AI IN IMAGING

Daniel L. Rubin, MD, MS
Associate Professor of Biomedical Data Science, Radiology, and Medicine (Biomedical Informatics)

Matthew Lungren MD MPH
Assistant Professor of Radiology
@mattlungrenMD

Department of Radiology
Stanford University

AI in Medical Imaging Opportunities

- Efficient image creation
- Image quality control
- Imaging triage
- Computer-aided detection
- Computer-aided classification
- Automatic report drafting

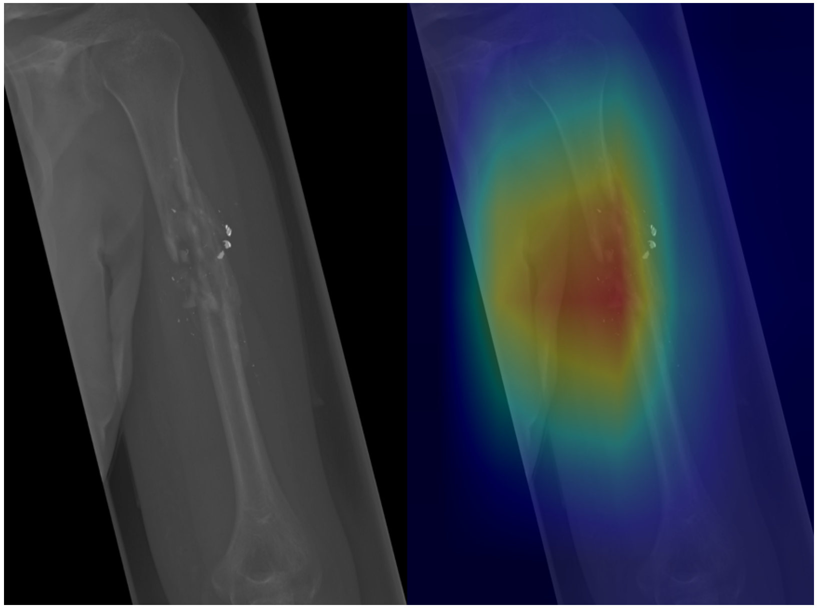

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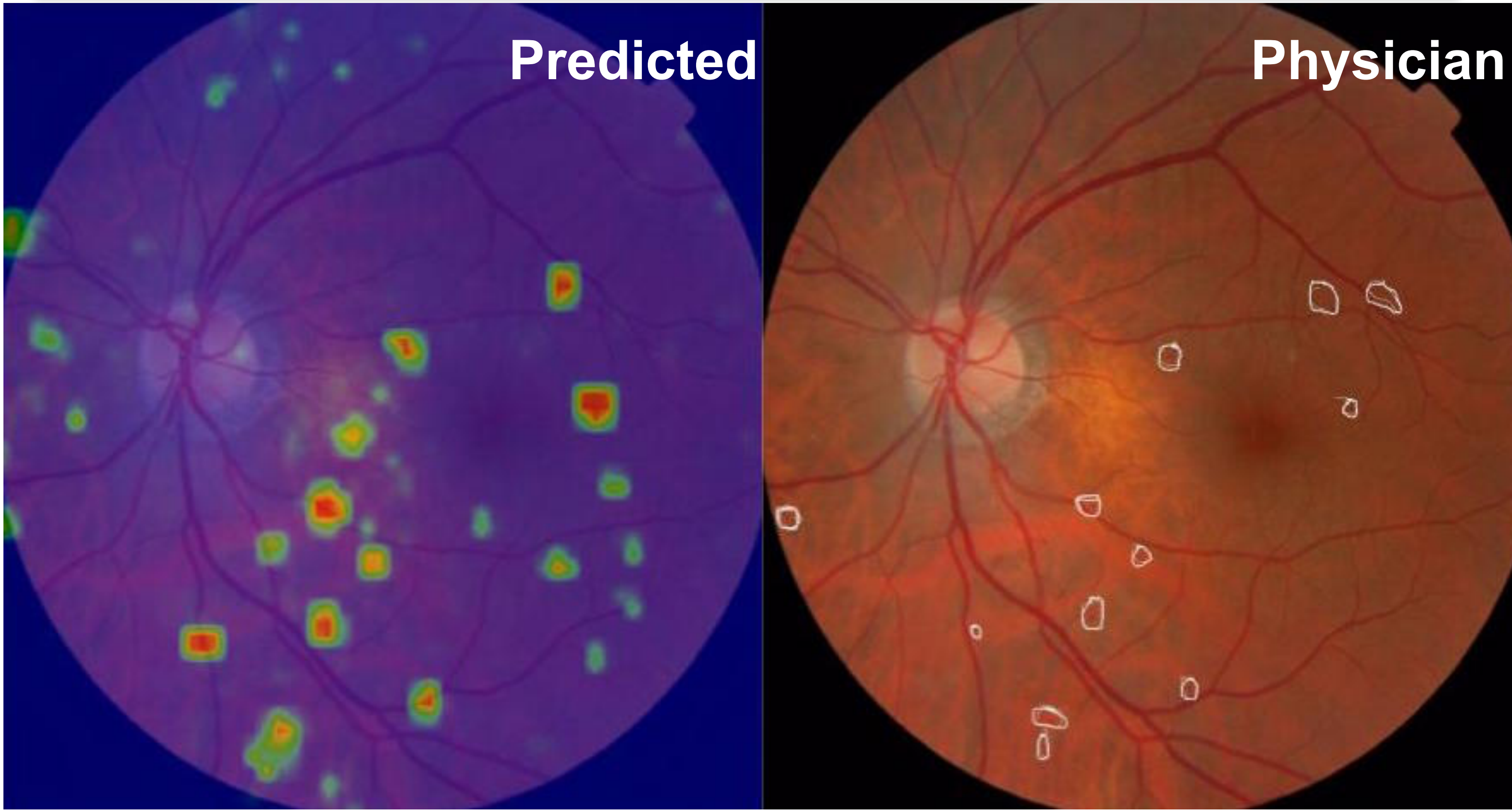
Image interpretation tasks for AI

