Artificial Intelligence for Prostate Cancer Detection

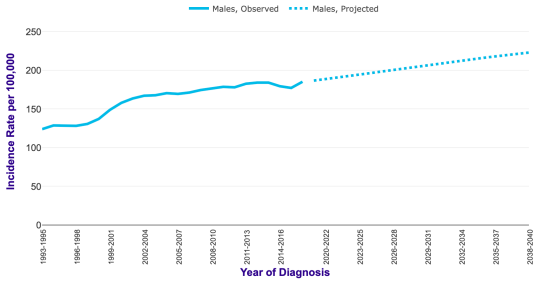
Amit Samani, Laura Loebelenz, Karen Welsh, Robert Grimm, Yeshaswini Nagaraj, Heinrich Von Busch, Sam Withey, Adam Mayer, Aishah Azam, Davide Prezzi, Vicky Goh

AI CENTRE for Value Based Healthcare

Background

- Prostate cancer is the second commonest cancer in the UK, with more than 50,000 new cases diagnosed in 2018[1]
- Recent NICE guidance mandates that bi/multiparametric MRI be performed for diagnosis[2]
- However, disease Incidence is rising, and continuing to do so (figure 1). Concomitant NHS workforce shortfalls[3] means new working practices are needed to cope with this increased demand

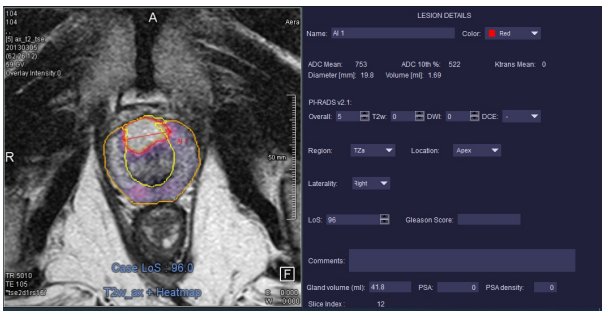
Figure 1: Prostate cancer incidence over time[1]



Siemens Prototype

- Siemens have developed a Deep-Learning Computer Aided Detection (DL-CAD) prototype to address the problem
- Their software segments the prostate gland on biparametric MRI scans, also detecting and overlaying a heatmap on suspicious lesions
- Each lesion is also given an estimated PI-RADS score (likelihood of clinically significant cancer)

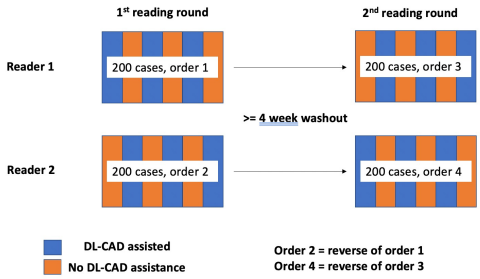
Figure 2: DL-CAD prototype



Study Design

- We sought to evaluate the DL-CAD prototype.
- Software evaluation can encompass various domains. Our scope was restricted to technical characteristics only
- We employed a multireader multi-case design:

Figure 3: Multireader multi-case design



- Four readers read initial (baseline) biparametric MRI scans from 200 patients who were subsequently enrolled on active surveillance.
- During the first reading round, cases were read in batches of 10. Batches alternated between DL-CAD assisted or not
- After a >= 4 week washout, cases were re-read with or without DL-CAD assistance an in a manner converse to round 1
- We used two ground truth labels:
  - Radiological – consensus annotation of two expert radiologists
  - Pathological – Gleason Grade Group score from temporally-related biopsy samples
- The primary outcome metrics were sensitivity, specificity and area under the receiver operating characteristics curve using the radiological ground truth and a PI-RADS cut-off of >= 3

Results + Future Work

- Results are in the processed of being analysed currently
- Future work may include tailoring detection sensitivity to optimize performance for an active surveillance cohort

1) CRUK cancer stats (https://www.cancerresearchuk.org/health-professional/cancer-statistics/incidence/) – accessed 14/05/2023
2) https://www.nice.org.uk/guidance/ng131/chapter/Recommendations - accessed 14/05/2023
3) https://www.rcr.ac.uk/posts/new-rcr-census-shows-nhs-needs-nearly-2000-more-radiologists - accessed 14/05/2023

NHS
Guy's and St Thomas'
NHS Foundation Trust