DivHSK: Diverse Headline Generation using Self-Attention based Keyword Selection

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Outline

- Introduction
- Proposed Approach
- Experiment Setup and Results
- Conclusion and Acknowledgments

Introduction

- Generating diverse and semantically similar multiple outputs in natural language generation (NLG) is an important and challenging task
- Well studies as a sequence-to-sequence learning problem for example paraphrase generation, machine translation, question generation, text summarization and so on.
- We consider the problem **generating diverse headlines given a single news article**.
- This may attract different sets of audiences and increase the consumption of the news

Problem Statement

Given a news article, the goal is to generate ***semantically similar***, **grammatically coherent, fluent** and **diverse** headlines.

Formally, given a news article x, the goal is to model the conditional distribution for k target outputs p(yk|x) with valid mappings x → y1, . . . , x → yk where {y1, y2, . . . , yk} should be diverse.

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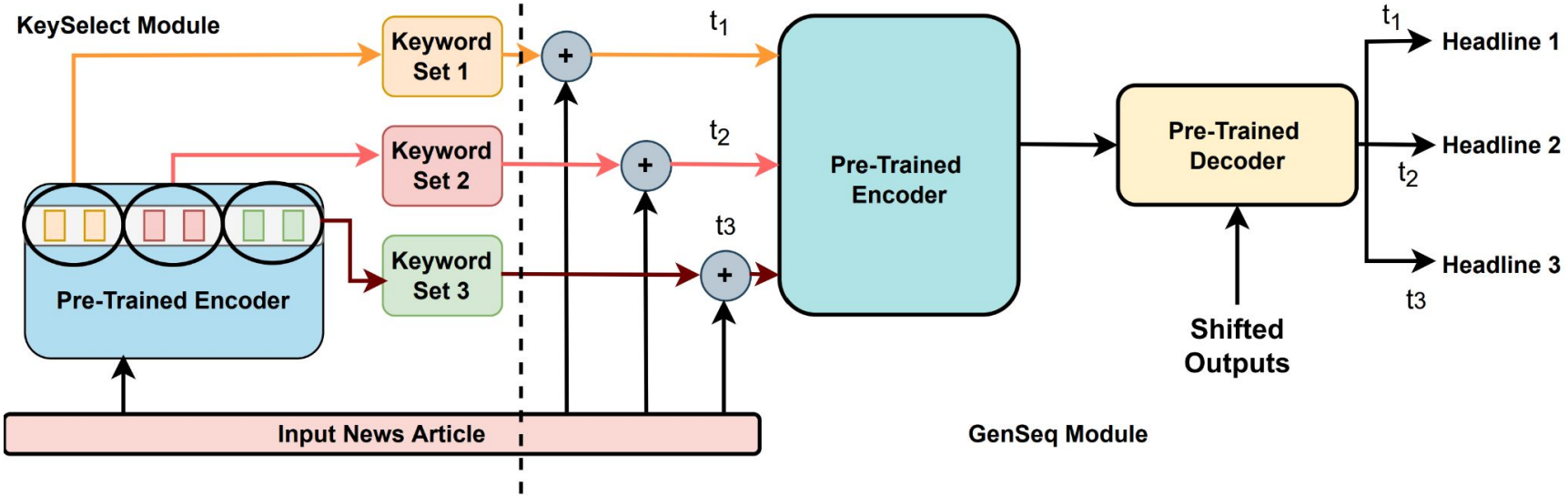
Proposed Model



Theme and General keywords Extraction

Theme Keywords: Most-attentive common across all the clusters.

General Keywords: Cluster-specific most attentive (non-theme) keywords.

Intuition: The theme keywords and general keywords guide generations towards semantically similar and diverse headlines, respectively.

Theme and General keywords Extraction

News	Keyword Set 1	Keyword Set 2	Keyword Set 3	Theme Keyword
Actress Raveena Tandon who will be making her digital **debut** with the **crime thriller** series Aranyak said that her kids are **excited** to see her on OTT. She added My **kids**...tell me Mom you re going to be on **Netflix** It s a cool thing for them. Speaking about her character as a **cop** in the series Raveena said She has incredible strength.	thriller cop Netflix	crime excited Netflix	debut kids Netflix	Netflix
China filed the **highest** number of patent applications globally in 2020 **retaining** its top **position** for the **second** consecutive year the UN s World Intellectual Property Organization WIPO said. **China** filed 68,720 applications last year while the US filed 59,230. In 2019 **China** had **replaced** the US as the **top** patent application filer for the first time in over four decades.	second position China	highest retaining China	top replaced China	China

Keyword Set 1 Keyword Set 2 Keyword Set 3

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Experimental Setup: MR_{Head} Dataset

S.No.	Example-1	Example-2
News Article	Days after a 20-year-old B.Com student was found unconscious with her hands and legs tied up on the outskirts of Andhra Pradesh, Vizianagaram town police said the incident was staged.The woman left her hostel to meet a male friend. After her brother inquired about her at the hostel she staged the incident to convince her family she was kidnapped.	A video showing a Chandigarh female traffic police constable holding her baby in her arms while on duty has gone viral on social media. The constable Priyanka was reportedly pulled up for not reporting to work at 8 am following which she took her baby to work. The clip was captured near the roundabout of Chandigarh's Sector 15:23 on Friday.
Headline 1	20-yr-old Andhra woman found with hands, legs tied staged 'kidnap': Police	Chandigarh traffic constable reports for duty with baby in arms; video goes viral
Headline 2	Andhra woman found 'unconscious' had staged 'kidnap' say police	Video of Chandigarh cop holding baby while on duty goes viral: The Tribune India
Headline 3	Kidnapping victim found tied up in backseat after police stop wrong way driver in Olympia	Video of a Woman Traffic Constable Holding Baby on Duty Goes Viral Netizens Demand Free Daycare for Cops