1. Disease detection
2. Lesion segmentation
3. Diagnosis

Disease Detection: Retinal hemorrhages

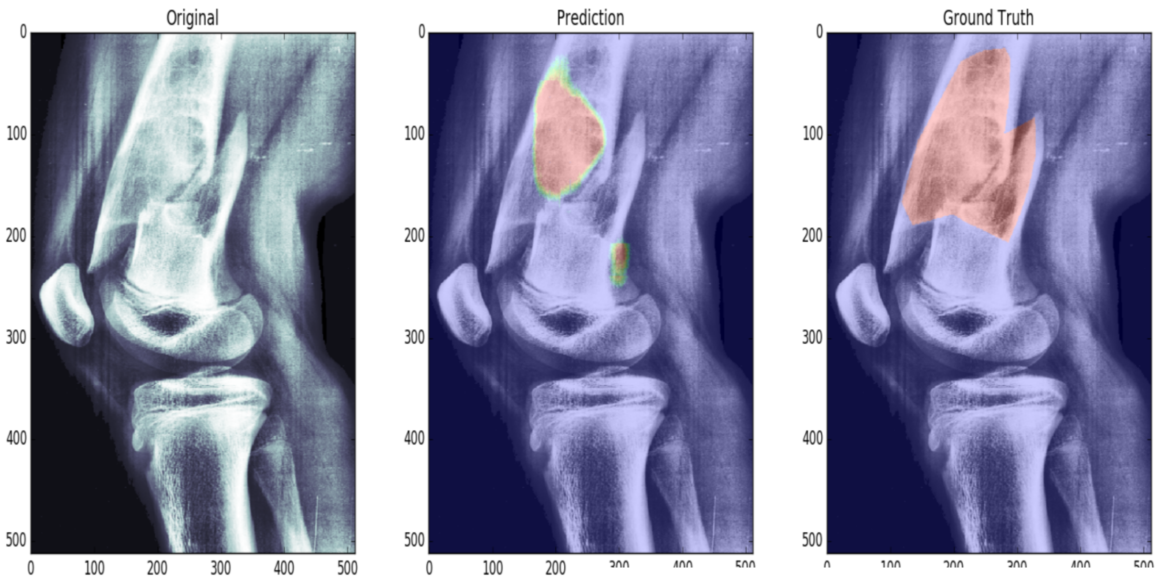


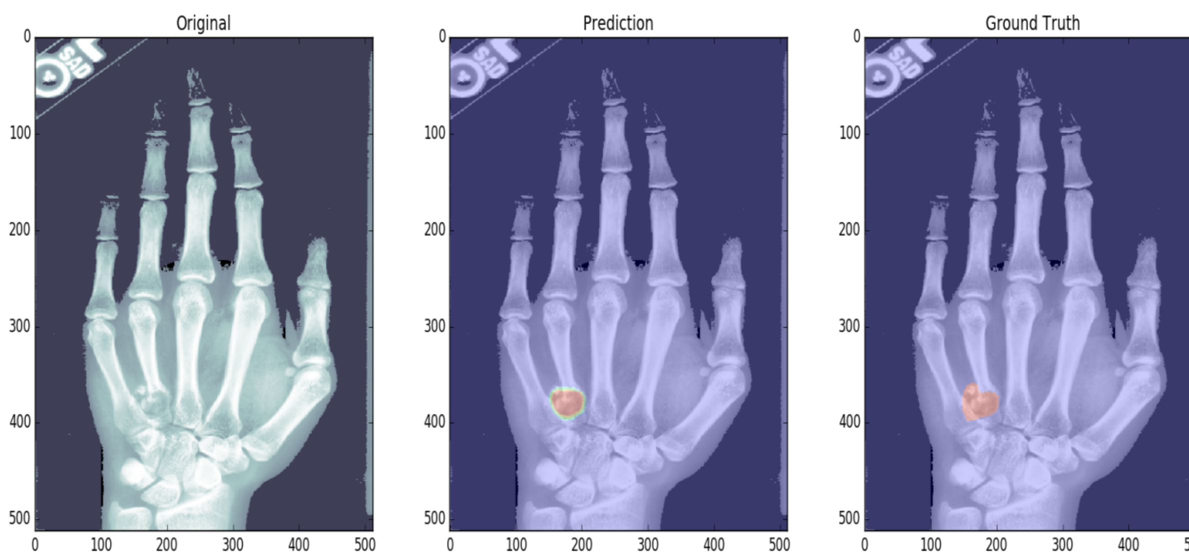
224x224 input CNN sliding window:
Detecting any abnormal feature

