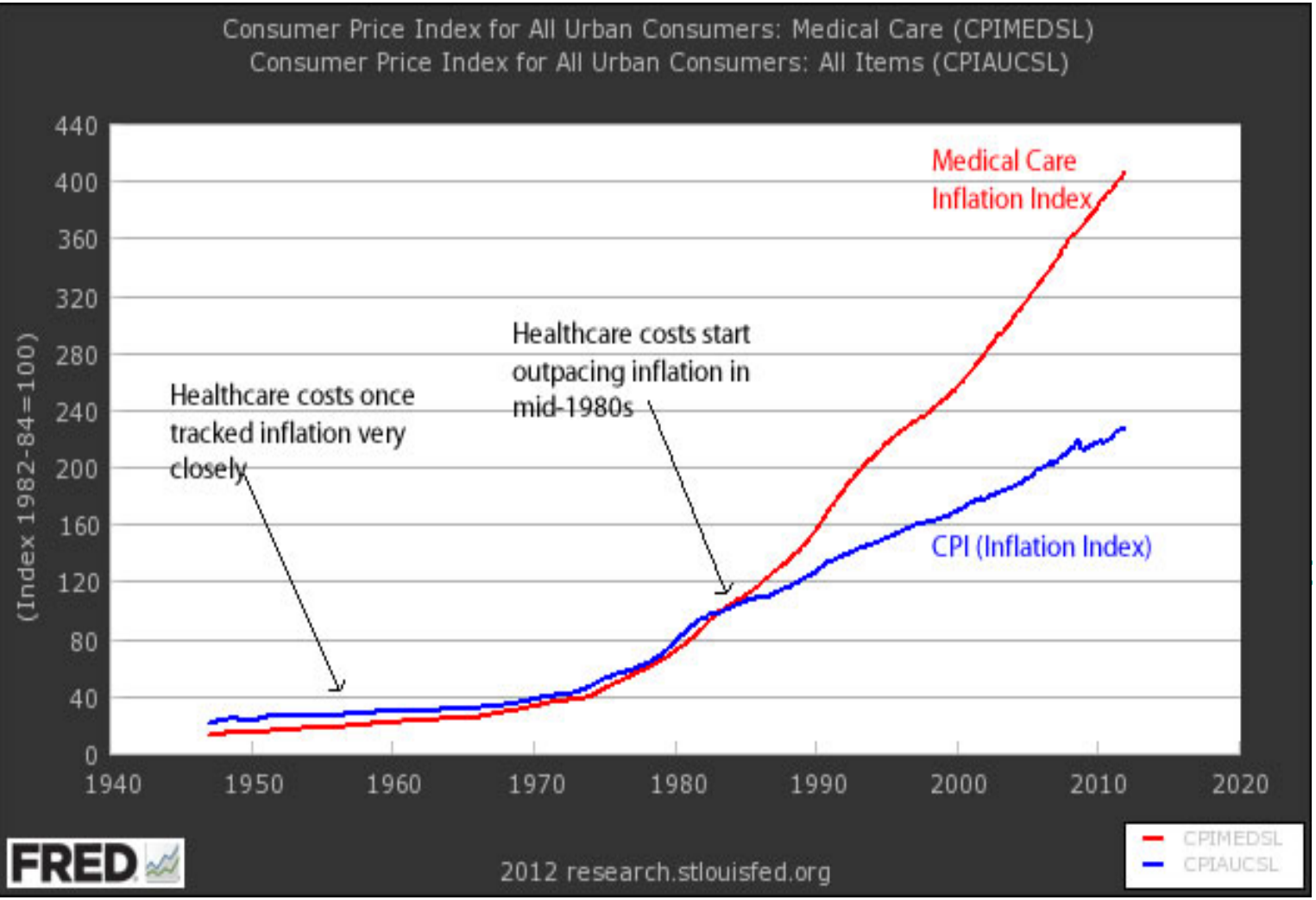
London Medical Imaging & Artificial Intelligence Centre for Value-Based Healthcare

