Research Statement of Xiuying Chen

Artificial Intelligence Generated Content (AIGC) aims to revolutionize content creation by generating customized content that aligns with user-specified requirements. AIG text is an essential step towards this goal, as ideas, information, and communication are conveyed through text. Though text generation has achieved enormous progress with pretrained language models and advanced algorithms, generating contextually relevant text that meets human standards and expectations is a long, arduous, and expensive journey. Hence it is highly in demand for AI models to gain the capability of understanding human language, generating high-quality text, and ultimately benefit human society. I have been motivated during my master and Ph.D. training by this goal, and working on the design of new fundamental algorithms for better AIG text. Principally, my efforts go towards the following aims:

- **Aim 1**: How can AI-generated text be *accurate*?
- **Aim 2**: How can AI-generated text be *trustworthy*?
- **Aim 3**: How can AI-generated text promote *social media* dynamics?
- **Aim 4**: How can AI-generated text facilitate *science* development?

Next, I briefly introduce the main contributions of my research to fulfill the Aim 1 to Aim 4, and illustrate the future plan.

1 Past & Current Research

1.1 Aim 1: Enhancement of Accurate Text Generation

The first step towards artificial intelligent text generation is to generate accurate text that prioritizes precision and correctness of the generated content. Accuracy serves as a fundamental requirement to ensure that the generated text is reliable and useful in various applications, ultimately enhancing the overall performance and usability of AI-powered text generation systems.

Multi-task To enhance the understanding of the given context and generate faithful text, our proposed approach utilizes reading comprehension aside from text generation task [AAAI'21]. We examine whether the encoder fully comprehends the input document by evaluating its ability to answer questions regarding key information within the input. Furthermore, we introduce a max-margin loss, which is defined based on the difference between the language model and the task-specific model, i.e., summarization model [NeurIPS'22]. This loss aims to prevent the language model from becoming overconfident in its generated output, ensuring more reliable and accurate text generation.

Refinement Drawing inspiration from the observation that humans often need to read an article multiple times to fully comprehend and summarize its content, we propose a refinement model in [EMNLP'18]. This model employs an iterative approach to refine the document representation through multiple passes over the document, improving its understanding and summarization capabilities. In addition to the model aspect refinement, we also explore data aspect refinement. In [AAAI'23], we propose to select representative and beneficial data samples for augmentation, which are then utilized to further train the model.

1.2 Aim 2: Development of Trustworthy Text Generation

While accuracy is the first step towards effective AI text generation, it's important to note that it's only one piece of the puzzle. To truly provide value, these systems must not only generate accurate text, but also earn the trust of their users. This is where the concept of trustworthy text generation comes into play, setting a higher standard for the quality and reliability of AI-generated content. However, existing text generation systems face challenges such as vulnerability to imperceptible attacks, lack of transparency, and significant environmental impact.

Robustness A trustworthy and robust text generation system should be able to capture the gist of the document, regardless of the specific word choices or noise in the input. In [ACL'23], we first show that state-of-the-art summarization models have a significant decrease in performance on adversarial and noisy test sets. Correspondingly, we propose a dual-augmentation method for improving the robustness, which generates discrete and virtual training cases in the same meaning but with various expression formats.

Explainability Generating text from scratch is challenging as it requires understanding, planning, and organizing content in a logical order. This process is often seen as a black-box, making it difficult to analyze and interpret how the text is generated. However, using prototype templates can alleviate the difficulty, as the generated text can be directly attributed to the underlying template, enhancing transparency and interpretability. In [EMNLP'19] and [TOIS'21], we applied this prototype template theory to text generation tasks. Through human evaluation, we observed that nearly 90% of the selected prototype templates significantly aided in understanding the generated text. This finding highlights the potential of using prototype templates as a valuable technique to enhance text generation and improve its interpretability.

Environmental Well-being The pursuit of larger models in deep learning is leading to considerable carbon emissions and increased resource consumption, underscoring the need for sustainability in AIG text systems. In [SIGIR'23], we introduce a unified-modal summarization framework with side information. This framework leverages side information from diverse modalities and covers various aspects, thus reduces the necessity for scenario-specific model retraining, enhancing overall efficiency. Building upon this, in our [submission'23], we take a step further by proposing a parameter-efficient unified summarization model. This model can effectively handle input text from different domains using a hierarchical expert structure, expanding its applicability to a wide range of text summarization tasks.

1.3 Aim 3: Promotion of Social-media Dynamics

Building upon the foundation of accuracy and trustworthiness in AI text generation, we can start to explore its practical applications. One of the most exciting and impactful of these lies in the realm of social media. It is clear that the advanced text generation techniques can empower content creators to generate engaging and captivating text for social media platforms, fostering increased user engagement and promoting effective communication in the dynamic and interactive digital landscape.

