

Radiology-Copilot: Collaborative Radiology Reporting

1. General Info

Project Title: Radiology-Copilot: Collaborative Radiology Reporting

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2. Background and Motivation

Automatic report generation in radiology based on a given radiographic image could reduce radiologists' workload and improve performance through assisted report generation [1,2]. There is a lot of on-going research on free-text radiology report generation, however there is still a lot of room for improvement in the accuracy and clinical correctness of these systems. Further, few works deal with the integration of such a system in the clinical practice. For an integration, the interaction of the radiologists with the system needs to be intuitive, and the radiologists must be able to trust the system and correct mistakes if necessary.

We want to investigate automatic radiology report generation within a collaborative system, supporting radiologists with useful proposals, while allowing them to adapt and correct these. Such a system would not aim to replace radiologists, but rather support them, increasing report quality and reporting speed. Only very limited prior work [3,4] partially investigated such systems, however not in combination with the powerful language generation models available today and without focusing on intelligent proposal completions.

3. Project Abstract

In this project, we aim to develop a collaborative reporting tool, similar to "Github Copilot" for coding, building upon a powerful radiology report generation model, RaDialog [5], which was developed by us. The goal is to research and develop different techniques for intelligently generating partial completions in the writing process of a radiology report, for instance based on model confidence. Further, we want to explore using an intermediate structured representation of finding, which can be modified by the radiologist in advance to get better report generation proposals. Lastly, the developed techniques should be integrated into an intelligent user interface which allows an effective use by radiologists. For a useful application, intelligent proposal selection and visualization in an intelligent interface is crucial, to find a balance between comprehensive and helpful proposals, while avoiding a lot of false predictions, which would reduce the trust in the tool. Developing such a tool could support radiologists in their daily tasks and reduce the mental load for writing radiology report, finally increasing speed and accuracy.

4. Prerequisites

- Good programming skills
- Good background in deep learning
- Good skills in Python and PyTorch
- High motivation

5. Benefits:

- Scientific contribution to the growing field of medical vision-language models
- Working with SOTA language models
- Possible publication of results

6. Students' Tasks Description

Students' tasks would be the following:

- WP1: Researching of related work in Report Generation, Confidence Estimation for language models and details on mechanisms in Github Copilot [6,7] or similar tools built.
- WP2: Project Setup and initial pipeline for generating a full report given an image + findings
- WP3: Design and development of initial intelligent user interface to enable display of proposals and collaborative writing. (parallel 1)
- WP4: Development of initial confidence-based proposals during the writing process. (parallel 1)
- WP5: Development of advanced intelligent user interface including selection of structured findings, intuitive next prediction visualization and selection and speed optimization. (parallel 2)
- WP6: Optimizing the confidence estimation for an intuitive use. (parallel 2)
- WP7: Qualitative and Quantitative Evaluation of the Method
- WP8: Documentation / Final Presentation

7. Work-packages and Time-plan:

	Description	#Students
WP1	Literature research	4
WP2	Initial pipeline setup	4
WP3	Development of initial intelligent user interface	2
WP4	Implementation of initial confidence estimation methods	2
M1	Intermediate Presentation	4
WP5	Implementation of advanced intelligent user interface	2
WP6	Implementation of optimized confidence estimation	2
WP7	Evaluation	2
WP8	Documentation	2
M2	Final Presentation	4

[1] Hou, B., Kaissis, G., Summers, R.M., Kainz, B.: Ratchet: Medical transformer for chest x-ray diagnosis and reporting. In: Medical Image Computing and Computer Assisted Intervention–MICCAI 2021: 24th International Conference, Strasbourg, France, September 27–October 1, 2021, Proceedings, Part VII 24. pp. 293–303. Springer (2021)

[2] Tanwani, A.K., Barral, J., Freedman, D.: Repsnet: Combining vision with language for automated medical reports. In: Medical Image Computing and Computer Assisted Intervention–MICCAI 2022: 25th International Conference, Singapore, September 18–22, 2022, Proceedings, Part V. pp. 714–724. Springer (2022)

[3] Biswal, S., Xiao, C., Glass, L. M., Westover, B., & Sun, J. (2020, April). Clara: clinical report auto-completion. In Proceedings of The Web Conference 2020 (pp. 541-550).

[4] Nishino, T., Ozaki, R., Momoki, Y., Taniguchi, T., Kano, R., Nakano, N., ... & Nakamura, K. (2020, November). Reinforcement learning with imbalanced dataset for data-to-text medical report generation. In Findings of the Association for Computational Linguistics: EMNLP 2020 (pp. 2223-2236).

[5] Pellegrini, C., Özsoy, E., Busam, B., Navab, N., & Keicher, M. (2023). RaDialog: A Large Vision-Language Model for Radiology Report Generation and Conversational Assistance. arXiv preprint arXiv:2311.18681.

[6] <https://github.com/features/copilot>

[7] <https://thakkarparth007.github.io/copilot-explorer/posts/copilot-internals>