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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

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Complex Word



Stemming\*

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Complex Word



Stemming\*



Substitute  
Generation\*

\*: requires external knowledge/tooling

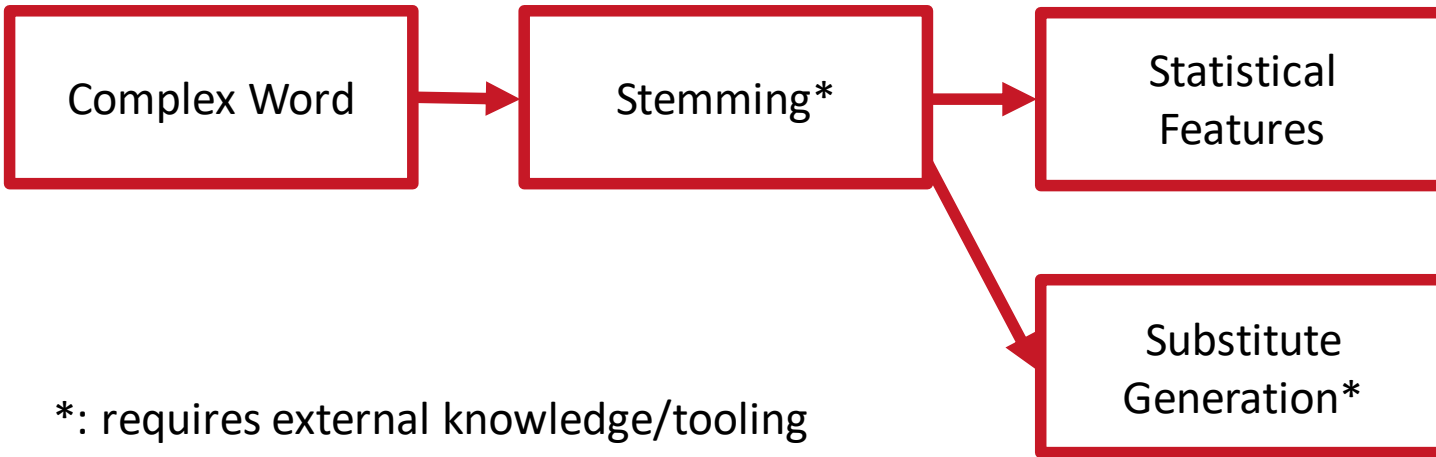
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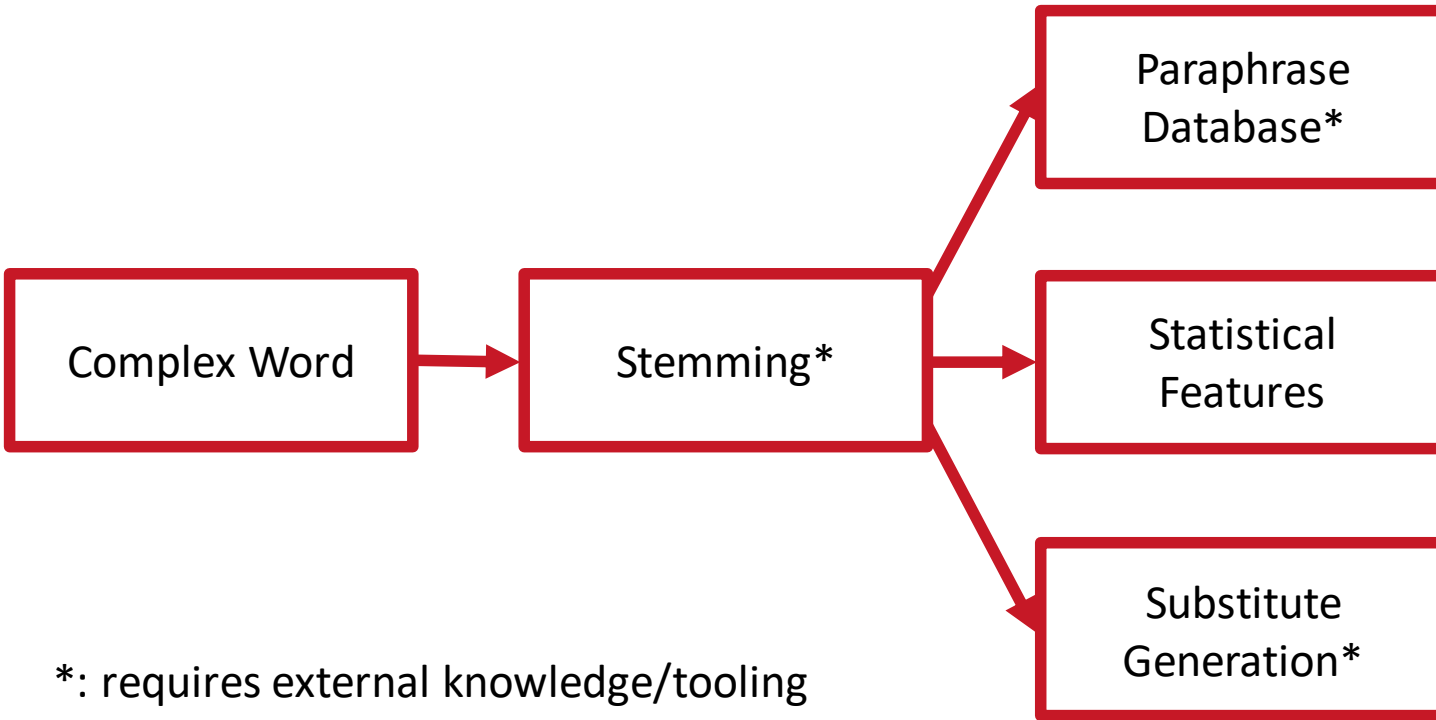


