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PP-Rec: News Recommendation with both Personalized User Interest and Time-aware News Popularity

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Personalized News Recommendation

- Online news platforms attract massive users to read news articles
 - E.g., Microsoft News, Google News, Toutiao
- News recommendation is critical for improving user experiences

SOCIAL TURMOIL

Grand jury will be set up in Prude death case
The New York Times

Louisville sees protests on Kentucky Derby day
ABC News

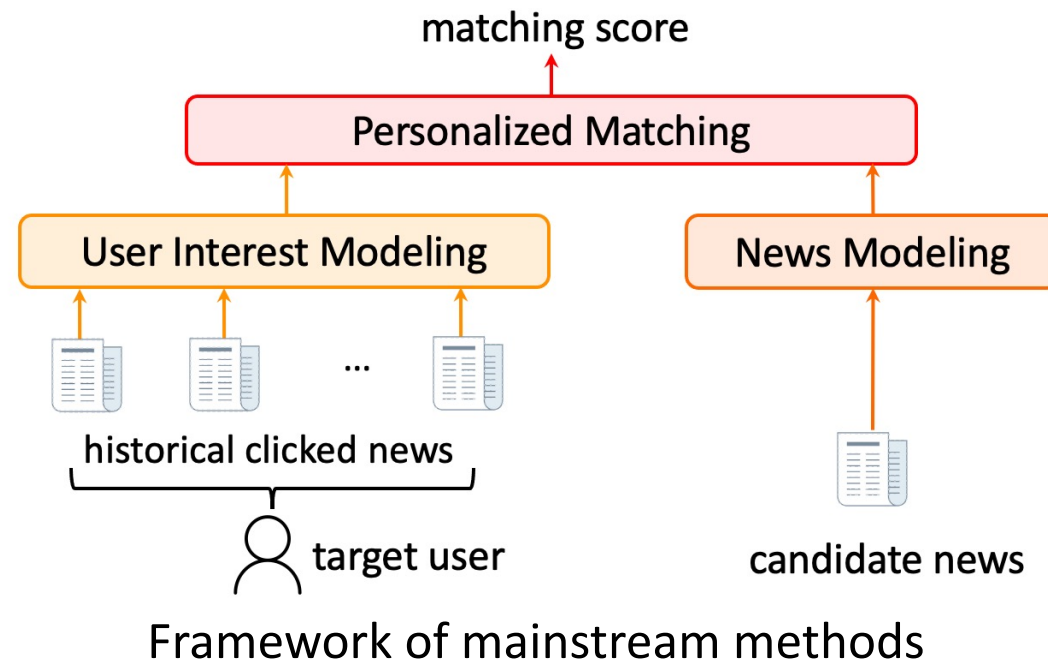
43 million Americans are baking under record heat
CBS News

Analysis: Home no longer safe for mayors
The Wall Street Journal.

Travel Trailers for Family Adventures
AutoNXT

Personalized News Recommendation

- Model user interest from user's historical click behaviors
- Recommend candidate news matching user interest



• Challenges:

- Difficult to model personal interests of cold-start users
- Cause filter bubble issues in recommender systems