Professor Reza Razavi
Centre Director

The traditional healthcare business model



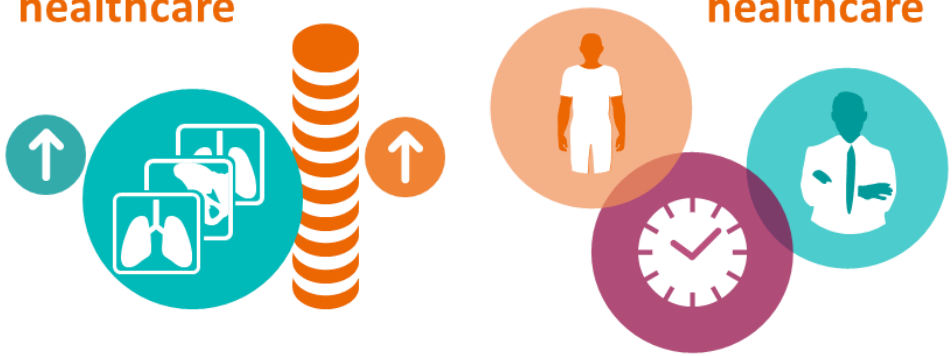
$\sum$ Healthcare costs

Our Centre Vision: Driving the Transformation towards Value-Based Healthcare

Personalised diagnosis & therapy

Today:
Volume-oriented healthcare

Tomorrow:
Value-oriented healthcare



Big data support

Artificial intelligence (AI)
for **personalized decisions:**

50%

potential reduction
in medical treatment
costs[1)]

1) Source: www.ai-healthandlifesciences.com

Centre Overview

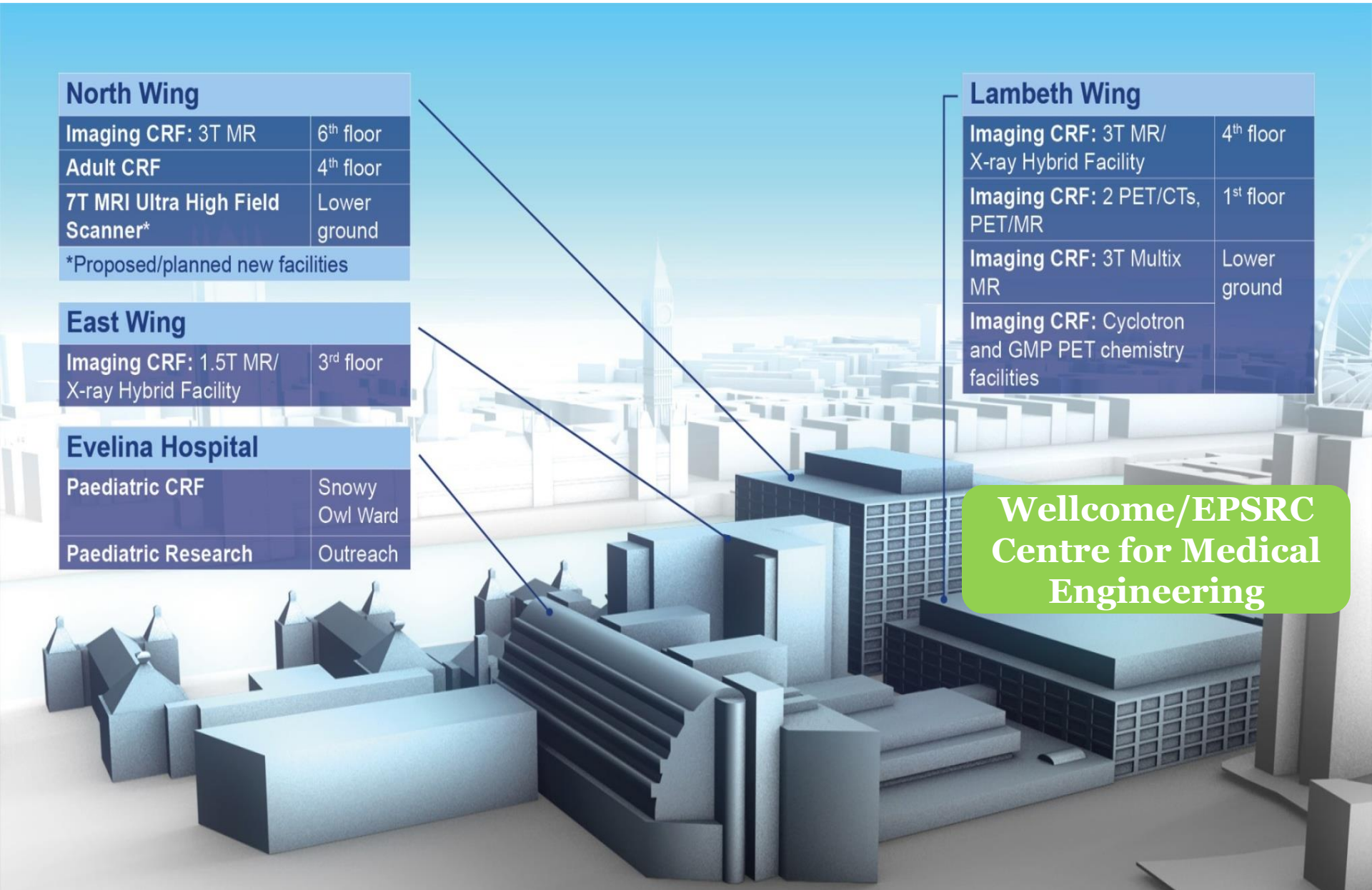
- Focus on 12 clinical pathways for maximum impact
- 10 SMEs core partners supported on site
- Siemens European Stratified Medicine R&D headquarters
- Co-location of academic, clinical and industry/SME staff: “sandpit” for rapid prototype iteration
- World-leading expertise in imaging, AI, clinical research
- Substantial computational infrastructure, in partnership with IBM & NVIDIA
- “Bringing the algorithms to the data”
- Engagement with NHS commissioners and health economics

