

Human-AI Collaboration in Data-Driven Visual Storytelling

Mengyi Wei ^a, Chenyu Zuo ^b, Liqiu Meng ^a

^a Technical University of Munich – mengyi.wei@tum.de,

^b ETH Zürich - zuoche@ethz.ch,

^a Technical University of Munich — liqiu.meng@tum.de.

Keywords: Visual storytelling, Generative AI, Human-AI collaboration

Abstract:

Data-driven visual storytelling aims to communicate insights about data in an intuitive and narrative way. It requires human creators to integrate multiple data resources and processes including data analysis, conceptual design, and visual presentation. Recent research has begun to explore the potential of AI to support and augment the data-driven visual storytelling. For example, AI can automatically derive facts from data (Wang et al. 2020), organize story fragments (Shi et al. 2021), generate visualizations (Qian et al. 2021), and provide feedback (Fu et al. 2019). In contrast, humans excel at logical reasoning, creativity, and emotional appeal (Li, Wang, and Qu 2024). Current research focuses either on implementing a specific aspect of storytelling such as generating data (Shi et al. 2021; Qian et al. 2021), or exploring storytelling tools relevant for human-AI collaboration (Li, Wang, and Qu 2024). Few studies provide fine-grained analytical processes to show how human-AI collaboration takes place in different stages of data-driven visual storytelling.

Many news cases, such as AI ethical cases in real world, involve complex spatial and temporal contexts and large amounts of data. A direct textual presentation may make the information difficult to understand. For example, it is challenging for readers to interpret the ethical issues involved in a news report (Wei et al. 2024). Data-driven visual storytelling helps to lower the barrier to understanding. The otherwise neutral data is given an emotional and humanized perspective, helping it to resonate with the audience (Knaflitz 2015; Matei and Hunter 2021; Li et al. 2023). Therefore, news cases told as data-driven visual stories have the potential to enhance the educational significance and social impact of the news, meet the needs of a diverse audience and promote public discourse.

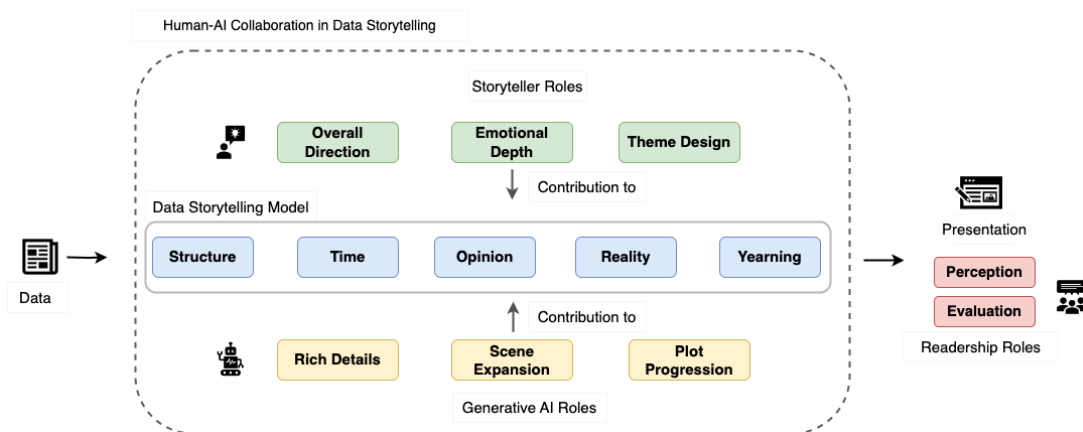


Figure 1. A framework for human-AI collaboration in data-driven visual storytelling

Based on the literature study, we divide the model of data-driven visual storytelling into five components to better characterize the collaboration between generative AI and humans: Structure, Time, Opinion, Reality, and Yearning. As shown in Figure 1, the primary roles of humans are Overall Direction, Emotional Depth, and Theme Design, while the roles of generative AI are Rich Details, Scene Expansion, and Plot Progression. The reader perceives and evaluates the final design. In Figure 2, the roles of generative AI and humans in different parts of the storytelling model are further refined.