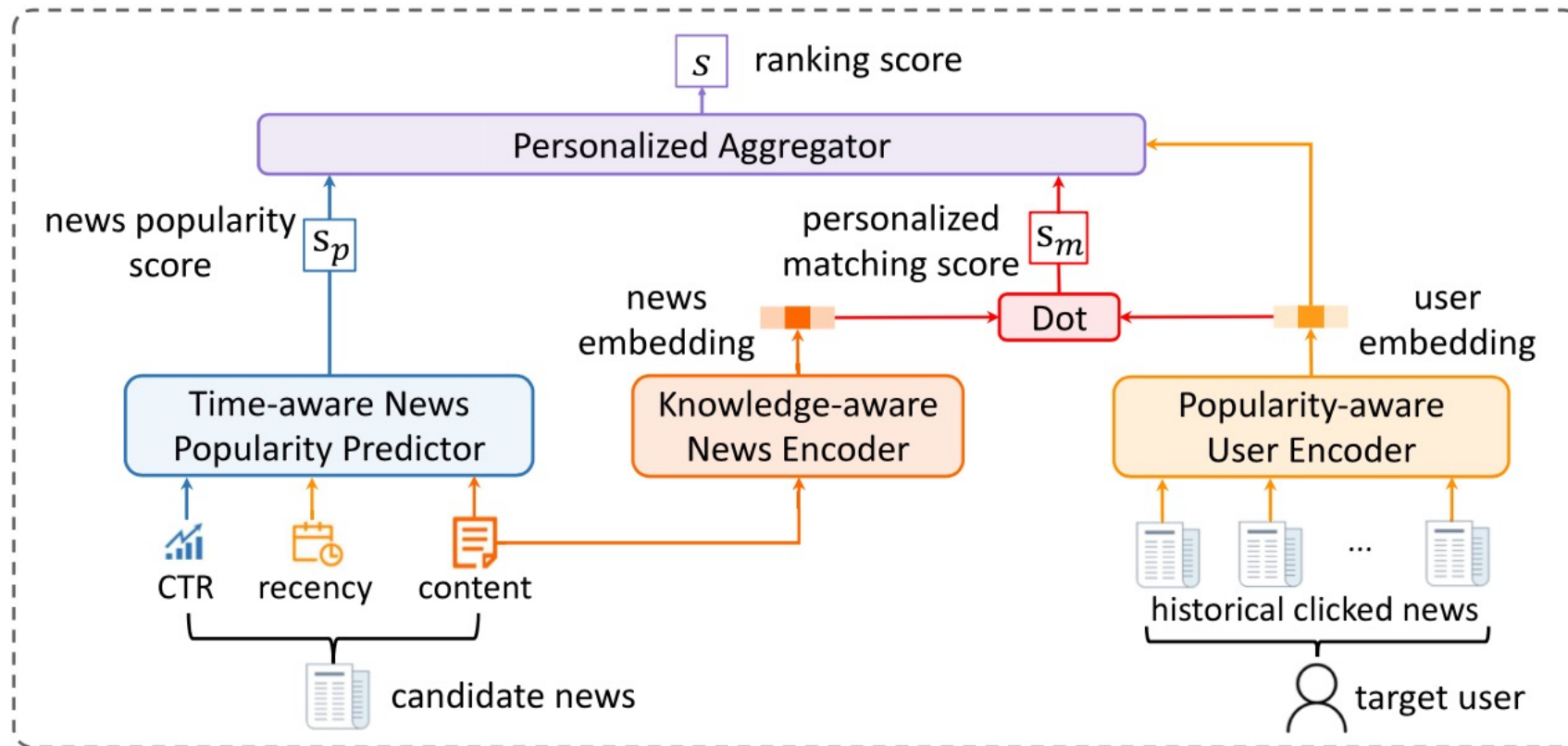
Motivation

- Popular news usually convey important and diverse information
- Attract users with different personal interest to read

		
6.1 magnitude quake rattles Alaska	Returning to normal is not simple for everyone	Biden aims to rebuild and expand legal immigration
		
Russia diplomat warns US ahead of summit	Man accused of plotting Walmart attack arrested	Black Wall Street was shattered 100 years ago

PP-Rec

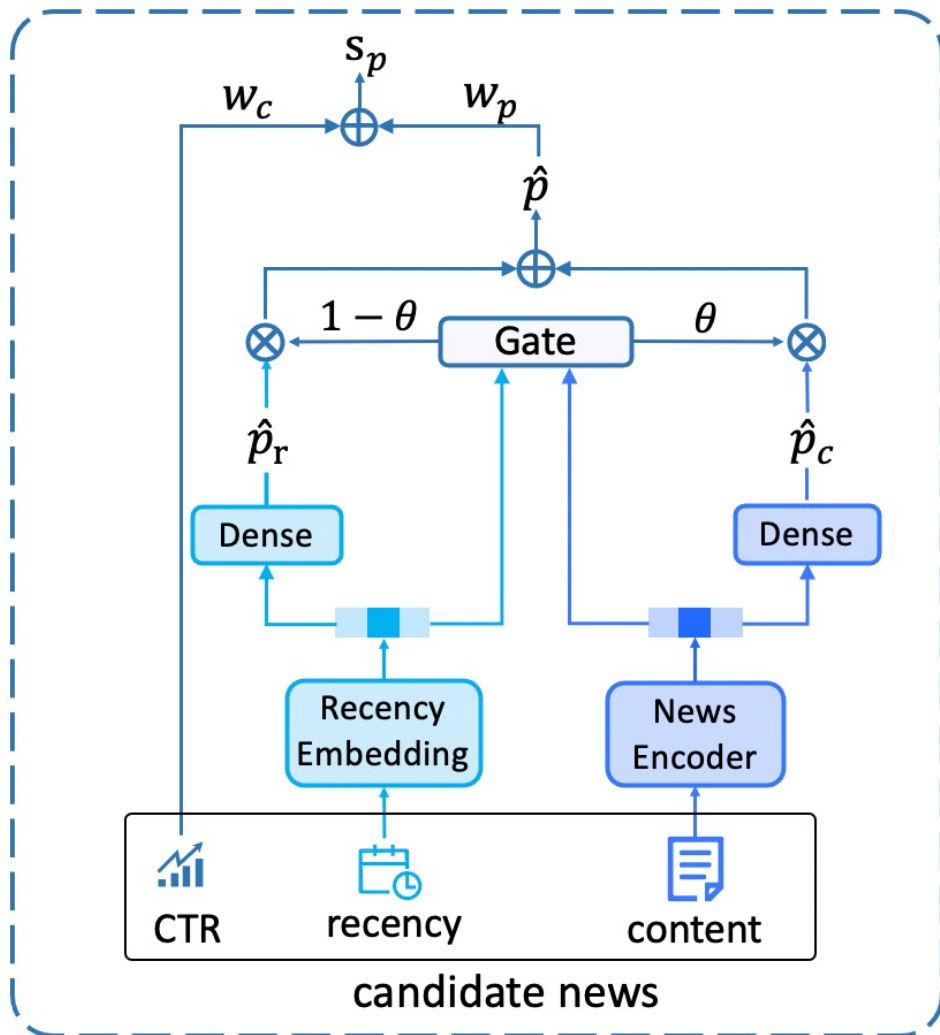
- News recommendation with both user interest and news popularity