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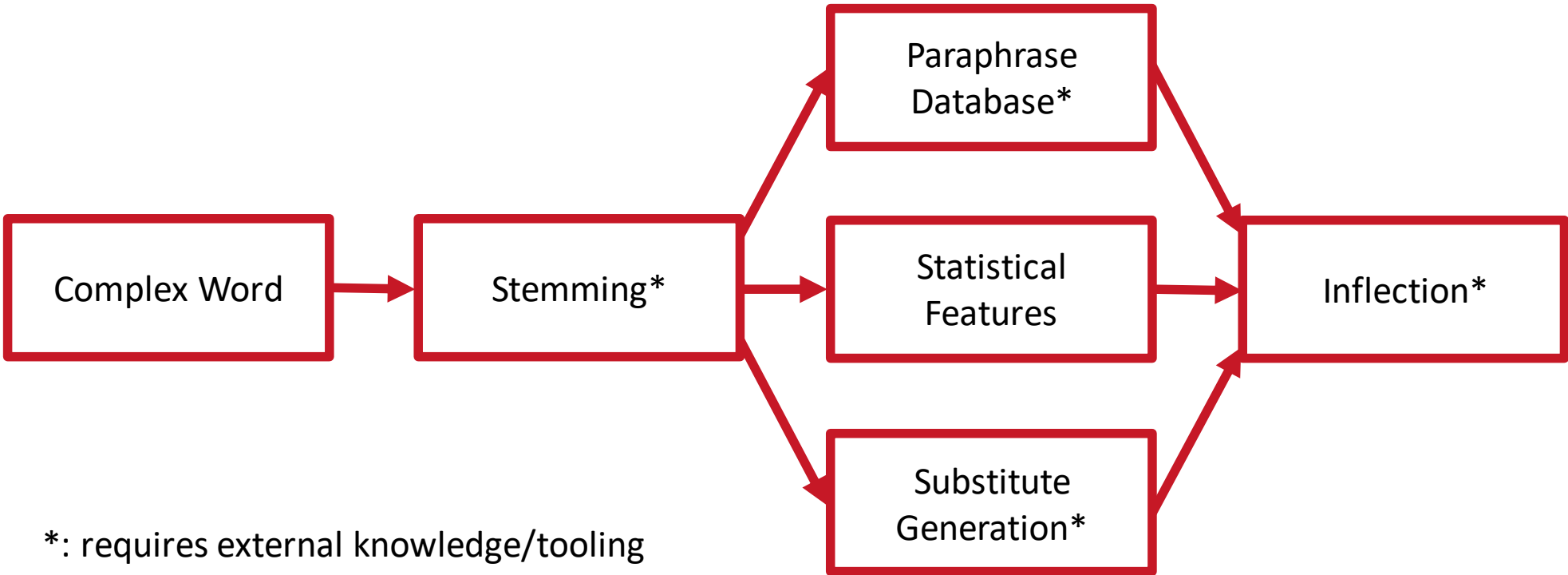
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