Figure 2. The role division between generative AI and humans in the model of data-driven visual storytelling.

We select a number of news cases about AI ethics with spatiotemporal references to implement this framework, demonstrating the collaborative roles of generative AI and humans and how they help the public better understand real-life AI ethical issues and improve AI ethical awareness. Figure 2 shows the preliminary results of the visual story. The data-driven visual storytelling brings new challenges in cartographic design. For instance, Generative AI has not yet been trained to generate meaningful maps with specific data layers. It is still difficult for Generative AI to generate images with correct text on it. The map style is restricted by the training dataset of specific Generative AI.

The outlook of this work is that 1) specifying parameters of the proposed five elements in data storytelling, including structure, time, opinion, reality, and yearning, 2) providing case studies of different styles of data storytelling, 3) evaluating the results with human-subject studies.

References

- Fu, Xin, Yun Wang, Haoyu Dong, Weiwei Cui, and Haidong Zhang. 2019. "Visualization Assessment: A Machine Learning Approach." In *2019 IEEE Visualization Conference (VIS)*, 126–130. doi:10.1109/VISUAL.2019.8933570.
- Knafllic, Cole Nussbaumer. 2015. *Storytelling with Data: A Data Visualization Guide for Business Professionals*. John Wiley & Sons.
- Li, Haotian, Yun Wang, Q. Vera Liao, and Huamin Qu. 2023. "Why Is AI Not a Panacea for Data Workers? An Interview Study on Human-AI Collaboration in Data Storytelling." arXiv. <http://arxiv.org/abs/2304.08366>.
- Li, Haotian, Yun Wang, and Huamin Qu. 2024. "Where Are We So Far? Understanding Data Storytelling Tools from the Perspective of Human-AI Collaboration." In *Proceedings of the CHI Conference on Human Factors in Computing Systems*, 1–19. Honolulu HI USA: ACM. doi:10.1145/3613904.3642726.
- Matei, Sorin Adam, and Lucas Hunter. 2021. "Data Storytelling Is Not Storytelling with Data: A Framework for Storytelling in Science Communication and Data Journalism." *The Information Society* 37 (5). Routledge: 312–322. doi:10.1080/01972243.2021.1951415.
- Qian, Chunyao, Shizhao Sun, Weiwei Cui, Jian-Guang Lou, Haidong Zhang, and Dongmei Zhang. 2021. "Retrieve-Then-Adapt: Example-Based Automatic Generation for Proportion-Related Infographics." *IEEE Transactions on Visualization and Computer Graphics* 27 (2): 443–452. doi:10.1109/TVCG.2020.3030448.

- Shi, Danqing, Xinyue Xu, Fuling Sun, Yang Shi, and Nan Cao. 2021. "Calliope: Automatic Visual Data Story Generation from a Spreadsheet." *IEEE Transactions on Visualization and Computer Graphics* 27 (2): 453–463. doi:10.1109/TVCG.2020.3030403.
- Wang, Yun, Zhida Sun, Haidong Zhang, Weiwei Cui, Ke Xu, Xiaojuan Ma, and Dongmei Zhang. 2020. "DataShot: Automatic Generation of Fact Sheets from Tabular Data." *IEEE Transactions on Visualization and Computer Graphics* 26 (1): 895–905. doi:10.1109/TVCG.2019.2934398.
- Wei, Mengyi, Chenjing Jiao, Chenyu Zuo, Lorenz Hurni, and Liqiu Meng. 2024. "How Generative AI Supports Understanding of An Ethically Sensitive AI-Induced Event." *Abstracts of the ICA 8* (November). Copernicus GmbH: 1–2. doi:10.5194/ica-abs-8-26-2024.