Overall framework

Time-aware News Popularity Predictor

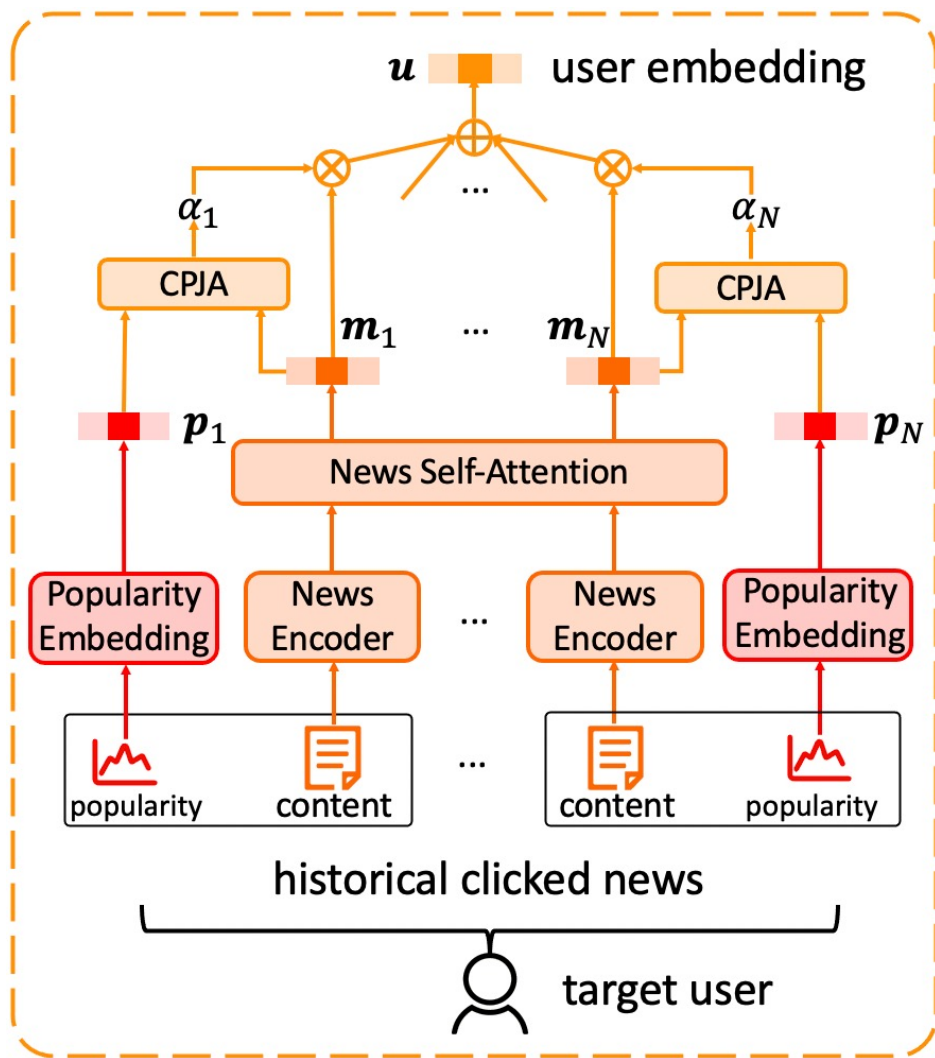
- Predict news popularity from news near real-time CTR, content and recency



- Click-through rate of news can effectively reflect its popularity
- News with breaking content are more likely to be popular
- Popular news will become unpopular quickly once its information is out-of-date

Popularity-aware User Encoder

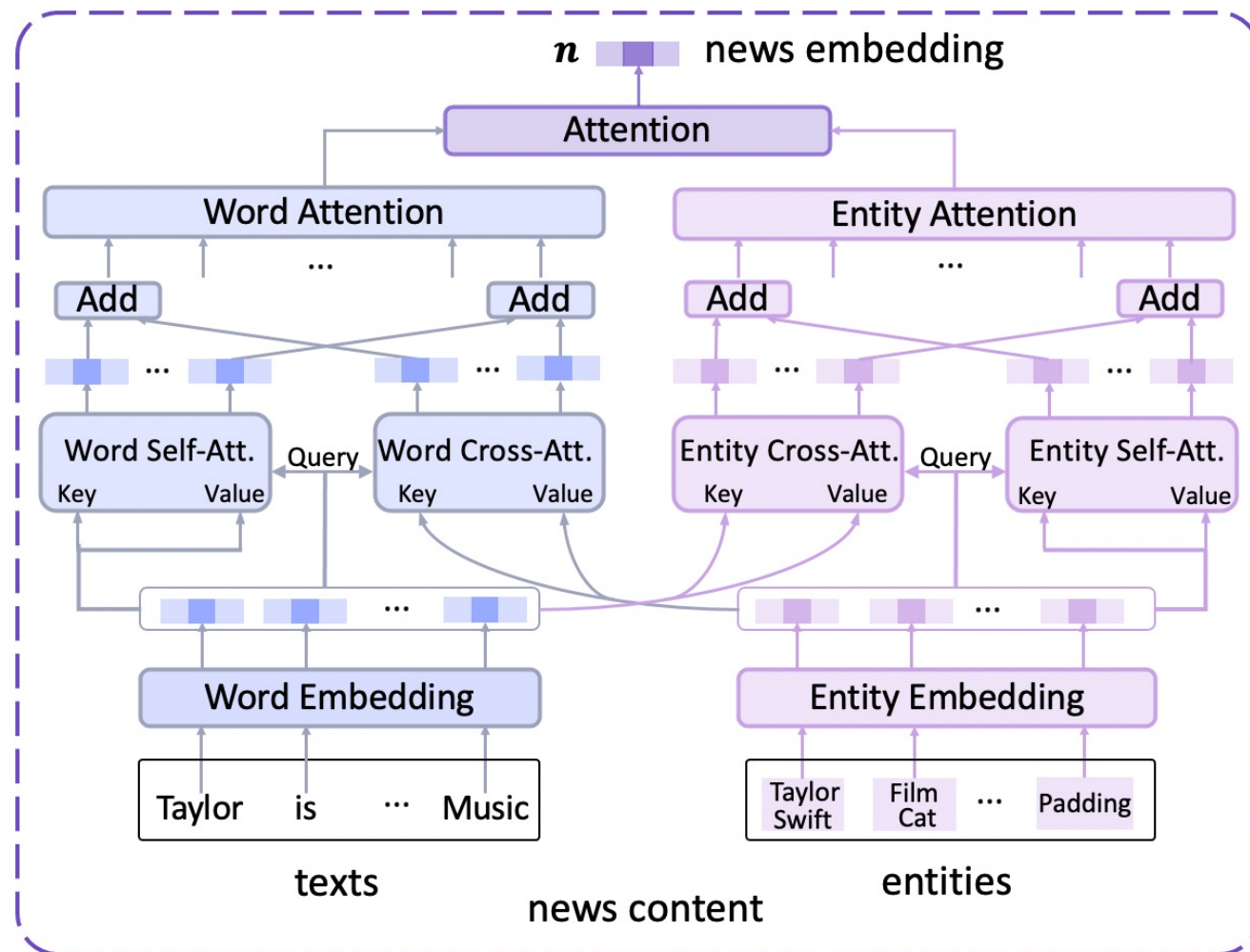
- Model accurate user interest from popularity bias-eliminated clicked news