Centre Members

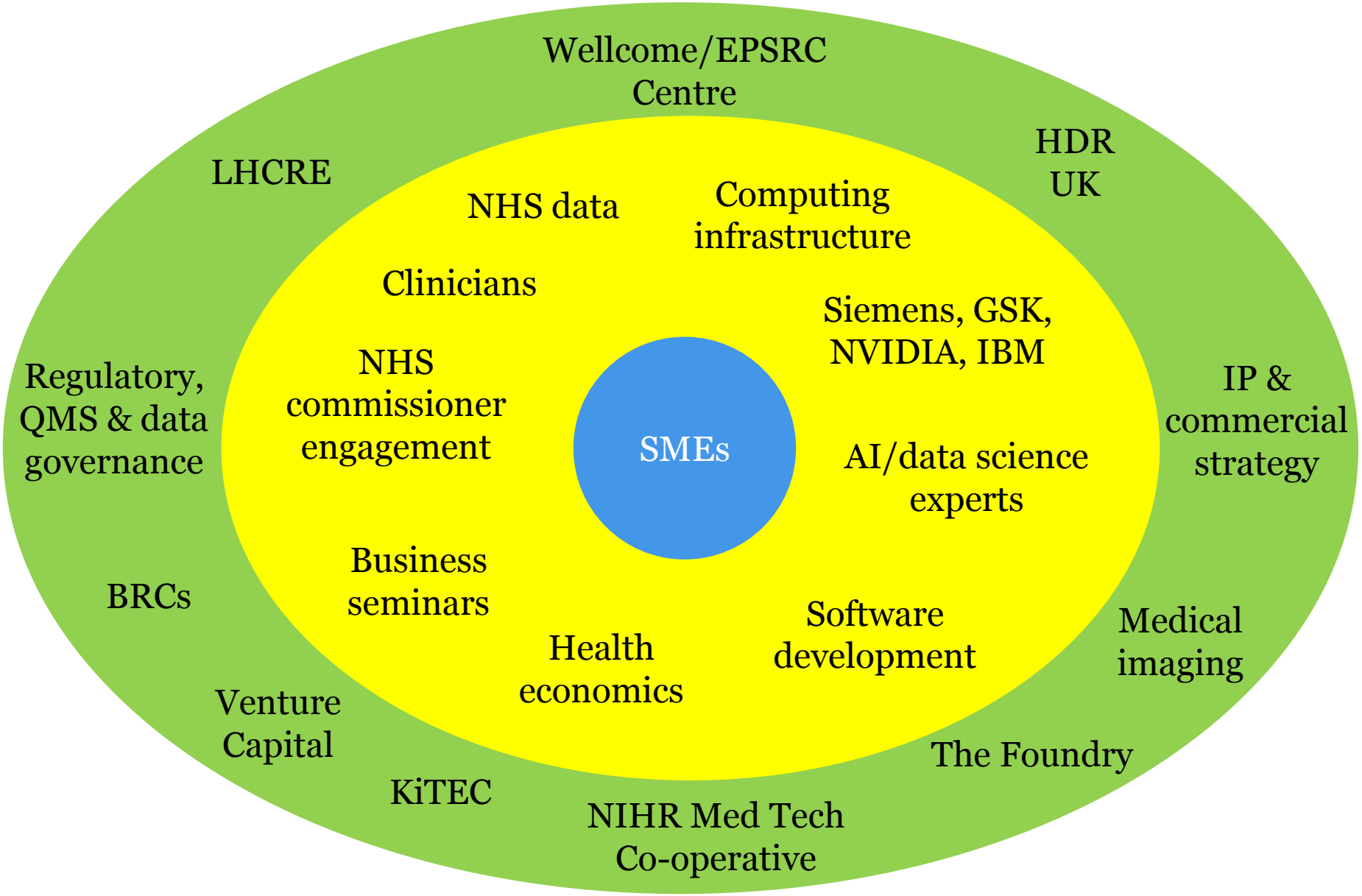
Thames Mammography

AInostics

St Thomas' Hospital Hub



Industrial strategy: growing SMEs

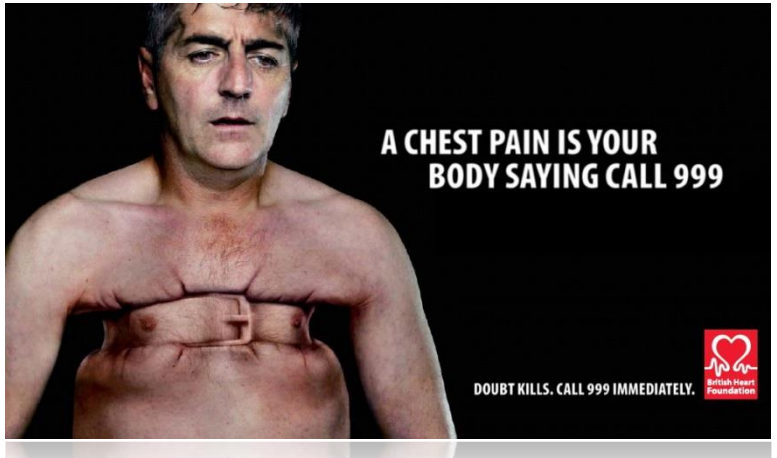


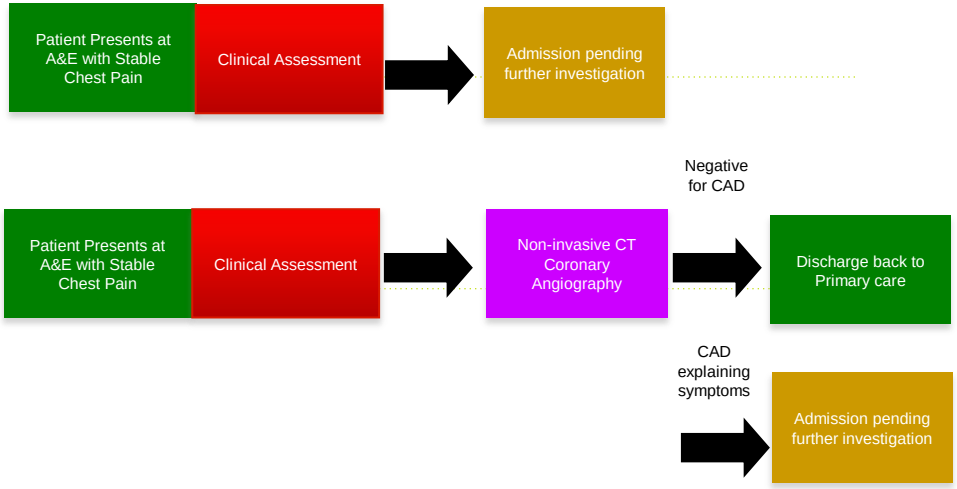
Acute Chest Pain

Key Question: *Does introducing a CT scan for low to intermediate risk ACP patients result in earlier diagnosis and subsequent appropriate treatment or discharge?*

Interesting Facts/Benefits:

- At St Thomas' 12 patients per day are admitted for observation with acute chest pain, at a cost of £1000 per patient.
- Cardiac CT costs £200. 80-90% of patients could potentially be discharged earlier with this facility available.
- ACP patients are often discharged to GPs with no definite diagnosis and are, subsequently, often referred back to cardiology.
- NICE acknowledges the use of cardiac CT
- Rapid turnaround of scan and report within 4 hr wait

