Detection of machine-generated fragments in text

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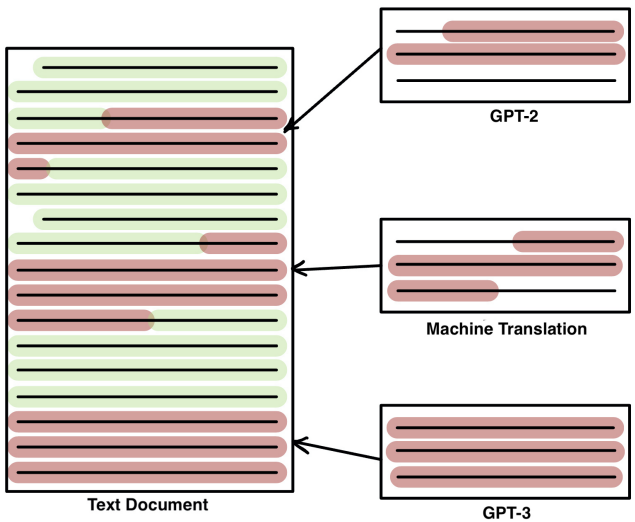
Goal of research



Suggest a model, that will detect machine-generated fragments in text and classify them according to their origin model. Number of model is fixed and known.

Problem statement

Let

$$\mathbb{D} = \left\{ \left[t_j \right]_{j=1}^{n} \quad | \quad t_j \in \mathbf{W}, n \in \mathbb{N} \right\}$$

be the space of documents, $\mathbf{W}$ is the alphabet.
Given set of N documents

$$\mathbf{D} = \bigcup_{i=1}^{N} D^i, D^i \in \mathbb{D}.$$

$\mathbf{C}$ is a set of $K+1$ labels for classification, where 0 is the label of human-written fragment, $\{1...K\}$ are the labels representing corresponding K language models, participated in generating $\mathbf{D}$.

$$\mathbb{T} = \left\{ \left[t_{s_j}, t_{f_j}, C_j \right]_{j=1}^{J} | t_{s_j} = t_{f_{j-1}}, s_j \in \mathbb{N}_0, f_j \in \mathbb{N}, C_j \in \mathbf{C} \right\},$$

where J is a number of fragments, t_{s_j} and t_{f_j} are start and end of the j-th fragment.

Problem statement

Our model is

$$\phi : \mathbb{D} \to \mathbb{T} \qquad \phi : \mathbf{g} \circ \mathbf{f},$$

f is mapping, responsible for text segmentation.
g is mapping, responsible for classifying obtained fragments.

The **quality criteria** is macro-averaged precision and recall, where S is ground truth fragmentation and R is predicted fragmentation. We compare segments on sentence level.

$$prec(S, R) = \frac{1}{|R|} \sum_{r \in R} \frac{|\bigcup_{s \in S}(s \cap r)|}{|r|},$$

$$rec(S, R) = \frac{1}{|S|} \sum_{s \in S} \frac{|\bigcup_{r \in R}(s \cap r)|}{|s|},$$

Computational experiment

We took the Medium dataset with articles from Medium.com

- Cropped it to the length of 4000 tokens
- Randomly picked from 2 to 4 paragraphes
- Generated paragraphes with LLaMA with prompt consisting of previous paragraphes
- Replaced the picked paragraphes with the artifical ones

Then we fine-tuned RoBERTa-XLM on it and classified the paragraphes. After that we took the **[CLS]** token and tried to clustered these vectors with cosine distance. We got two distinctive clusters.

The same experiment but on sentence-levels showed much worse results.

Future Work

- Weaken the hypothesis "One paragraph - one author" and develop a method for style-change within paragraph with sliding window
- Add other LLM's as authors (i.e Alpaca-7b or Mistral-7b)

Literature

- **German Gritsay et al.**, 2022, Automatic Detection of Machine Generated Texts: Need More Tokens
- **Sebastian Gehrmann et al.**, 2019, GLTR: Statistical Detection and Visualization of Generated Text
- **Mikhail P. Kuznetsov et al.**, 2016, Methods for intrinsic plagiarism detection and author diarization
- RUATD Competition 2022
- **Adaku Uchendu et al.** Authorship Attribution for Neural Text Generation