Deep imaging

Quantitative biomarker for clinical decision making

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English, October 2017
54% of healthcare leaders see an expanding role of AI in medical decision support.*

What does a radiologist do?

Select

Read

Acquire

Report
UK Radiologist workforce grew by 5%, but number of CT scans increased by 29%.*

* The clinical radiology UK workforce census 2015, The Royal College of Radiologists
When radiologists are forced to work faster, their average interpretation error rate rises by 16.6%. *

* Faster Reporting Speed and Interpretation Errors: Conjecture, Evidence, and Malpractice Implications, Journal of the American College of Radiology, Volume 12, Issue 9, September 2015, Pages 894-898
The average radiologist is interpreting an image every 3–4 seconds, 8 hours a day.*

* Edward Choi et al.: Medical Concept Representation Learning from Electronic Health Records and its Application on Heart Failure Prediction, Atlanta, USA, 2016.
AI helps radiologists by providing accelerated image interpretation
Applying AI to medical imaging is a powerful strategy to deal with high volumes and low reimbursement.
Radiology is characterized by high volumes of examinations at low reimbursement

35 Million chest procedures per year
- 87% X-ray
- 12% CT
- 1% Nuclear, MRI, US

Low reimbursement
- CT: $54-86
- X-ray: $7-25

Numbers represent Medicare reimbursement only. Calculation based on 2015 Medicare reports.
AI based image analytics can drive automation – helping to read chest imaging faster

Abnormality highlighting
Helps avoid missed abnormalities and identify incidental findings.

Augmented reporting
Provides standardized, reproducible quantitative reports using automated information extraction from images.

Image-based biomarker
Assists with differential diagnosis for lung disease

Assists with automated differential diagnosis: Lung nodule malign or benign?

Supports automatic detection and characterization of calcification in the coronary artery

Image courtesy: Erasmus University Medical Center Rotterdam / Netherland
This feature is based on research, and is not commercially available. Due to regulatory reasons its future availability cannot be guaranteed.
Deep learning algorithms help to fuel AI technology in chest imaging

**Input**

- Multi-modal Chest images
- X-Ray & CT

**Deep Reinforcement Learning**
- Learning to detect anatomical landmarks

**Deep Adversarial Network**
- to segment anatomical structures and recognize abnormalities

**Output**

**Key Images for PACS**

**Report for RIS/EMR**

**Quantification**

- Series: Type: Description
  - Nodule: Ground Glass, Size 9mm
  - Parenchyma: Centrolobular emphesyma, Upper right Lob
  - Heart: LCA Calcification, minor

- Series: Type: Description
  - Airways: Not detected
  - Pleura: Not detected
  - Vascular: Not detected

**Helps to get the core information faster**

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AI helps radiologists by providing more precise image-based biomarkers.
AI helps increase precision in a given amount of time – providing results independent from user skills
Artificial Intelligence technology assists prostate cancer risk assessment and amplifies reporting capabilities

**Augmented mpMRI reading**
Leverage algorithms trained on expert findings and correlations with pathology

**Augmented reporting**
Pre-populate PI-RADS (Prostate Imaging Reporting and Data System) structured report

Enable broad access to mpMRI for early detection of clinically significant prostate cancer
Enable fast, high-quality adoption beyond specialist centers

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Deep learning technology drives AI-assisted prostate mpMRI reading

Adversarial 3D Image-2-Image Network assists prostate MRI evaluation

Deep Reinforcement Learning to detect anatomical landmarks

Discriminative Adversarial Image to Image Network to segment prostate, localize and characterize lesions

May improve the precision of less experienced prostate readers on mp-MRI

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Artificial Intelligence: AI is vital for value-based care

Improving patient experience

AI drives improvement of clinical pathways
by
• complex/acute case prioritization
• avoiding unnecessary interventions

AI drives quality of care
by increasing
• diagnostic precision through quantitative imaging
• personalization

AI drives efficiency and productivity
by enabling
• automation and standardization through image analytics tactics

Lower cost of care

Better health outcomes
Siemens Healthineers: We have what it takes in AI

- Curated images, reports, operational data: 100,000,000
- Dedicated annotation team
- Regional supercomputing data centers: 4
- Close clinical collaborations
- AI competence center with awarded Data Scientists: ~600,000 installed base
- More than 30 AI-enriched offerings on the market
- 400 patents and patent applications in machine learning
- 75 in deep learning

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In the future, AI can do so much more

Digital twin – lifelong, personalized physiological model updated with each scan, exam

Patient-centric, holistic treatment

Comaniciu et al, Shaping the Future through Innovations: From Medical Imaging to Precision Medicine, Medical Image Analysis, 2016.
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