

Paper summaries

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1 On the Automatic Generation of Medical Imaging Reports (Jing, Xie, and Xing, 2018)

1.1 Introduction

The reading and interpretation of medical images are usually conducted by specialized medical professionals. Report writing can be error-prone for inexperienced physicians, and time-consuming and tedious for experienced physicians. Several challenges need to be addressed:

1. A complete report consists of multiple heterogeneous sources of information
2. Localize image regions and attach the right description to them
3. Descriptions in reports are usually long, with multiple sentences

The proposed solutions are:

1. A **multi-task learning framework** for simultaneous prediction of tags and text generation
2. A **Co-attention mechanism**: simultaneous attention to images and predicted tags; explores synergistic effects of visual and semantic information
3. A **Hierarchical LSTM**: Leverages compositional nature of reports: first generates high-level topics, then fine-grained descriptions from each one

1.2 Methods and Architecture

An image is divided into regions, and a CNN encoder is used to learn visual features for these patches. These features are fed into a *multi-label classifier*, from which tags are predicted. These tags are transformed into *semantic feature vectors* by a custom embedding. Both visual and semantic features are fed into the co-attention module, which produces a combined *context vector*, which **simultaneously captures the visual and semantic information of this image**.

The decoding and caption generation process is performed by the hierarchical LSTM, which leverages the compositional structure of a medical report (each sentence focusing on one specific topic). The sentence LSTM, using the context vector, first generates a sequence of high-level topic vectors representing sentences.

References

Jing, Baoyu, Pengtao Xie, and Eric Xing (July 2018). "On the Automatic Generation of Medical Imaging Reports". In: *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*. Melbourne, Australia: Association for Computational Linguistics, pp. 2577–2586. DOI: 10.18653/v1/P18-1240. URL: <https://www.aclweb.org/anthology/P18-1240>.

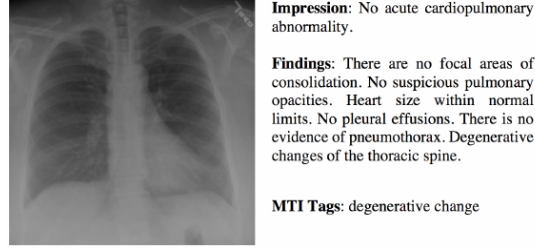


Figure 1: An exemplar chest x-ray report. In the *impression* section, the radiologist provides a diagnosis. The *findings* section lists the radiology observations regarding each area of the body examined in the imaging study. The *tags* section lists the keywords which represent the critical information in the findings. These keywords are identified using the Medical Text Indexer (MTI).

Figure 1: Sample report from IU X-ray

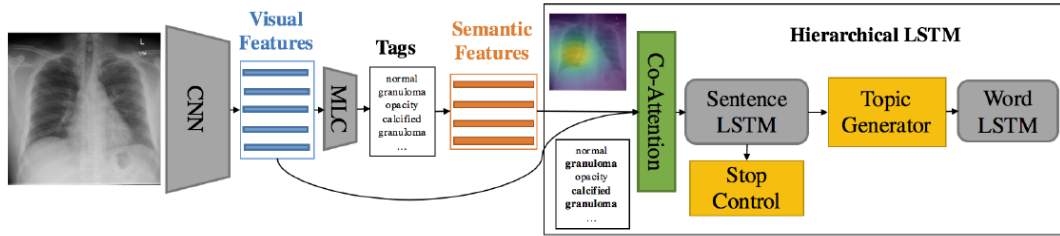


Figure 2: Illustration of the proposed model. MLC denotes a *multi-label classification* network. Semantic features are the word embeddings of the predicted tags. The boldfaced tags “calcified granuloma” and “granuloma” are attended by the co-attention network.

Figure 2: Architecture