700	0.4358	0.5347	0.6229	0.5014	0.3620	0.2167	0.9171	0.9491	0.9786
Single (Ours)	0.6363	0.3716	0.4625	0.5160	0.4105	0.2889	0.1615	0.7860	0.8181	0.8422
GMU-WLV-1	0.4812	0.2540	0.3716	0.3957	0.2816	0.1966	0.1153	0.6871	0.7566	0.8395
Cental-1	0.3689	0.1737	0.2433	0.2673	0.1983	0.1344	0.0766	0.524	0.5641	0.6096
LSBert	0.3262	0.1577	0.2326	0.286	0.1904	0.1313	0.0775	0.4946	0.5802	0.6737
TUNER	0.2219	0.1336	0.1604	0.1604	0.1005	0.0623	0.0311	0.2673	0.2673	0.2673



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Take Away and Limitations

Is Compute All We Need?



- **Maybe?**
 - Great performance
 - Expensive inference
 - Hard to steer generation
- Useful for silver labels?

Thank you for your attention!



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Code: <https://github.com/dennlinger/TSAR-2022-Shared-Task>

Any questions?



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Alternative Models:

- Smaller models struggle with coherence

Name ten alternative words for "instilled" that are easier to understand.

instructed, instilled, ingrained, ingrained, ingrained, implanted, implanted, implanted,
implanted, planted

All Prompts:



Prompt Type	Template
Zero-shot /w context temperature: 0.3 (conservative), 0.8 (creative)	Context: {context_sentence}\n Question: Given the above context, list ten alternatives for “{complex_word}” that are easier to understand.\n Answer:
Single-shot /w context temperature: 0.5	Context: A local witness said a separate group of attackers disguised in burqas – the head-to-toe robes worn by conservative Afghan women – then tried to storm the compound.\n Question: Given the above context, list ten alternative words for “disguised” that are easier to understand.\n Answer:\n1. concealed\n2. dressed\n3. hidden\n4. camouflaged\n5. changed\n6. covered\n7. masked\n8. unrecognizable\n9. converted\n10. impersonated\n Context: {context_sentence}\n Question: Given the above context, list ten alternatives for “{complex_word}” that are easier to understand.\n Answer:



All Prompts:

Two-shot /w context temperature: 0.5	<p>Context: That prompted the military to deploy its largest warship, the BRP Gregorio del Pilar, which was recently acquired from the United States.\n</p> <p>Question: Given the above context, list ten alternative words for “deploy” that are easier to understand.\n</p> <p>Answer:\n1. send\n2. post\n3. use\n4. position\n5. send out\n6. employ\n7. extend\n8. launch\n9. let loose\n10. organize\n\n</p> <p>Context: The daily death toll in Syria has declined as the number of observers has risen, but few experts expect the U.N. plan to succeed in its entirety.\n</p> <p>Question: Given the above context, list ten alternative words for “observers” that are easier to understand.\n</p> <p>Answer:\n1. watchers\n2. spectators\n3. audience\n4. viewers\n5. witnesses\n6. patrons\n7. followers\n8. detectives\n9. reporters\n10. onlookers\n\n</p> <p>Context: {context_sentence}\n</p> <p>Question: Given the above context, list ten alternatives for “{complex_word}” that are easier to understand.\n</p> <p>Answer:</p>
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All Prompts:



Zero-shot w/o context temperature: 0.7	Give me ten simplified synonyms for the following word: {complex_word}
Single-shot w/o context temperature: 0.6	Question: Find ten easier words for “compulsory”. Answer:\n1. mandatory\n2. required\n3. essential\n4. forced\n5. important\n6. necessary\n7. obligatory\n8. unavoidable\n9. binding\n10. prescribed\n\nQuestion: Find ten easier words for “{complex_word}”. Answer:

Outline



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- 1. Reading a Simplified Article**
- 2. Constructing the Klexikon Dataset**
- 3. Exploratory Analysis**
- 4. Future Work**