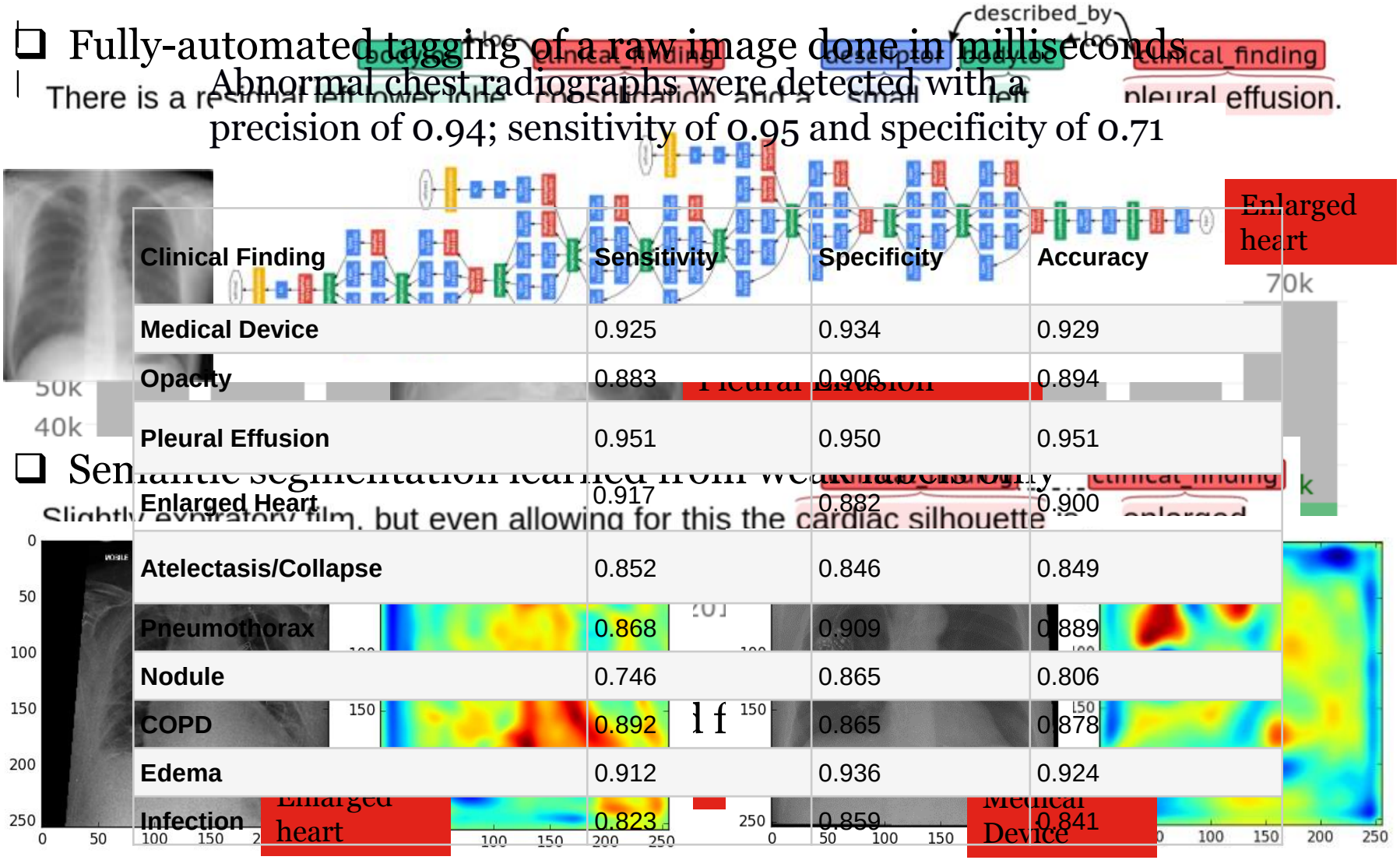




Deep learning for automatic reporting of X-rays

- Fully-automated tagging of a raw image done in milliseconds
- Semantic segmentation learned from weak labels only

Abnormal chest radiographs were detected with a precision of 0.94; sensitivity of 0.95 and specificity of 0.71

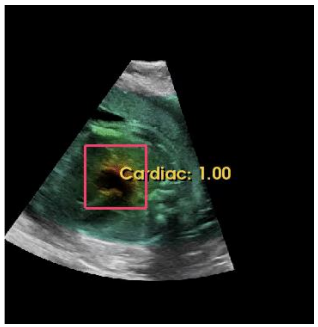


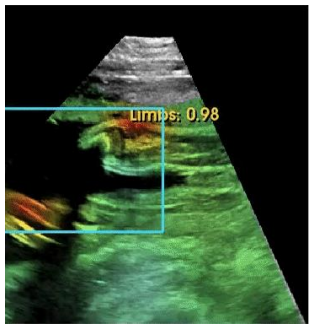