- User's historical clicked news usually encodes news popularity bias
- Eliminate news popularity bias can help us better understand user interest
- Content-popularity joint attention network (CPJA)

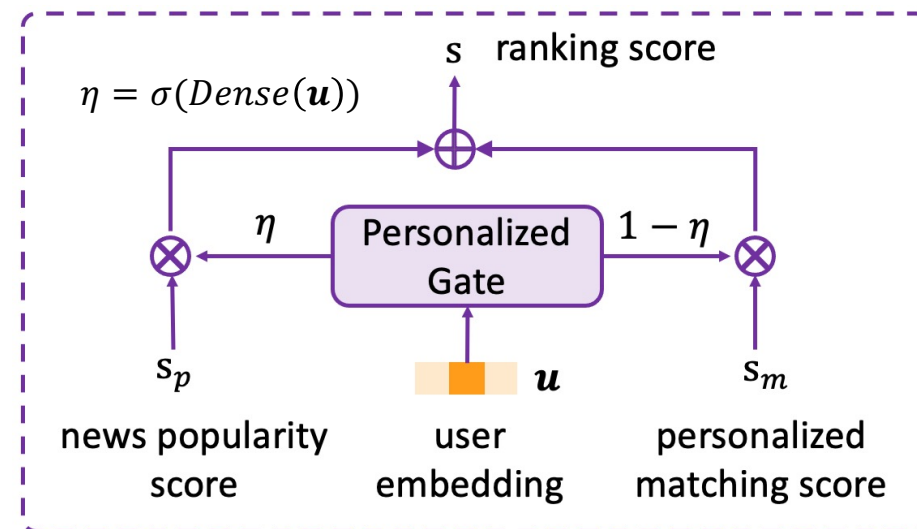
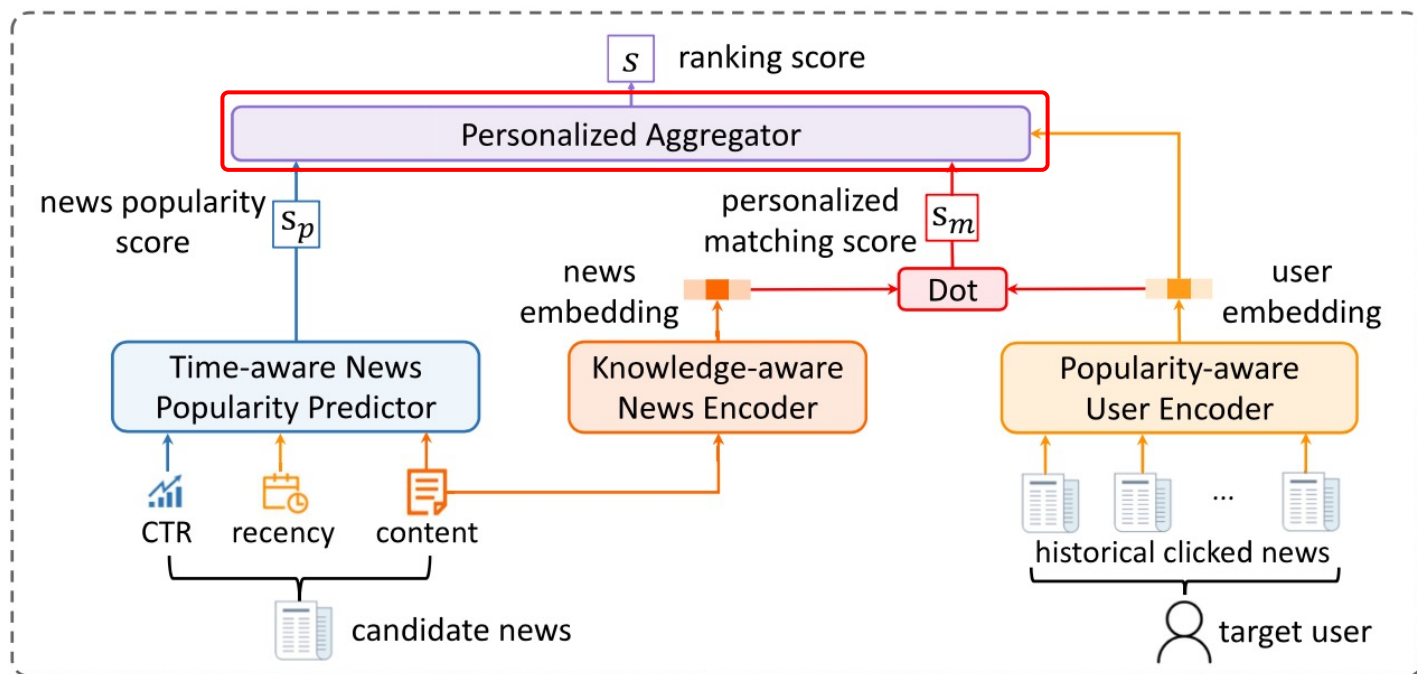
Knowledge-aware News Encoder