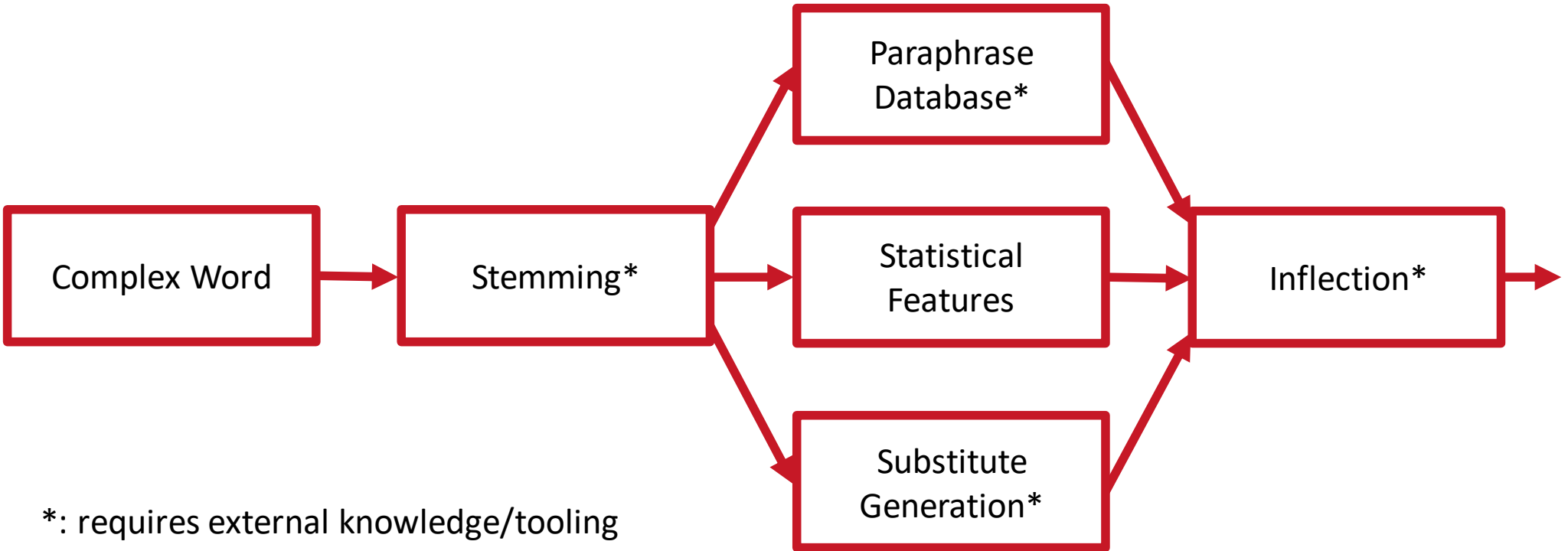
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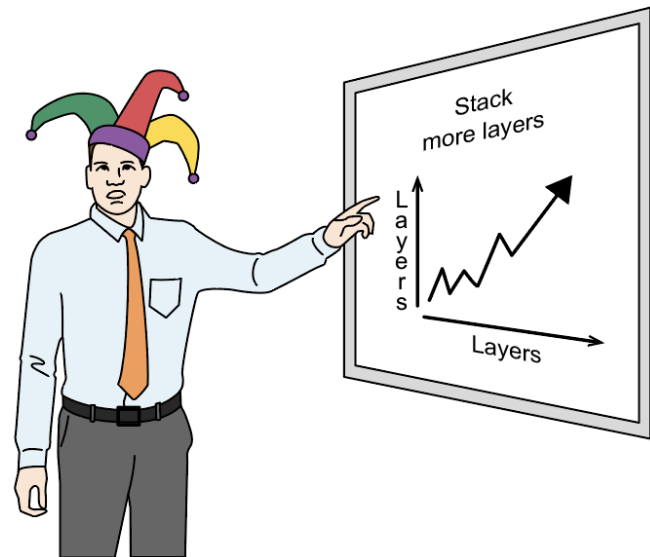