Clinical Finding	Sensitivity	Specificity	Accuracy
Medical Device	0.925	0.934	0.929
Opacity	0.883	0.906	0.894
Pleural Effusion	0.951	0.950	0.951
Enlarged Heart	0.917	0.882	0.900
Atelectasis/Collapse	0.852	0.846	0.849
Pneumothorax	0.868	0.909	0.889
Nodule	0.746	0.865	0.806
COPD	0.892	0.865	0.878
Edema	0.912	0.936	0.924
Infection	0.823	0.859	0.841

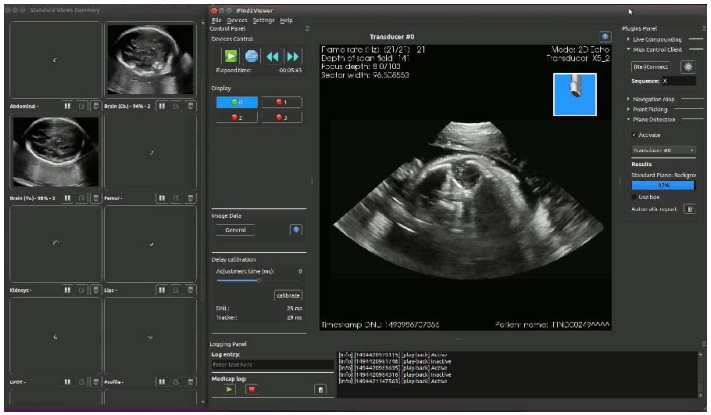
Pesce E, et al. Radiology 2018 (in print)