Red = P~.99 **Green = P ~ 0.5** **Blue = ~ 0.01**

Carson Lam, et al, in preparation

Segmentation: Bone tumors

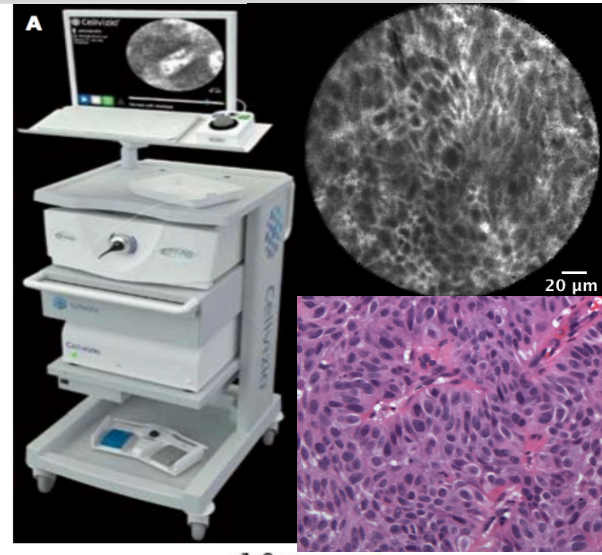




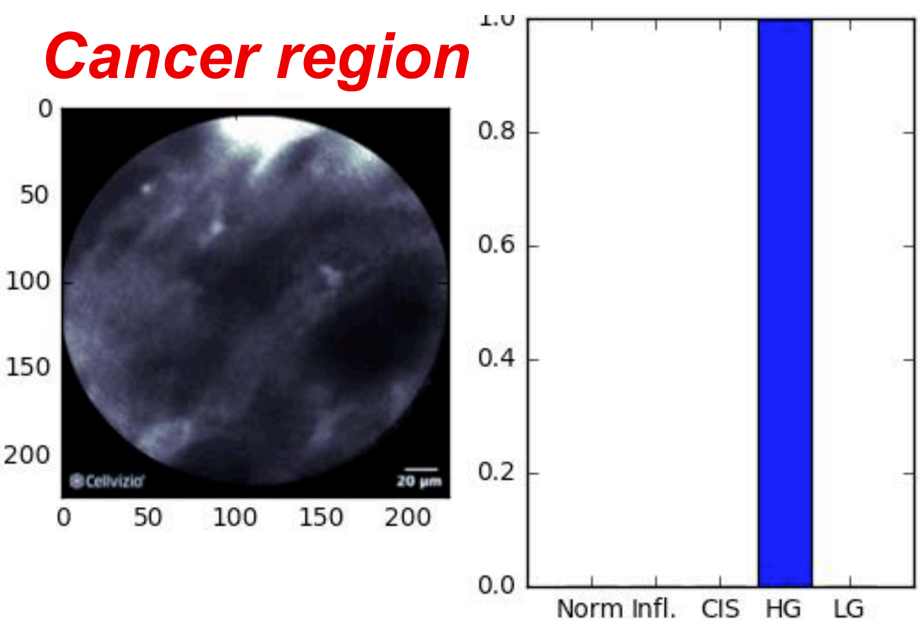
Darvin Yi, et al, in preparation

Diagnosis: Real-time diagnosis of cancer using deep learning

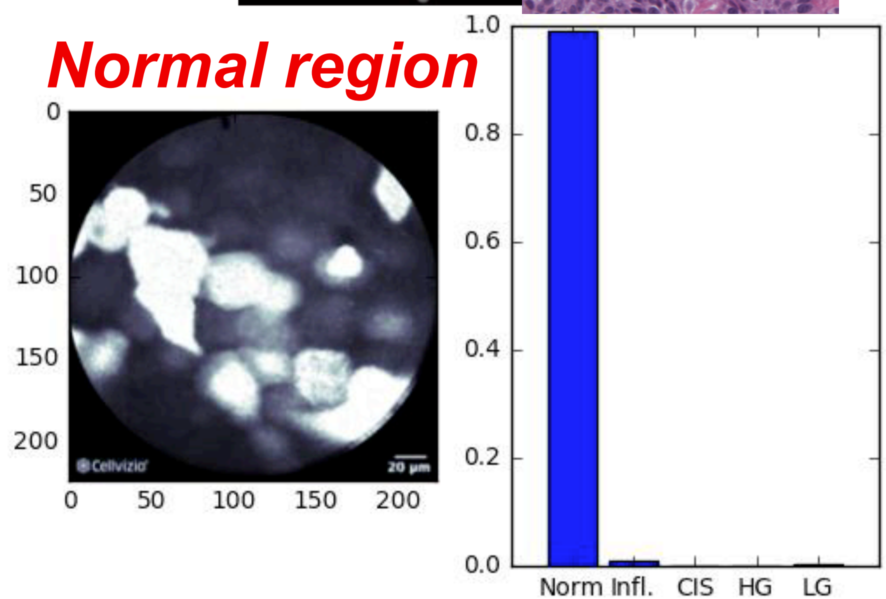
Computerized interpretation during confocal endomicroscopy examination of the bladder permits localization of tumors in heterogeneous bladder lesions



