

Supplementary Material for EMNLP 2019 Paper: Text Summarization with Pretrained Encoders

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A Ablation Studies

Ablation studies are conducted to show the contribution of different components of BERTSUM. The results are shown in Table 1. Under extractive setting, interval segments and the inter-sentence Transformer layers increase the performance of base model. Under abstractive setting, interval segments are still helpful to the final results. Without the separated optimizers (encoder and decoder are optimized with the same learning rate and warmup-steps), the ROUGE scores drop dramatically.

Model	R1	R2	RL
BERTSUMEXT	43.25	20.24	39.63
-interval segments	43.14	20.01	39.22
-inter-sent Transformer	43.23	20.22	39.60
BERTSUMABS	41.72	19.39	38.76
-interval segments	41.54	19.31	38.76
-seperated optimizers	39.77	16.89	36.53

Table 1: Results of ablation studies of BERTSUMEXT and BERTSUMABS on CNN/DailyMail test set using ROUGE F1.

B Examples of System Output and Evaluation Questions

Table 1 shows examples of system output on the CNN/DailyMail dataset. Specifically, we show summaries produced from our BERT-based models, NEUSUM (Zhou et al., 2018), the pointer-generator network (PTGEN See et al. 2017) and the bottom-up (BOTTOMUP) summarization model of Gehrmann et al. (2018). Table 2 shows examples of system output on the NYT datasets. Specifically, we show summaries produced from our BERT-based models, SUMO (Liu et al., 2019) and the pointer-generator network (See et al., 2017). Table 3 shows examples of system output

on the XSum dataset. Specifically, we show summaries produced from our BERT-based models, the pointer-generator network (See et al., 2017) and the topic-conditioned convolutional model (TCONVS2S) of Narayan et al. (2018).

The tables also contain examples of questions (and their answers) used in our QA-based evaluation study (see Section 5.3 in the paper).

References

- Sebastian Gehrmann, Yuntian Deng, and Alexander Rush. 2018. Bottom-up abstractive summarization. In *Proceedings of the EMNLP Conference*.
- Yang Liu, Ivan Titov, and Mirella Lapata. 2019. Single document summarization as tree induction. In *Proceedings of the ACL Conference*.
- Shashi Narayan, Shay B. Cohen, and Mirella Lapata. 2018. Don't give me the details, just the summary! topic-aware convolutional neural networks for extreme summarization. In *Proceedings of the EMNLP Conference*.
- Abigail See, Peter J. Liu, and Christopher D. Manning. 2017. Get to the point: Summarization with pointer-generator networks. In *Proceedings of the ACL Conference*.
- Qingyu Zhou, Nan Yang, Furu Wei, Shaohan Huang, Ming Zhou, and Tiejun Zhao. 2018. Neural document summarization by jointly learning to score and select sentences. In *Proceedings of the ACL Conference*.

CNN/Daily Mail	
GOLD	Emergency services were called to the Kosciuszko bridge at about 11.50 am Monday, where a woman had climbed over the bridge’s railing and was standing on a section of metal piping. Officers tried to calm her down as NYPD patrol boats cruised under the bridge on Newtown Creek, which connects Greenpoint in Brooklyn and Maspeth in Gueens. A witness said the woman was a 44-year-old Polish mother-of-one who was going through a tough divorce. She agreed to be rescued after police talked to her about her daughter and was taken to Elmhurst hospital.
QA	When were emergency services called to the Kosciuszko bridge? [11.50 am] What did the witness say about the woman? [44-year-old polish mother-of-one who was going through a tough divorce] Did the woman agreed to be rescued? [yes]
LEAD	A woman who threatened to jump to her death off a New York City bridge was saved by a group of hero cops who spent more than two hours talking the woman out of jumping. The unidentified woman from Greenpoint, Brooklyn, was apparently distraught over her troubled marriage. She walked to the Kosciuszko bridge from the Brooklyn side shortly before noon on Monday, climbed over a railing and stood on a section of metal piping barely wide enough to fit her feet.
Extractive Models	
NEUSUM	A woman walked on to New York city’s Kosciuszko bridge from the Brooklyn side on Monday just before noon, climbed over the railing and stood on a section of metal piping 125 feet above Newtown Creek. A witness said the woman is a 44-year-old Polish mother-of-one who was going through a tough divorce with her husband. The unidentified woman from Greenpoint, Brooklyn, was apparently distraught over her troubled marriage.
BERTSUMEXT	The unidentified woman from Greenpoint, Brooklyn, was apparently distraught over her troubled marriage. A woman walked on to New York City’s Kosciuszko bridge from the Brooklyn side on Monday just before noon, climbed over the railing and stood on a section of metal piping 125 feet above Newtown Creek. Police arrived on scene at about 11.50 am and spent more than two hours talking to the woman and trying to calm her down.
Abstractive Models	
PTGEN	A woman who threatened to jump to her death off a New York bridge was apparently distraught over her troubled marriage. She walked to the Kosciuszko bridge from the Brooklyn side shortly before noon on Monday, climbed over the railing. Police arrived on scene at about 11.50am and spent more than two hours talking to the woman and trying to calm her down.
BOTTOMUP	The woman from Greenpoint, Brooklyn, was apparently distraught over her troubled marriage. She walked to the Kosciuszko bridge from the Brooklyn side shortly before noon on Monday, climbed over a railing and stood on a section of metal piping barely wide enough to fit her feet. After she was pulled to safety by police officers, the woman was taken by ambulance to Elmhurst hospital for observation.
BERTSUMABS	The unidentified woman from Greenpoint, Brooklyn , was apparently distraught over her troubled marriage. She walked to the Kosciuszko bridge from the Brooklyn side shortly before noon on Monday, climbed over a railing and stood on a section of metal piping 125 feet above Newtown Creek. At about 2pm the woman agreed to be rescued and NYPD officers were able to pull her to safety over the railing.
BERTSUMEXTABS	The unidentified woman from Greenpoint, Brooklyn, was apparently distraught over her troubled marriage. She walked to the Kosciuszko bridge from the brooklyn side shortly before noon on Monday, climbed over a railing and stood on a section of metal piping 125 feet above Newtown Creek. She agreed to be rescued after police officers spoke to her about her daughter, and was lifted off the bridge ‘so she could be with her’. a witness said the woman is a 44-year-old polish mother-of-one who was going through a tough divorce with her husband.