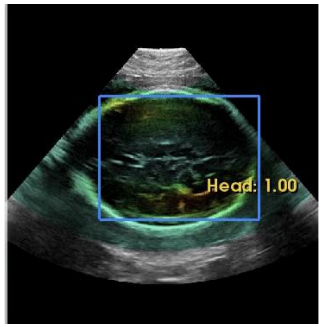
Machine Learning for Organ Recognition in Fetal screening

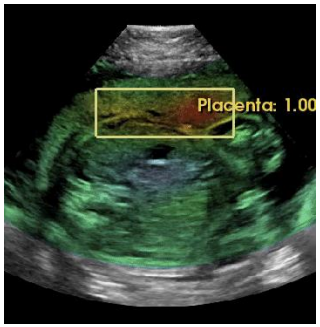
Run-time performance: 15 fps

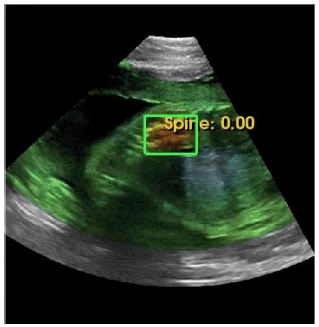








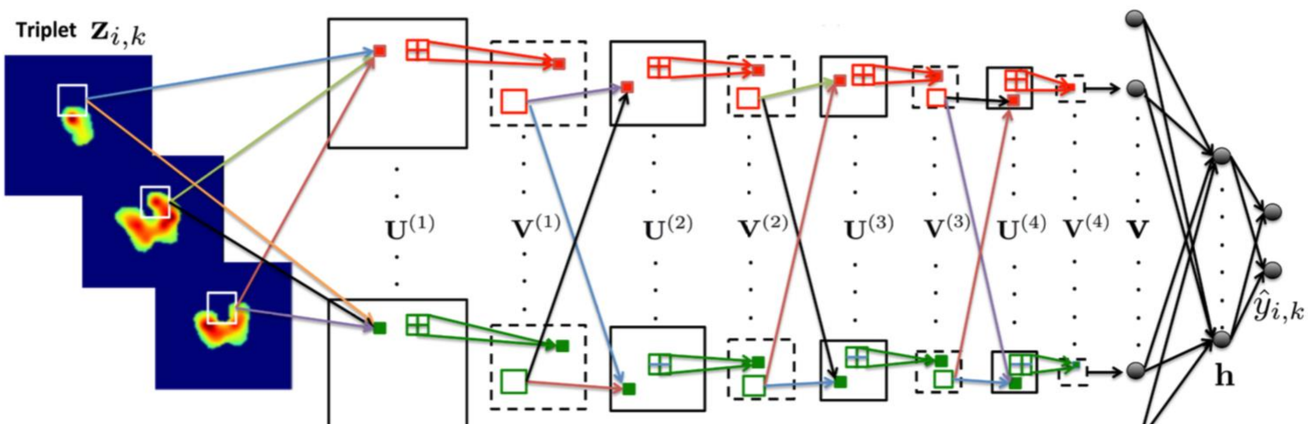




Baumgartner CF et al IEEE Trans Med Imaging. 2017 Nov;36(11):2204-2215

Deep Learning for Prognostic Modelling in Cancer

- For the *treatment* of oesophageal cancer, neoadjuvant chemotherapy (NC) is given as a first step before surgery
- Recent radiomics studies have suggested that texture features extracted from 18F-FDG PET scans can predict NC response
- Responders to NC have improved survival after surgery, but prognosis is worse for non-responders
- Deep neural networks offer an alternative radiomics strategy: they learn predictive imaging features from raw scans



Survival rates in 107 patients

Time in days

- Best classifier using >100 texture features achieves 66.8% accuracy
- A convolutional network fusing adjacent slices reaches 73.4%

Ypsilantis et al. 2015 PLOS One