Results: Automated and Human Evaluation

Model	Headline 1(⇑)					Headline 2(⇑)					Headline 3(⇑)					P-BLEU (⇓)
	BLEU	R-L	BES	BAS	HMean	BLEU	R-L	BES	BAS	HMean	BLEU	R-L	BES	BAS	HMean	
T5+DSA	22.83	**0.342**	67.21	61.43	0.525	22.97	0.345	67.89	61.26	0.525	25.39	0.346	67.57	61.88	0.525	0.734
T5+WMD	14.60	0.346	64.11	57.83	0.529	16.37	0.353	64.91	57.32	0.530	14.81	0.346	64.23	58.08	0.529	0.730
T5+Avg-Loss	12.07	0.310	61.31	56.44	0.637	12.02	0.308	62.11	56.03	0.637	11.06	0.306	61.72	56.95	0.636	0.672
MixD	**23.18**	0.322	**71.64**	68.52	0.320	**25.63**	**0.349**	71.91	68.28	0.320	**25.84**	**0.351**	71.43	68.88	0.320	0.838
MixCS	14.01	0.242	64.12	56.98	0.347	15.62	0.245	64.83	56.73	0.347	16.77	0.241	64.36	57.22	0.348	0.824
MoKGE	8.94	0.185	57.32	51.11	0.571	12.44	0.208	57.74	50.67	0.576	7.87	0.163	57.34	50.82	0.568	0.705
DivHSK	16.83	0.289	71.56	**69.01**	**0.690**	17.95	0.295	**72.03**	**68.66**	**0.691**	17.72	0.295	**71.55**	**69.98**	**0.690**	**0.647**

	DivHSK Vs T5+Avg-Loss			DivHSK Vs MixCS			DivHSK Vs MoKGE		
	Win	Lose	Tie	Win	Lose	Tie	Win	Lose	Tie
Annotator Set 1									
Flu	**44.0**	34.0	22.0	**48.0**	30.0	20.0	**52.0**	36.0	12.0
Rel	26.0	20.0	**54.0**	**48.0**	32.0	20.0	**42.0**	22.0	36.0
Corr	**38.0**	24.0	**38.0**	**38.0**	26.0	36.0	**42.0**	32.0	26.0
Annotator Set 2									
Flu	**38.0**	32.0	30.0	**42.0**	40.0	18.0	**50.0**	42.0	8.0
Rel	28.0	26.0	**46.0**	34.0	30.0	**36.0**	**48.0**	28.0	24.0
Corr	**38.0**	32.0	30.0	**42.0**	34.0	24.0	**48.0**	28.0	24.0

Model	Diversity(⇑)	
	Annotators set-1	*Annotators set-2*
T5 + Avg-Loss	3.12	3.06
MixCS	2.74	2.56
MoKGE	3.08	2.96
DivHSK	**3.60**	**3.72**

Results: Sample Generations

News	Actress Raveena Tandon who will be making her digital debut with the crime thriller series Aranyak said that her kids are excited to see her on OTT. She added My kids...tell me Mom you re going to be on Netflix It s a cool thing for them. Speaking about her character as a cop in the series Raveena said She has incredible strength.		
Reference Headlines	My kids feel it's a cool thing to be on OTT: Raveena on her digital debut	Raveena Tandon on her digital debut with Aranyak My kids feel it's a cool thing to be on Netflix	My kids feel being on Netflix is a cool thing Raveena Tandon on digital debut with Aranyak
Model	**Generated Headline 1**	**Generated Headline 2**	**Generated Headline 3**
Mixture Selector	My kids are excited to see me on Netflix: Raveena Tandon	My kids are excited to see me on Netflix: Raveena	My kids are excited to see me on OTT: Raveena
MoKGE	Raveena Tandon Says Her Kids Are Excited To See Her On Netflix	My kids are excited to see me on OTT: Raveena	My kids are excited to see her on Netflix
T5-Avg	Tell me mom you're going to be on Netflix it's a cool thing for kids: Raveena	Tell me mom you're going to be on Netflix it's cool for kids: Raveena	Tell me mom you're going to be on Netflix it's a cool thing for kids, Raveena
Mixture Decoder	My kids are excited: Raveena on making digital debut in 'Aranyak'	Kids excited to see me on Netflix: Raveena on 'Aranyak': Tandon	Kids excited to see me on Netflix: Raveena on making digital debut with 'Aranyak'
Ours	Actress Raveena to play as cop in a thriller on Netflix	I am super excited for my kids to see me on Netflix: Raveena	Mom is to be on Netflix. It's a cool thing for kids: Raveena on her OTT debut

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Conclusion

- This work, present a novel task and dataset for diverse headline generation.
- We also propose a strong a self-attention based clustering approach to extract theme and general keywords that guide the pre-trained encoder-decoder model to generate diverse headlines.
- The model consistently outperforms all baseline models on both automated and human evaluation metrics, while maintaining diversity as a key criterion.
- In future we will extend this to multiple tasks.

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- Human Evaluators for human evaluation
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Thank You!!!

Questions????

To know more about my research you can check my website: https://kaushal0494.github.io/


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