Compelling Content Creation I first delve into the creation of compelling and attractive text in various real-world scenarios. In [EMNLP'19, EMNLP'20], my focus lies on generating product descriptions that encompass key information to attract and assist customers in making informed purchasing decisions. In news domain, we emphasize the significance of eye-catching headlines for news articles. In [AAAI'20], we investigate the style-content duality of attractiveness and explore the learning process of crafting captivating headlines through disentanglement techniques. Multimodal information naturally offers another compelling method to disseminate information. Furthermore, we acknowledged the natural appeal of multimodal information as an effective method for information delivery. In [EMNLP'20], we proposed an approach to automatically generate vivid image and textual summaries for videos.

Trend Identification It's evident that social media content is continuously expanding. Staying current with the latest developments in content analysis models is therefore of paramount importance. In [IJCAI'19], we proposed the first large-scale summarization dataset with timestamps, and introduced a memory-based timeline summarization model capable of generating timestamped summary. Later, in [TOIS'23], we put forward a unified summarizer capable of producing both abstractive and extractive timeline summaries for structured and unstructured inputs.

User Engagement User participation plays a vital role in the process of social media interaction. In [WSDM'23], we propose to a Mock Interview Generator, offering tailored, interactive practice sessions that prepare users for real job interviews, thereby encouraging more active and meaningful participation. In [WWW'20,TOIS'21], we present a framework of unifying multi-modality in multi-turn dialog by allowing personalized, multi-modal responses in dialogues, thereby making interactions more enjoyable and expressive.

1.4 Aim 4: Facilitation of Scientific Development

While we are still exploring the vast potential of AI-driven text generation in enhancing social media dynamics, the horizon of its applicability is far-reaching. One area that stands to benefit significantly from these technological advancements is scientific development, which can significantly contribute to technological innovation, economic growth, and the tackling of complex global challenges. Moving forward, I will continue my research in the field of artificial intelligence for science and strive to uncover new possibilities and advancements in this area.

Survey Generation Automatic generation of survey can aid researchers in familiarizing themselves with specific research domains, significantly easing the entry of beginners into the realm of scientific discovery. In [ACL'21], we explore capturing the intricate relations between scientific papers through an abstractive model designed for generating the related work section. Building on this, my subsequent study [SIGIR'22] expanded this concept, incorporating information from the target paper to enhance the relevance and accuracy of generated summaries.

2 Future Research

Given the vast terrain of AI and the immense complexity of AIG-T, the aforementioned four questions remain largely unaddressed. Therefore, I plan to delve deeper into this core aspect of AIG-T in my future endeavors.

2.1 Advancing Reasoning Capabilities in AIG-T

Reasoning ability plays a crucial role in natural language processing, enabling systems to comprehend and generate text that demonstrates logical coherence. However, current AIG-T models face a significant limitation: they often struggle with common sense reasoning tasks. The expectation is that by enhancing their reasoning capabilities, AIG-T models can achieve more sophisticated outcomes. Chain-of-thought (CoT) prompting emerges as a promising solution. By elucidating the logical reasoning process employed by humans to reach answers, CoT prompts guide models along a similar cognitive path. Nonetheless, constructing task-specific CoT prompts remains a complex undertaking. Moreover, there is still a considerable distance to cover in fully harnessing the potential of reasoning in generative AI models.

2.2 High-stakes applications: Harnessing the Power of AIG-T

Despite the remarkable achievements of AIG-T in general domains, its application in high-stakes domains remains challenging. Domains like science discovery and healthcare demand a greater emphasis on accuracy, reliability, transparency, and minimal fault tolerance. Inaccurate medical diagnoses could have severe consequences for patients, while misleading scientific conclusions can misdirect research efforts. To address these concerns, generative models in high-stakes applications should incorporate confidence scores, reasoning abilities, and source information alongside the generated results. This approach ensures that decision-makers have the necessary context and information to make informed judgments, minimizing the potential risks and maximizing the benefits of AIGT in these critical domains.

2.3 Environmentally-Friendly Continual Learning for AIG-T

In today's world, knowledge keeps expanding and new challenges continuously emerge. This underscores the importance of enabling language models to acquire new knowledge. However, the considerable costs associated with training large language models can't be ignored. Therefore, it's crucial to develop language models that are efficient in terms of resource use and environmentally friendly, while maintaining their ability to adapt and learn new things. A promising initial step could be to synergize software enhancement with hardware development.

Reference

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