Text summarization with transformers and pointer-generator networks.

**Overview and Motivation**
- Transformers have outperformed RNNs on many seq2seq tasks - including abstractive summarization.
- However, transformers produce many of the same issues as RNN-based models do in summarization:
  - Repetition
  - Factual inaccuracies
- We present variations of transformers that use techniques that successfully addressed these issues in RNNs.

**Data**
- We use the CNN/DM dataset:
  - 300,000 pairs of news articles and widely for summarization; good basis
- We used 40,000 pairs for training.

**Approaches**

### N-Gram Blocking
- Used to reduce repetition
- During beam search, eliminates words that create an n-gram that already exists in the summary.

### Coverage Loss
- Also used to reduce repetition
- Create a coverage vector $c'_t$, given all attention distributions over previous time steps:
  $$c'_t = \sum_{i=0}^{t-1} a'_i$$
- Use to define the coverage loss, which gets added to the final loss of the transformer with a weight of $\lambda$
  $$loss_t = -\log P(w^*_t) + \lambda \sum_i \min(a'_t, c'_t)$$

**Transformer**
- For our baseline, we use an open-source implementation of the basic transformer architecture as laid out in the seminal paper Attention is all you need [2].

**Results**

<table>
<thead>
<tr>
<th>Model</th>
<th>Rouge-1</th>
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<tbody>
<tr>
<td>Transformer</td>
<td>20.23</td>
</tr>
<tr>
<td>Transformer + Pointer-Generator</td>
<td>22.10</td>
</tr>
<tr>
<td>Transformer + Pointer-Generator + Coverage</td>
<td>22.93</td>
</tr>
<tr>
<td>Transformer + Pointer-Generator + N-Gram Blocking</td>
<td>25.31</td>
</tr>
</tbody>
</table>

### Example Summaries
- **Human Summary:** "oleg kalashnikov died of gunshot wounds, ukraine's interior ministry said. he was a party of regions deputy in ukraine's previous parliament. kalashnikov was ally of deposed ukrainian president viktor yanukovych."
- **Baseline Transformer Summary:** "viktor [UNK] was found dead at the vladimir putin's death. he was found dead in his remained remained remained remained ...
- **Pointer-Generator Network Summary:** "russian oleg oleg oleg oleg sergei yanukovych was found dead. viktor yanukovych was found dead in the the kremlin has been been been been since."
- **Pointer-Generator + Coverage Summary:** "ukrainian prime minister yanukovych was found dead in his home in kiev. ukranian leader was found dead in his home in kiev, in kiev."
- **Pointer-Generator + 2-Gram Summary:** "oleg yanukovych was found dead in his home in kiev. he is of the ukraine of ukraine's parliament. the former ukrainian president vladimir putin says he was " 'the communist party'."