Learning Semantic Image-Text Embeddings in the Radiology Context

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Motivation

- Global shortage of Radiologists

- In most countries there is an insufficient number of radiologists to meet the ever-increasing demand for imaging and diagnostic services.

- The situation will get worse, as imaging volumes are increasing at a faster rate than new radiologists are entering the field.

- Cognitive computing techniques, such as neural networks, deep learning and predictive analytics, may help by improving the productivity of radiologists.

Source: National radiology societies and government agencies. See slide 9 for details.
Motivation

- Medical and Imaging data is growing

Inspired by: [IDC/EMC Report, 2014]
Motivation

- Average radiologists spend 3-4 seconds, 8 hours per day.

- Missed radiological findings can be as high as 30%.

- Diagnostic errors lead to multiple scans, and in the worst case, death of a patient.

5% of diagnosis are in Error translating to

62 diagnostic errors per physician per year

18 Million

Diagnostic errors per year in United States

The Need: Augmentation Intelligence

- Human + Computers can achieve better performance than either alone.

"In contrast to automation, augmentation presumes that smart humans and smart machines can coexist and create better outcomes than either could alone. AI systems may perform some health care tasks with limited human intervention, thereby freeing clinicians to perform higher-level tasks."

Proposed Model

Radiology Report
Findings: Interval performance of anterior cervical spinal fusion, xox ox intact without complicating features. There is stable cardiomegaly, with persistent bibasilar opacities xxx atelectasis and/or infiltrate. No xxx focal consolidations, pneumothorax, or pleural effusions. The visualized osseous structures demonstrate mild multilevel degenerative disc disease of the thoracolumbar spine, without acute osseous abnormality. Impression: Stable cardiomegaly and persistent minimal bibasilar atelectasis.

Medical Keywords
atelectases
degenerative disc disease
infiltrates
opacity
cervical spinal fusion
Atelectasis
Cardiomegaly
Cervical Vertebrae
Lumbar Vertebrae
Spinal Fusion
Surgery
The proposed model can enhance radiologist’s productivity by:

- Automatic image annotation and quantification
- Alert for relevant regions of interest in a medical image
- Compare readings, diagnosis, and outcomes of similar cases existing in the Picture Archiving and Communication Systems (PACS)
- Retrieving radiology reports given medical image and vice-versa
- Allow multi-modal query expansion to retrieve radiology reports or medical images as per radiologists’ special needs.