TopicGPT: A Prompt-based Framework for Topic Modeling

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Github: https://github.com/chtmp223/topicGPT

Introduction

- Conventional topic models represent topics in a **bag-of-words** format that often requires "reading the tea leaves" to interpret; additionally, they offer a limited and inconvenient way to control topic semantics.
- We introduce **TopicGPT**, a framework that uses **large language models (LLMs)** to uncover latent topics in text corpora.

1. TopicGPT produces **interpretable** topics that consist of natural language labels and descriptions.

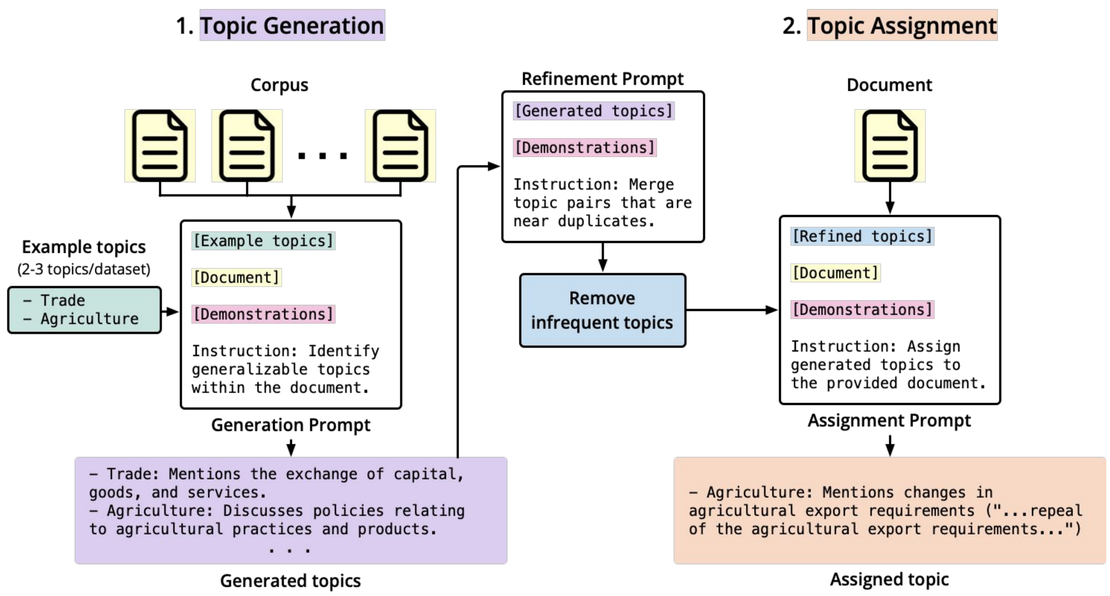
Wikipedia article

```
The Grant Park Music Festival (formerly
Grant Park Concerts ) is an annual
ten-week classical music concert series
held in Chicago, Illinois, USA. It
features the Grant Park Symphony Orchestra
and Grant Park Chorus along with featured
guest performers and conductors….
```

Output topics

- **TopicGPT:** Music & Performing Art (Discuss creation, production, and performance of music, as well as related arts and cultural aspect).
- **LDA:** city, building, area, new, park.

2. TopicGPT is **customizable** to fit user needs through example topic guidance and semantic-based topic refinement.



3. TopicGPT **outperforms** current state of the art in generating topics that are aligned with human-annotated topics.

- Baselines: LDA, BERTopic, SeededLDA
- Default setting: generator = `GPT-4`, assigner = `GPT-3.5-turbo`
- Dataset: Wikipedia articles (`Wiki`) and Congressional bills summaries (`Bills`)
- Alignment Metrics: Harmonic Mean Purity (P_1), Adjusted Rand Index (ARI), Normalized Mutual Information (NMI)

Dataset	Setting	TopicGPT			LDA			BERTopic			SeededLDA		
		P_1	ARI	NMI	P_1	ARI	NMI	P_1	ARI	NMI	P_1	ARI	NMI
Wiki	Default setting (k=31)	**0.73**	**0.58**	**0.71**	0.59	0.44	0.65	0.54	0.24	0.50	0.61	0.47	0.65
	Refined topics (k=22)	**0.74**	**0.60**	**0.70**	0.64	0.52	0.67	0.58	0.28	0.50	0.62	0.51	0.65
Bills	Default setting (k=79)	**0.57**	**0.42**	**0.52**	0.39	0.21	0.47	0.42	0.10	0.40	0.50	0.28	0.43
	Refined topics (k=24)	**0.57**	**0.40**	**0.49**	0.52	0.32	0.46	0.39	0.12	0.34	0.52	0.31	0.45
TopicGPT stability ablations, baselines controlled to have the same number of topics (k).													
Bills	Different generation sample (k=73)	**0.57**	**0.40**	**0.51**	0.41	0.23	0.47	0.38	0.08	0.38	0.40	0.21	0.44
	Out-of-domain prompts (k=147)	**0.55**	**0.39**	**0.51**	0.31	0.14	0.47	0.35	0.07	0.41	0.29	0.13	0.44
	Additional example topics (k=123)	**0.50**	**0.33**	**0.49**	0.33	0.15	0.46	0.36	0.07	0.40	0.33	0.15	0.44
	Shuffled generation sample (k=118)	**0.55**	**0.40**	**0.52**	0.33	0.16	0.47	0.36	0.08	0.40	0.34	0.18	0.44
	Assigning with Mistral (k=79)	**0.51**	**0.37**	0.46	0.39	0.21	**0.47**	0.42	0.10	0.40	0.50	0.28	0.43

4. TopicGPT topics are **semantically close** to ground truth.

- Manual matching between ground truth, TopicGPT & LDA labels.
- Misaligned topics are categorized as (1) out-of-scope, (2) missing, or (3) repeated.

Dataset	Setting	Out-of-scope	Missing	Repeated	Total
Wiki	LDA (k=31)	46.3	4.3	11.9	62.4
	Unrefined (k=31)	38.7	**0.0**	1.1	39.8
	Refined (k=22)	**30.3**	**0.0**	**0.0**	**30.3**
Bills	LDA (k=79)	56.1	2.1	22.0	80.2
	Unrefined (k=79)	65.0	**1.3**	3.8	70.1
	Refined (k=24)	**27.8**	4.2	**0.0**	**31.9**

5. TopicGPT can also be extended to a **hierarchical** setting.

- Generated topics are treated as the top-level topics and LLMs are prompted to generate subtopics.