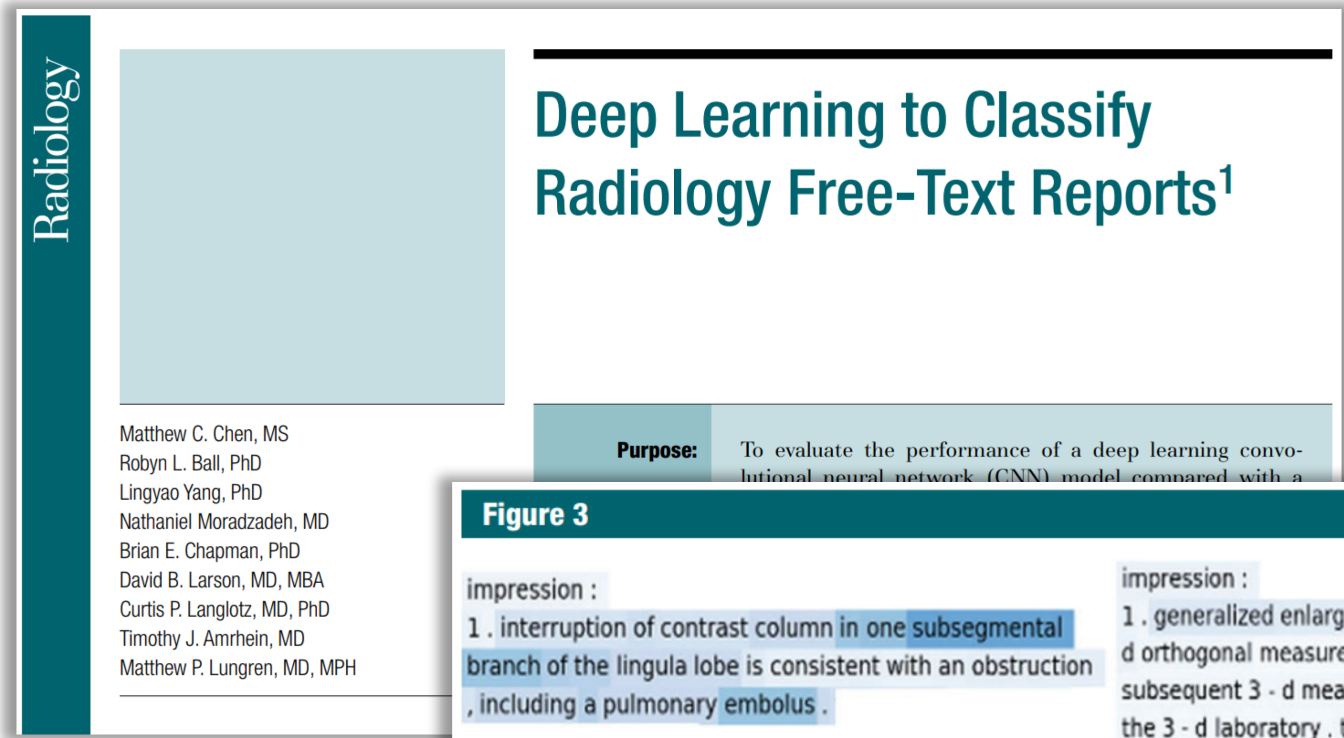
Cancer region



Normal region



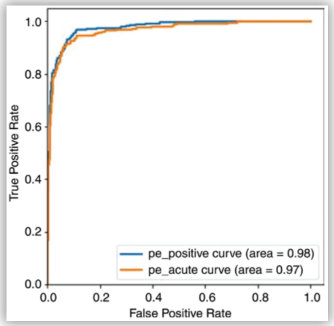
Darvin Yi, et al, in preparation

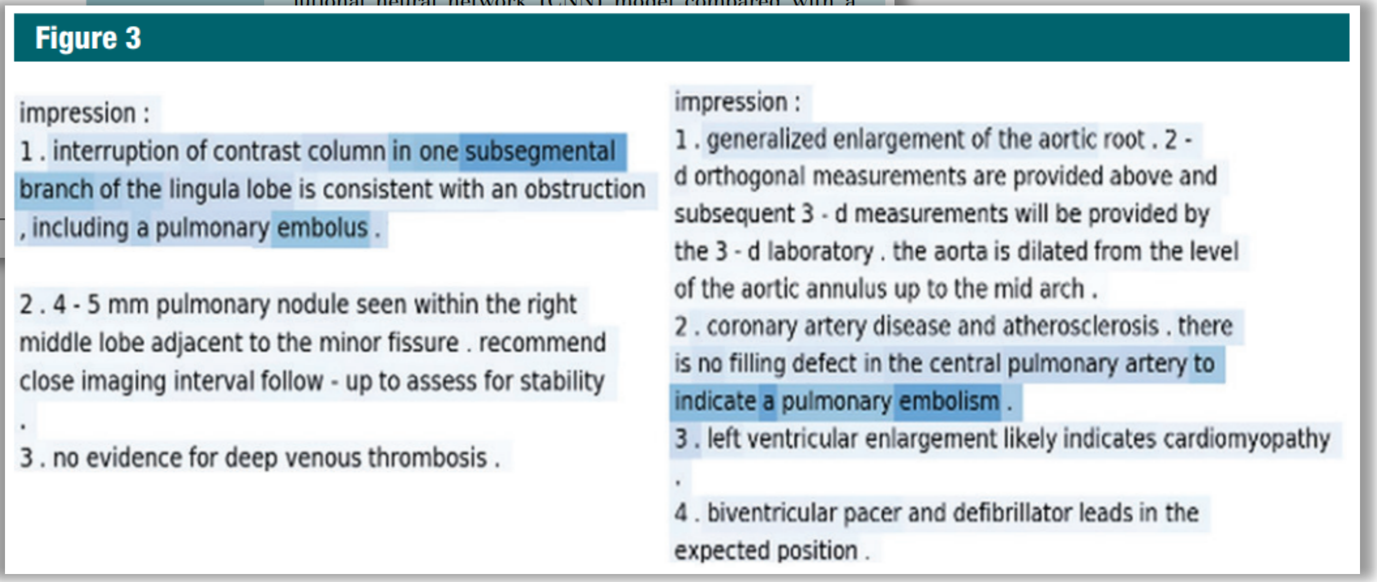

Radiology

Deep Learning to Classify Radiology Free-Text Reports[1]

Matthew C. Chen, MS
Robyn L. Ball, PhD
Lingyao Yang, PhD
Nathaniel Moradzadeh, MD