# Wishful Thinking

- 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 (LLMs) as few-shot (contextualized) recommenders for Lexical Simplification
- Improve prediction diversity and coverage by sampling from multiple system prompts



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# "The Plan is Simple"

# 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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# 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*)





# Prompting

- Query GPT-3 for ten simplification candidates
- Ensure structured outputs by prompt tuning

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



# 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)	<b>0.7721</b>	<b>0.4262</b>	<b>0.5335</b>	<b>0.5710</b>	<b>0.5090</b>	<b>0.3653</b>	0.2092	<b>0.8900</b>	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 (6 total)

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



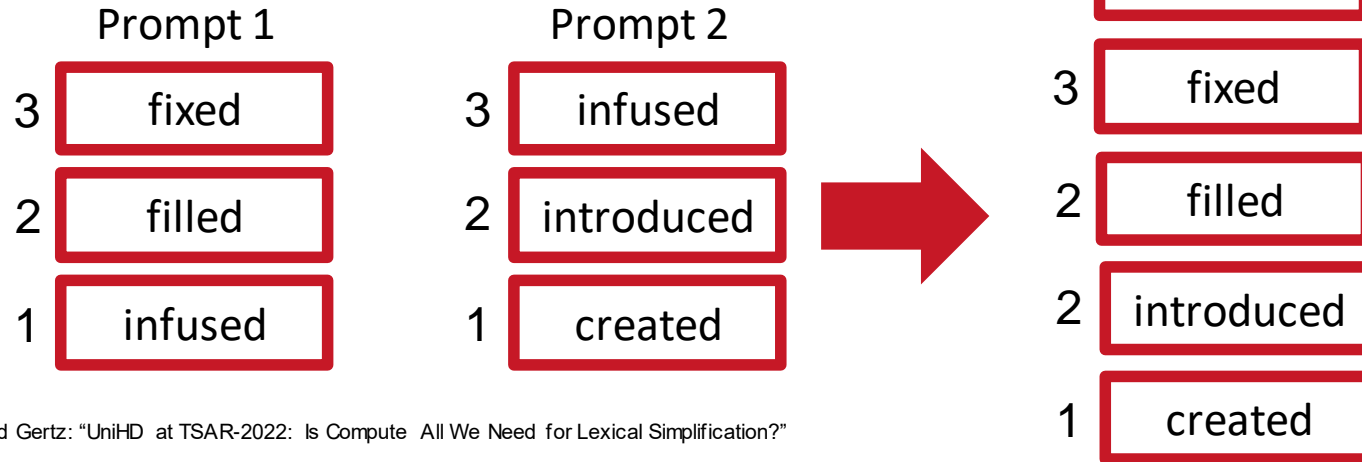
# Merging Predictions

- 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

# Merging Predictions

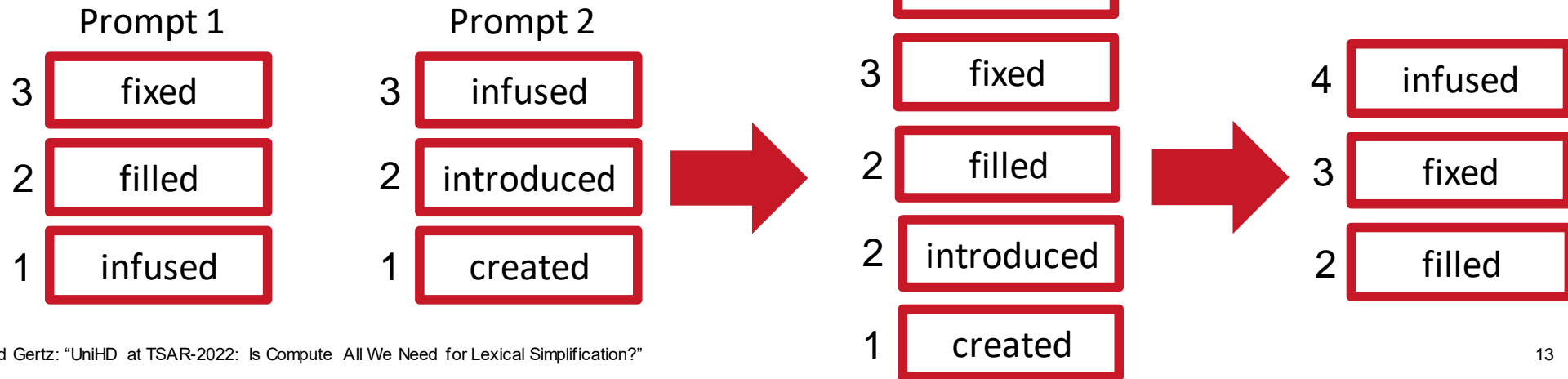
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# Merging Predictions

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





# 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)	<b>0.8096</b>	<b>0.4289</b>	<b>0.6112</b>	<b>0.6863</b>	<b>0.5834</b>	<b>0.4491</b>	<b>0.2812</b>	<b>0.9624</b>	<b>0.9812</b>	<b>0.9946</b>
Single (Ours)	0.7721	0.4262	0.5335	0.5710	0.5090	0.3653	0.2092	0.8900	0.9302	0.9436
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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
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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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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.

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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)	<b>0.6521</b>	<b>0.3505</b>	<b>0.5108</b>	<b>0.5788</b>	<b>0.4281</b>	<b>0.3239</b>	<b>0.1967</b>	<b>0.8206</b>	<b>0.8885</b>	<b>0.9402</b>
