BlendX : Complex Multi-Intent Detection with Blended Patterns

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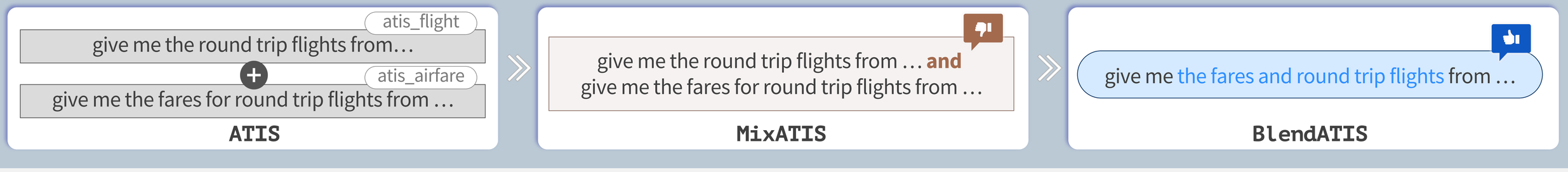
Introduction

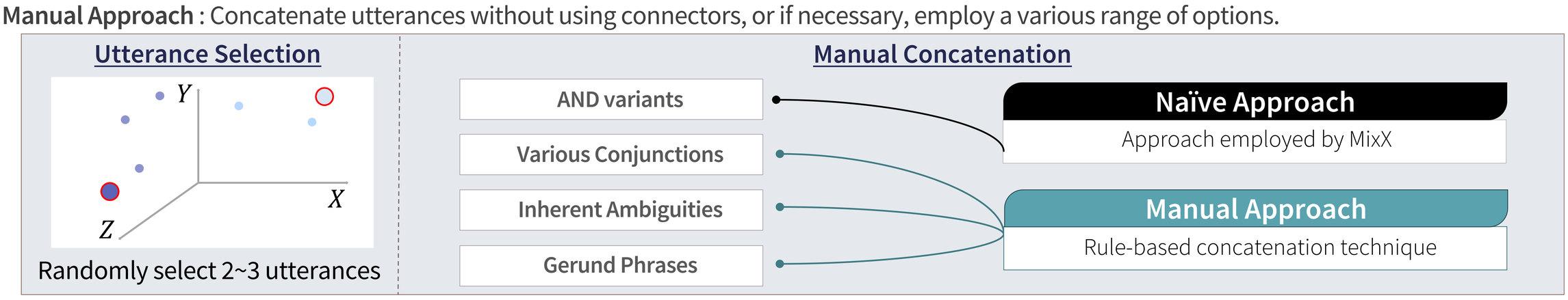
MixATIS and MixSNIPS datasets rely on only a few specific connectors (‘*and*’, ‘*and then*’, ‘*and also*’, ‘**,**(comma)’) when concatenating 2 or more single-intent utterances. Real-world conversations often involve more varied and complex ways of combining intents.



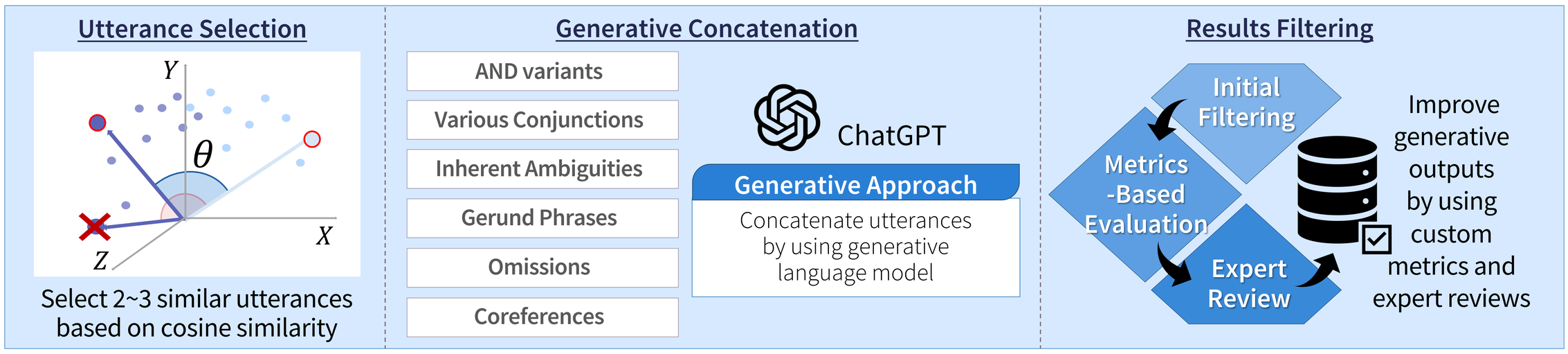
Dataset Construction

Without generating brand-new multi-intent utterances and ensuring they fit within the existing intent space, we propose 2 approaches:

- **Manual Approach** : Concatenate utterances without using connectors, or if necessary, employ a various range of options.



- **Generative Approach** : Extend ChatGPT's capabilities for producing coherent multi-intent utterances by concatenating single-intent utterances.



We’ve developed **BlendX**, a dataset that mirrors the complexity and diversity of natural dialogue. In total, it contains about 180,000 utterances, covering both manual and generative approach concatenations.

Comparative Evaluation – BlendX vs. MixX

(1) 3 CUSTOM METRICS (Differences before and after an utterance concatenation)
→ Our approach yields more realistic explicit and implicit concatenations

- $\mathrm{W}(utt, n) \stackrel{\text{def}}{=} \mathbf{1}_{\mathbb{Z}-\mathbb{N}}\left(|utt|_{word} - \sum_{i=1}^{n} |utt_i|_{word}\right)$. : Check if the word count difference
- $\mathrm{C}(utt, n) \stackrel{\text{def}}{=} \mathbf{1}_{\mathbb{Z}-\mathbb{N}}\left(|utt|_{conj} - \sum_{i=1}^{n} |utt_i|_{conj}\right)$. : Verify if the number of conjunctions
- $\mathrm{P}(utt, n) \stackrel{\text{def}}{=} \mathbf{1}_{\mathbb{N}}\left(|utt|_{pron} - \sum_{i=1}^{n} |utt_i|_{pron}\right)$. : Assess if the difference in pronoun count

Utterance 1	play my 88 keys playlist (`PlayMusic`)			
Utterance 2	add another song to my 88 keys playlist (`AddToPlaylist`)			
Strategies	**Concatenation Results**	$\mathrm{W}(utt, 2)$	$\mathrm{C}(utt, 2)$	$\mathrm{P}(utt, 2)$
Explicit Concatenation	play my 88 keys playlist **and** also add another song to my 88 keys playlist	0	0	0
Implicit Concatenation				
Inherent Ambiguity	play my 88 keys playlist add another song to my 88 keys playlist	1	1	0
Omissions	play my 88 keys playlist and add another song	1	0	0
Coreferences	play my 88 keys playlist and add another song to it	1	0	1
Gerund Phrase	add another song to my 88 keys playlist playing it	1	1	1

We've used 3 metrics to validate the naturalness of our approach. An implicitly concatenated utterance is likely to receive 1 in the metrics evaluation.

(2) EVALUATE STATE-OF-THE-ART BASELINES → Significant drops

Model	Option		Dataset (Metric: accuracy)			
	Training	Test	SNIPS	ATIS	Banking77	CLINC150
TFMN	MixX	MixX	95.68* ±0.57	77.98* ±0.57	76.61 ±1.17	85.88 ±1.03
	MixX	BlendX	52.51 ±1.86	42.51 ±1.48	37.31 ±0.81	42.45 ±2.40
	BlendX	BlendX	94.93 ±0.85	76.50 ±0.83	63.99 ±0.81	77.96 ±0.82
SLIM	MixX	MixX	95.97* ±0.23	77.10* ±0.28	83.71 ±0.88	88.67 ±0.56
	MixX	BlendX	93.51 ±0.18	72.80 ±1.48	69.89 ±0.46	73.39 ±2.46
	BlendX	BlendX	95.73 ±0.86	76.92 ±0.84	75.30 ±0.71	85.62 ±0.51
gpt-3.5-turbo	-	MixX	81.68	40.30	30.90	49.22
	-	BlendX	76.18	38.84	22.67	37.55

The significant performance drop indicates BlendX’s complexity and the need for more advanced models to handle such intricate tasks.

(3) VISUALIZATION → Nearly identical distributions