Brian E. Chapman, PhD
David B. Larson, MD, MBA
Curtis P. Langlotz, MD, PhD
Timothy J. Amrhein, MD
Matthew P. Lungren, MD, MPH

Purpose: To evaluate the performance of a deep learning convo-
lutional neural network (CNN) model compared with a





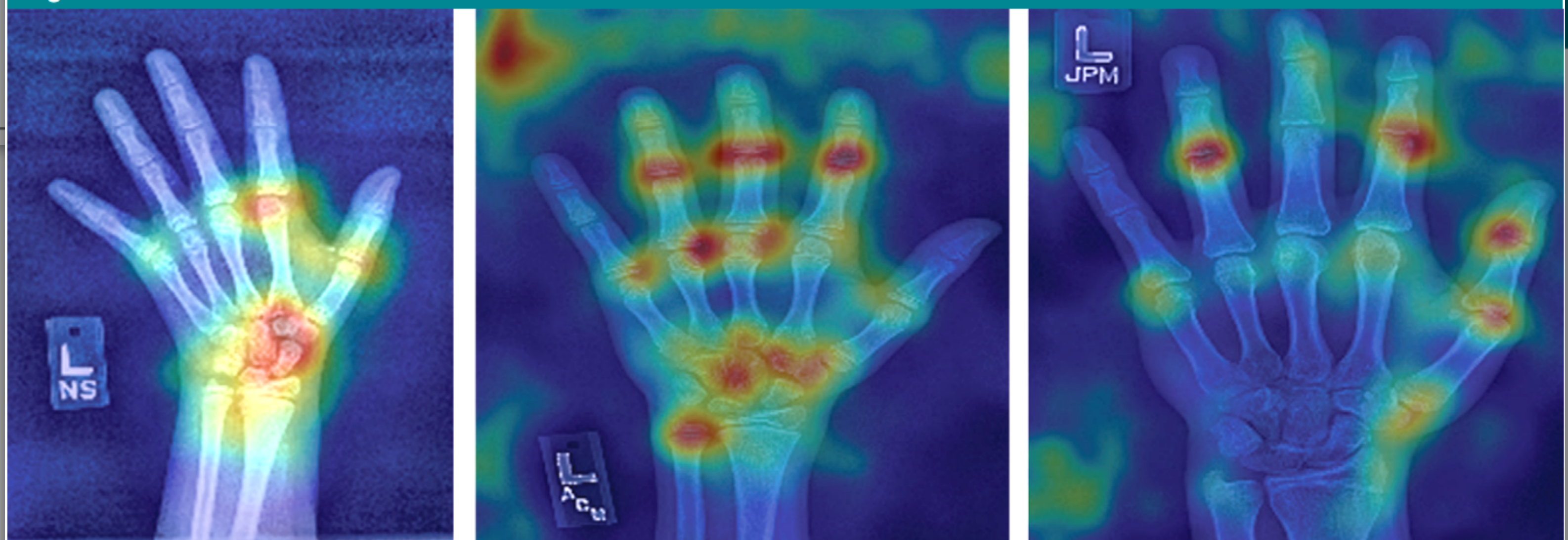
https://doi.org/10.1148/radiol.2017171115