- Learn news representation from both news texts and entities



Personalized Aggregator

- Users usually have different personal preferences on popular news
- A personalized aggregator to combine personalized matching score and news popularity score



Datasets

- MSN:
 - User logs during 10.19-11.15, 2019 on Microsoft News
 - Using logs in the last week for model evaluation
- Feeds:
 - User logs during 01.23-04.23, 2020 on a news feeds in Microsoft
 - Using logs in the last three weeks for model evaluation

	# News	# Users	# Impressions	# Clicks
<i>MSN</i>	161,013	490,522	1,100,000	1,675,084
<i>Feeds</i>	4,117,562	98,866	1,100,000	2,384,976

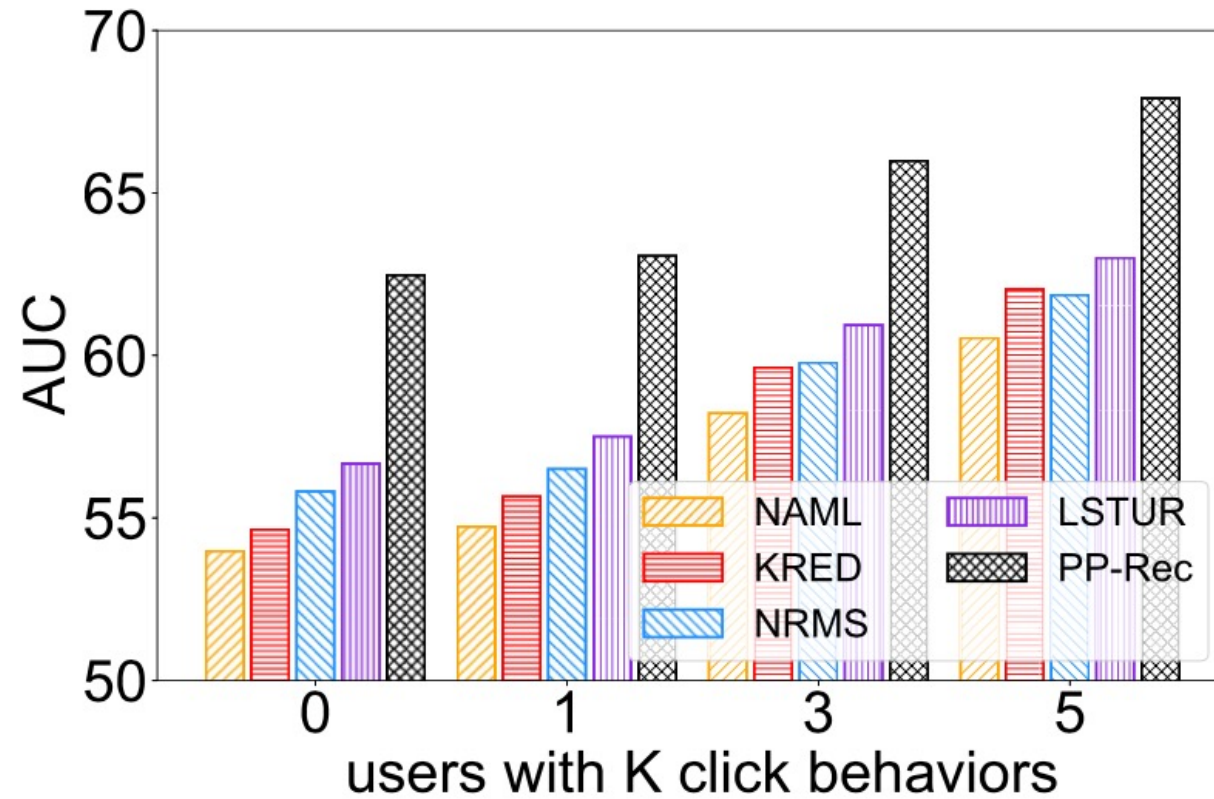
Performance Comparison

Methods	<i>MSN</i>				<i>Feeds</i>				
	AUC	MRR	nDCG@5	nDCG@10	AUC	MRR	nDCG@5	nDCG@10	
Group1	ViewNum	54.12±0.00	24.95±0.00	26.07±0.00	31.56±0.00	58.99±0.00	23.71±0.00	26.83±0.00	32.38±0.00
	RecentPop	55.67±0.00	28.72±0.00	30.45±0.00	36.62±0.00	56.27±0.00	24.93±0.00	28.37±0.00	33.89±0.00