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)	<b>0.6521</b>	<b>0.3505</b>	<b>0.5108</b>	<b>0.5788</b>	<b>0.4281</b>	<b>0.3239</b>	<b>0.1967</b>	<b>0.8206</b>	<b>0.8885</b>	<b>0.9402</b>
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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)	<b>0.7700</b>	<b>0.4358</b>	<b>0.5347</b>	<b>0.6229</b>	<b>0.5014</b>	<b>0.3620</b>	<b>0.2167</b>	<b>0.9171</b>	<b>0.9491</b>	<b>0.9786</b>
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?



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- **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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# Exact prompts used:

Prompt Type	Template
<b>Zero-shot /w context</b> 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:
<b>Single-shot /w context</b> 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:



# Exact prompts used:

<b>Two-shot /w context</b> 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>
--	--

# Exact prompts used:



<b>Zero-shot w/o context</b> temperature: 0.7	Give me ten simplified synonyms for the following word: {complex_word}
<b>Single-shot w/o context</b> temperature: 0.6	Question: Find ten easier words for “compulsory”.\n 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}”. \n Answer:



# 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



# Play around, Find out

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





# Play around, Find out

- Finding the “best” prompt is difficult
  - No observable gradients
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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
  - No observable gradients
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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
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9. conveyed
10. transferred

- Downside: More context -> higher inference cost