Radiology

Performance of a Deep-Learning Neural Network Model in Assessing Skeletal Maturity on Pediatric Hand Radiographs[1]

David B. Larson, MD, MBA
Matthew C. Chen, MS
Matthew P. Lungren, MD, MPH
Safwan S. Halabi, MD
Nicholas V. Stence, MD
Curtis P. Langlotz, MD, PhD

Figure 6

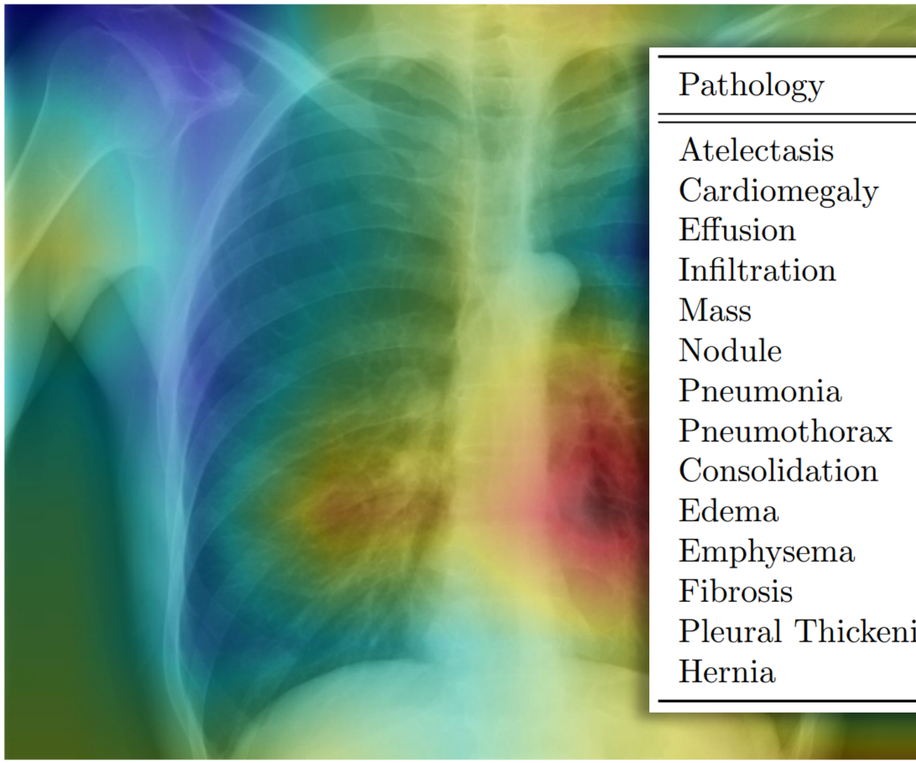


a. b. c.