	SCENE	57.89±0.02	27.41±0.01	28.81±0.02	34.36±0.03	60.82±0.03	27.29±0.03	31.25±0.02	36.56±0.03
	CTR	65.72±0.00	30.50±0.00	32.79±0.00	38.68±0.00	66.40±0.00	30.29±0.00	35.53±0.00	40.72±0.00
Group2	EBNR	63.90±0.20	30.13±0.12	32.25±0.14	38.05±0.14	64.88±0.04	28.91±0.03	33.29±0.03	38.87±0.02
	DKN	64.16±0.19	30.63±0.10	32.98±0.12	38.66±0.11	66.30±0.11	30.25±0.06	35.01±0.07	40.55±0.06
	NAML	66.06±0.17	32.10±0.10	34.73±0.11	40.43±0.11	67.50±0.09	31.07±0.08	36.08±0.10	41.61±0.10
	NPA	65.83±0.20	31.70±0.09	34.24±0.10	39.96±0.10	67.25±0.10	30.80±0.05	35.72±0.07	41.25±0.07
	NRMS	66.34±0.16	32.00±0.08	34.68±0.09	40.39±0.09	68.10±0.05	31.47±0.03	36.61±0.03	42.12±0.03
	LSTUR	66.69±0.16	32.12±0.05	34.76±0.05	40.51±0.04	67.43±0.16	30.95±0.11	35.92±0.16	41.45±0.14
	KRED	66.54±0.17	31.97±0.14	34.65±0.14	40.38±0.14	67.67±0.18	31.16±0.13	36.19±0.16	41.72±0.16
PP-Rec	71.05±0.09	39.34±0.08	44.01±0.13	50.46±0.20	72.11±0.21	32.42±0.12	38.13±0.08	43.50±0.13	

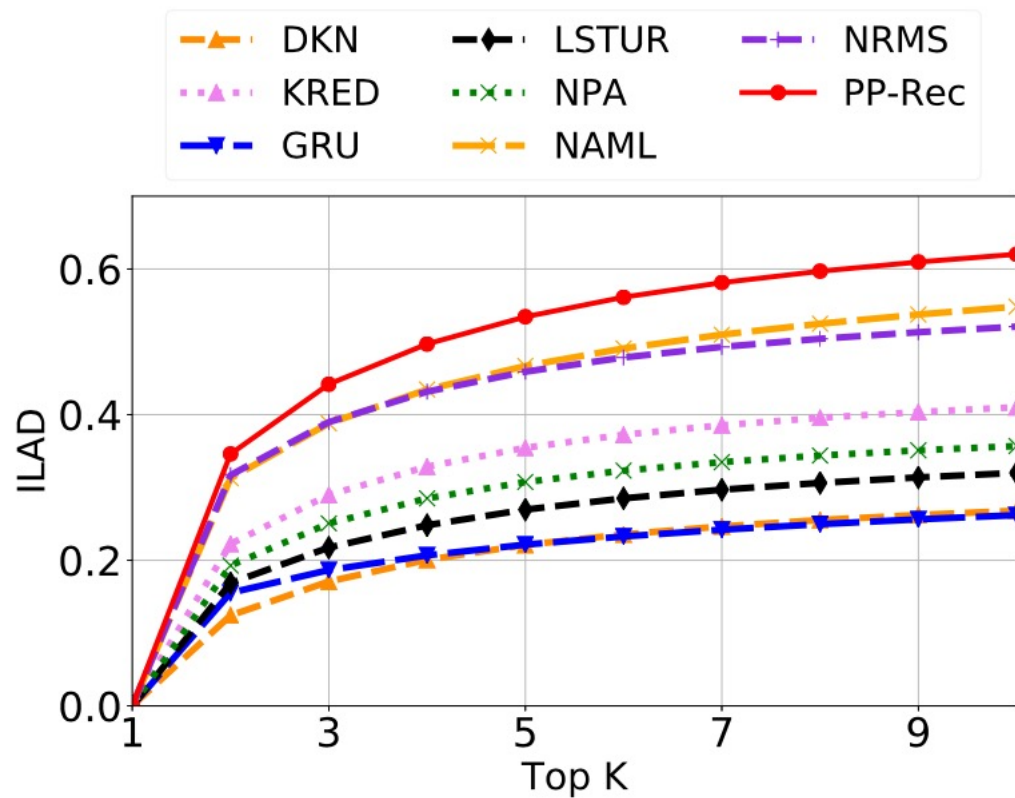
Group1: Personalized news recommendation methods