Table 2: GOLD human authored summaries, questions based on them (answers shown in square brackets), and automatic summaries produced by our BERT-based models NEUSUM (Zhou et al., 2018), a pointer-generator network (See et al., 2017) and a bottom-up summarizer (Gehrmann et al., 2018) for a CNN/Daily Mail article.

NYT	
GOLD	Louisiana officials set July 31 deadline for applicants for the Road Home, grant program for homeowners who lost their houses to hurricanes Katrina and Rita. Program is expected to cost far more than \$7.5 billion provided by Federal Government, in part because many more families have applied than officials anticipated. With cutoff date, State hopes to figure out how much more money it needs to pay for program. Shortfall is projected to be \$2.9 billion.
QA	<p>What is Road Home? [The Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita]</p> <p>When is the applicants' deadline for the Road Home? [july 31]</p> <p>What is the shortfall projected to be? [\$2.9 billion]</p>
LEAD	<p>The Road Home, the Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita, is expected to cost far more than the \$7.5 billion provided by the Federal Government, in part because many more families have applied than officials had anticipated.</p> <p>As a result, Louisiana officials on Tuesday night set a july 31 deadline for applicants, who can receive up to \$150,000 to repair or rebuild their houses.</p> <p>With the cutoff date, the State hopes to be able to figure out how much more money it needs to pay for the program.</p>
Extractive Models	
SUMO	<p>The Road Home, the Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita, is expected to cost far more than the \$7.5 billion provided by the Federal Government, in part because many more families have applied than officials had anticipated.</p> <p>As a result, Louisiana officials on Tuesday night set a july 31 deadline for applicants, who can receive up to \$150,000 to repair or rebuild their houses.</p> <p>The shortfall is projected to be \$2.9 billion.</p>
BERTSUMEXT	<p>The Road Home, the Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita, is expected to cost far more than the \$7.5 billion provided by the Federal Government, in part because many more families have applied than officials had anticipated.</p> <p>The shortfall is projected to be \$2.9 billion.</p> <p>Only 22,000 families statewide, out of 140,000 applicants, have received grants so far, for a total of \$1.3 billion.</p>
Abstractive Models	
PGNET	Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita is expected to cost far more than \$7.5 billion provided by Federal Government. Louisiana officials set July 31 deadline for applicants, who can receive up to \$150,000 to repair or rebuild their houses.
BERTSUMABS	Road Home, Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita, is expected to cost far more than \$ 7.5 billion provided by Federal Government, in part because many more families have applied than officials had anticipated. State hopes to be able to figure out how much more money it needs to pay for program.
BERTSUMEXTABS	Road Home, Louisiana grant program for homeowners who lost their houses to hurricanes Katrina and Rita, is expected to cost far more than \$7.5 billion provided by Federal Government, in part because many more families have applied than officials had anticipated. State hopes to be able to figure out how much more money it needs to pay for program. Financial woes of Road Home have set off frenzy of fingerpointing between Federal and State officials.

Table 3: GOLD human authored summaries, questions based on them (answers shown in square brackets) and automatic summaries produced by our BERT-based models, SUMO (Liu et al., 2019) and the pointer-generator network (See et al., 2017) for a NYT article.

XSum	
GOLD	A council plans to employ its own staff to help young people with mental health problems.
QA	Why are young people getting help? [mental health problems] Who is employing staff for this purpose? [the council]
LEAD	West Berkshire Council is setting up an emotional health academy to train psychology graduates and health professionals.
Abstractive Models	
PGNET	A mental health academy in Berkshire has been put up for sale in a bid to reduce the number of mental health patients.
TCONVS2S	A new academy for children with mental health problems is being launched in West Berkshire.
BERTSUMABS	A new mental health academy is to be launched in West Berkshire in a bid to raise awareness of mental health problems.
BERTSUMEXTABS	An academy to train mental health patients with mental health problems is being launched by West Berkshire Council.

Table 4: GOLD human authored summaries, questions based on them (answers shown in square brackets) and automatic summaries produced by BERT-based models, a pointer-generator Network (See et al., 2017) and TConvS2S (Narayan et al., 2018) for a XSum article.