Figure 6: Original image with superimposed saliency map for sample hand radiographic images in three male patients age 4 years (**a**), 15 years (**b**), and 17 years (**c**).

https://doi.org/10.1148/radiol.2017170236

CheXNet: 121-layer CNN



Pathology	Wang et al. (2017)	Yao et al. (2017)	CheXNet (ours)
Atelectasis	0.716	0.772	**0.8209**
Cardiomegaly	0.807	0.904	**0.9048**
Effusion	0.784	0.859	**0.8831**
Infiltration	0.609	0.695	**0.7204**
Mass	0.706	0.792	**0.8618**
Nodule	0.671	0.717	**0.7766**
Pneumonia	0.633	0.713	**0.763**
Pneumothorax	0.806	0.841	**0.893**
Consolidation	0.708	0.788	**0.7939**
Edema	0.835	0.882	**0.8932**
Emphysema	0.815	0.829	**0.9260**
Fibrosis	0.769	0.767	**0.8044**
Pleural Thickening	0.708	0.765	**0.8138**
Hernia	0.767	0.914	**0.9387**

Matt Lungren, MD, MPH and Andrew Ng, PhD. https://arxiv.org/abs/1711.052

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Affiliated Faculty From 8 Departments Across 3 Schools

Supporting Departments:

- Radiology
- Pathology
- Medicine
- Ophthalmology
- Dermatology
- Computer Science
- Biomedical Data Science
- Anesthesia

ring

- Guido Davidzon, MD
  Clinical Assistant Professor of Radiology
- Shreyas Vasanawal, MD, PhD
  Associate Professor of Radiology
- Brian Hargreaves, PhD
  Associate Professor of Radiology and, by courtesy, Electrical Engineering
- Garry Gold, MD
  Professor of Radiology and, by courtesy, Bioengineering

Medicine (Biomedical Informatics Research) and Biomedical Data Science

- Nigam Shah, MBBS, PhD
  Associate Professor of Medicine (Biomedical Informatics)
- Olivier Gevaert, PhD
  Assistant Professor of Medicine (Biomedical Informatics Research) and Biomedical Data Science
- Manisha Desai, PhD
  Professor of Medicine (Biomedical Informatics Research), Biomedical Data Science, and, by courtesy, of Health Research and Policy
- Daniel Rubin, MD, MS
  Associate Professor of Biomedical Data Science, Radiology, Medicine (Biomedical Informatics Research), and, by courtesy, Ophthalmology

Computer Science

- Fei Fei Li, PhD
  Associate Professor of Computer Science
- Andrew Ng, PhD
  Adjunct Professor of Computer Science
- Christopher Re', PhD
  Associate Professor of Computer Science

Clinical Instructor in Pathology

- Jeanne Shen, MD
  Assistant Professor of Pathology
- Roberto Novoa, MD
  Clinical Assistant Professor of Pathology and Dermato

Ophthalmology

- David Myung, MD, PhD
  Assistant Professor of Ophthalmology
- Joyce Liao, MD, PhD
  Associate Professor of Ophthalmology and Neurology
- Robert Chang, MD
  Assistant Professor of Ophthalmology

Dermatology

- Justin Ko, MD, MBA
  Clinical Associate Professor of Dermatology

Anesthesia

- Sean Mackey, MD, PhD
  Redlich Professor of Anesthesiology, Perioperative and Pain Medicine, Neurosciences, and Neurology

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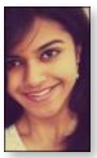
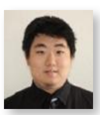
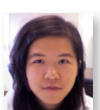

– Imon Banerjee


– Hersh Sagreiya


– Darvin Yi


– Carson Lam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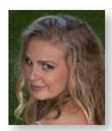
– Selen Bozkurt


– Jocelyn Barker


– Curt Langlotz


– Matthew Lungren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– Bao Do


– Sandy Napel


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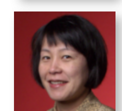
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Issues for discussion

1. How do you get labels in practice? What do they mean?
2. Issues about label quality
   a) An image annotation is not ground truth
   b) Impact of quality of image labels on models
   c) Uncertainty in the labels; inter-annotator disagreement
3. Confounding variables
4. Integrating domain expertise into models
5. Leveraging un-annotated images, weak supervision
6. Deployment and evaluation of models ("post-marketing surveillance")
7. Structures for sharing labels and annotations