Group2: Popularity-based news recommendation methods

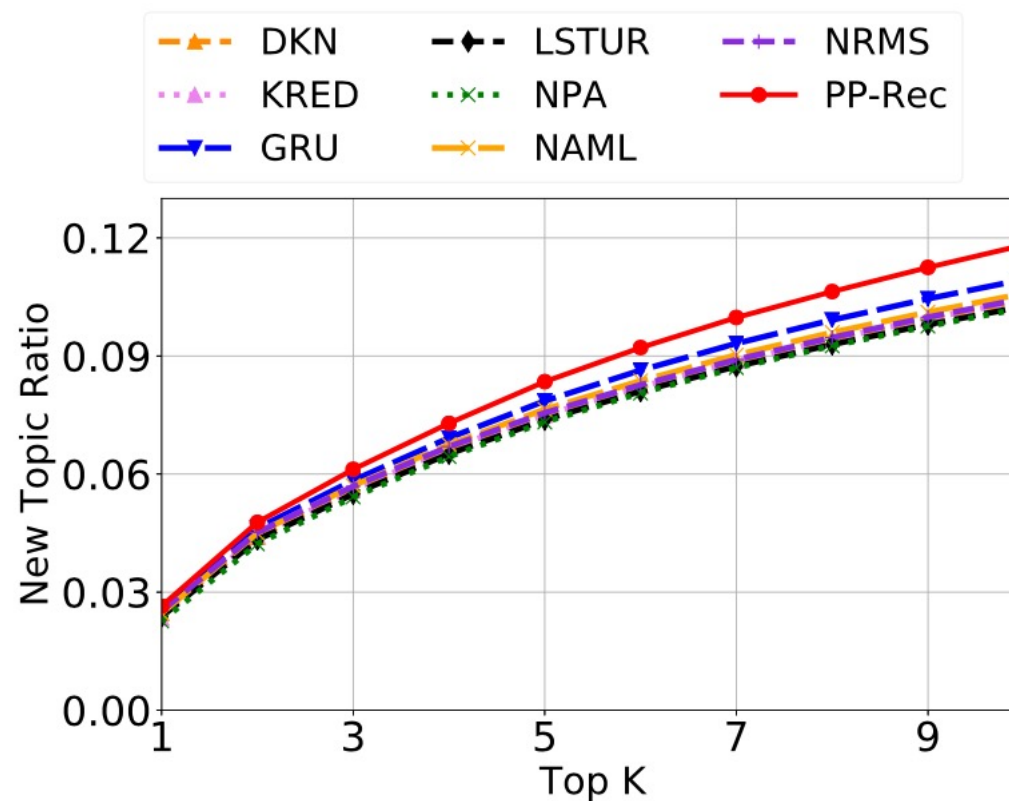
Performance on Cold-Start Users



Recommendation Diversity

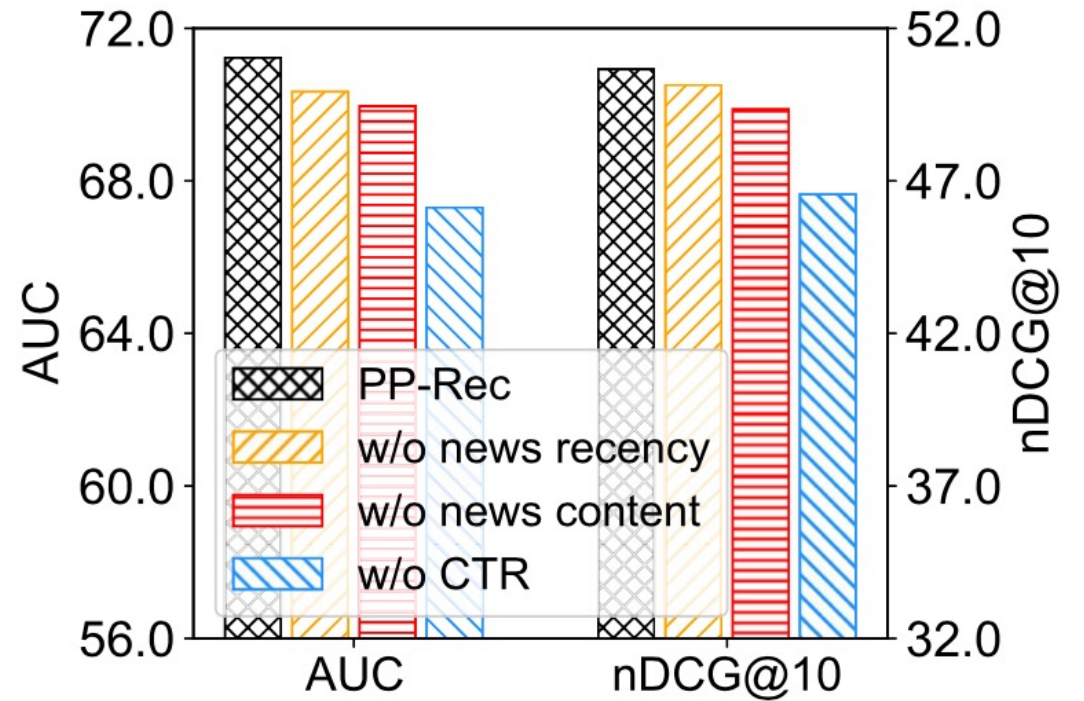
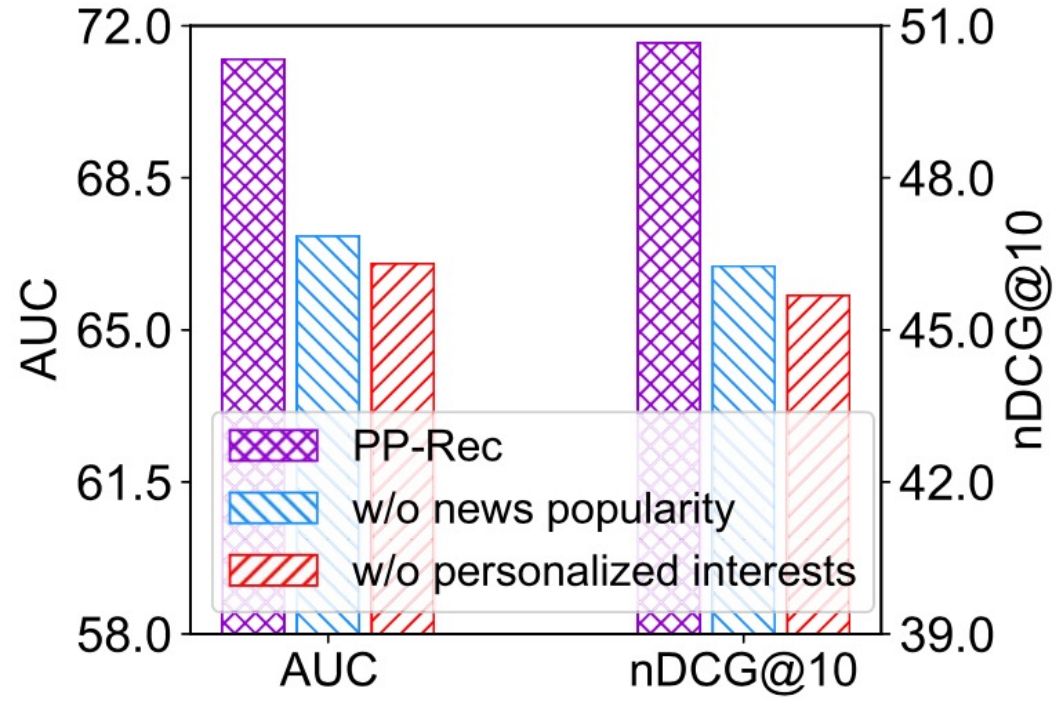


Intra-list average distance



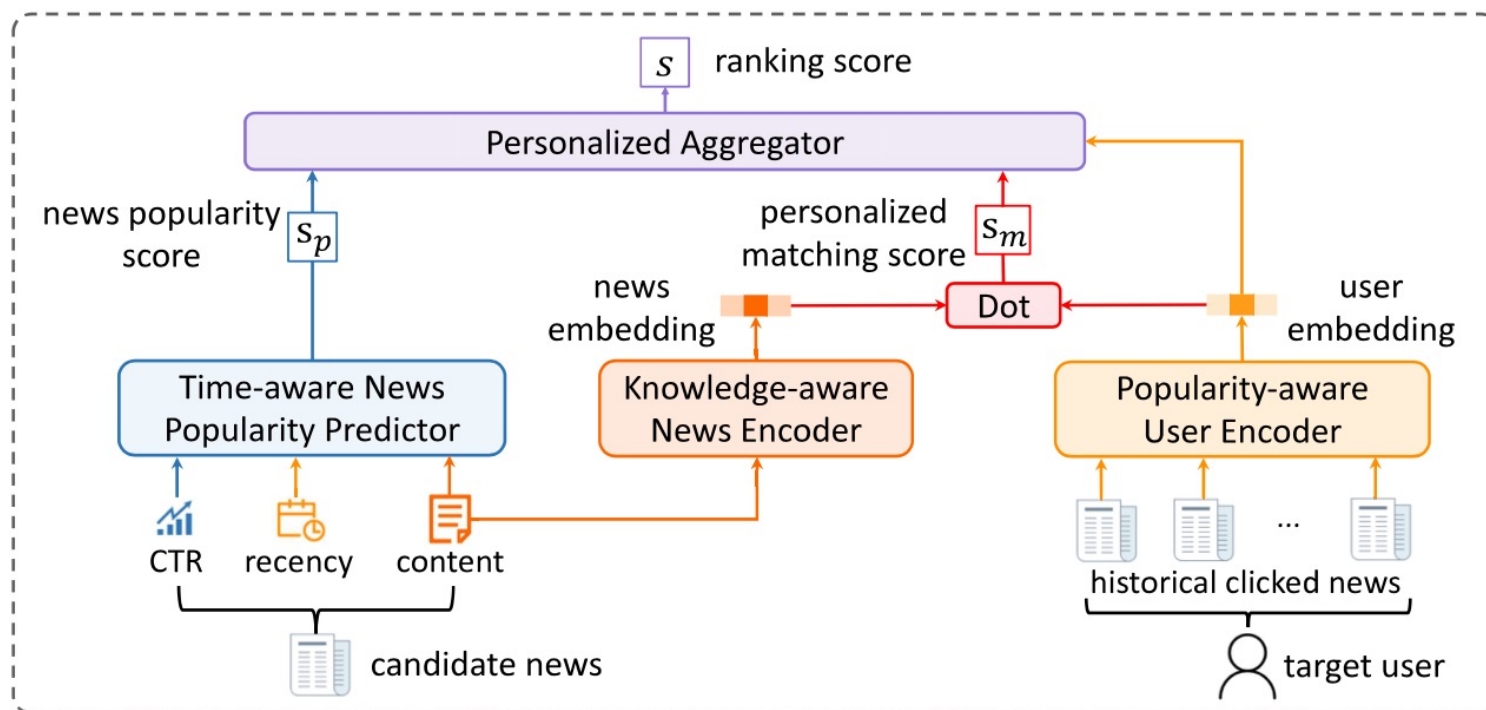
New topic ratio

Ablation Study



Conclusion

- News recommendation framework with both personalized user interest and time-aware news popularity
 - Improve performance of news recommendation, especially for cold-start users
 - Improve diversity of news recommendation



*Thank
you*



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