Sheffield Teaching Hospitals NHS
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3DLAB

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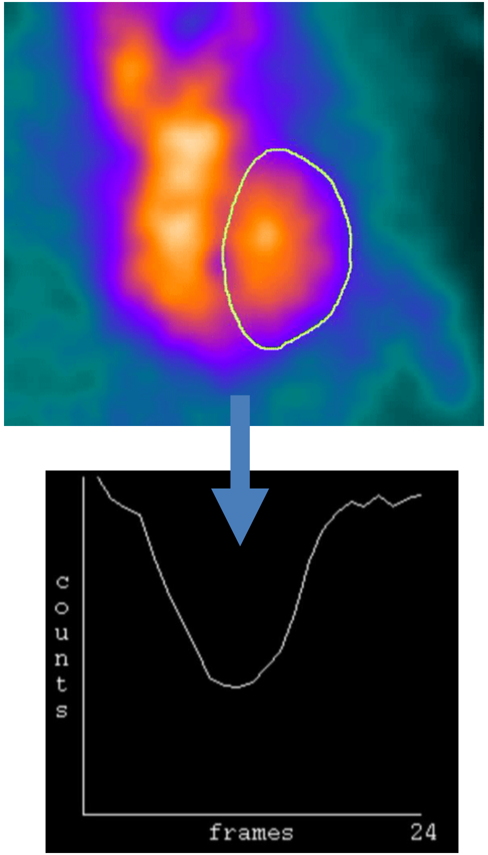
IMPROVING THE EFFICIENCY OF A LVEF MEASUREMENT SERVICE THROUGH ADOPTION OF AI AUTO-CONTOURING FOR MUGA SCANS

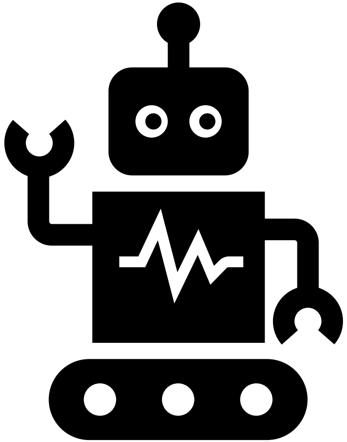
The problem

- Multi Gated Acquisition (MUGA) is a Nuclear Medicine technique used to measure Left Ventricular Ejection Fraction (LVEF).
- Calculation involves segmentation of the radiolabelled blood inside the LV for each phase of the cardiac cycle.
- Segmentation is traditionally a manual process (for each of 24 frames)



The solution

- 6-7 MUGAs processed a week
- ~10 mins manual processing time per case
- **The process is ripe for automation through AI auto-contouring**:
  - Increases efficiency
  - Reduces variability
- We developed, implemented **and audited** our own algorithm

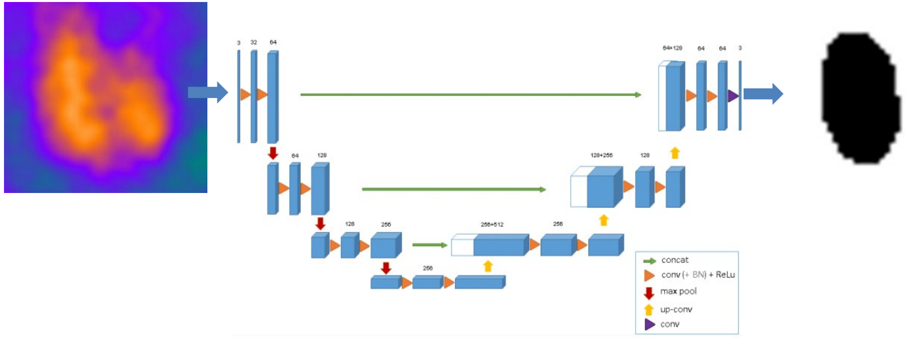


Data (for algorithm training)

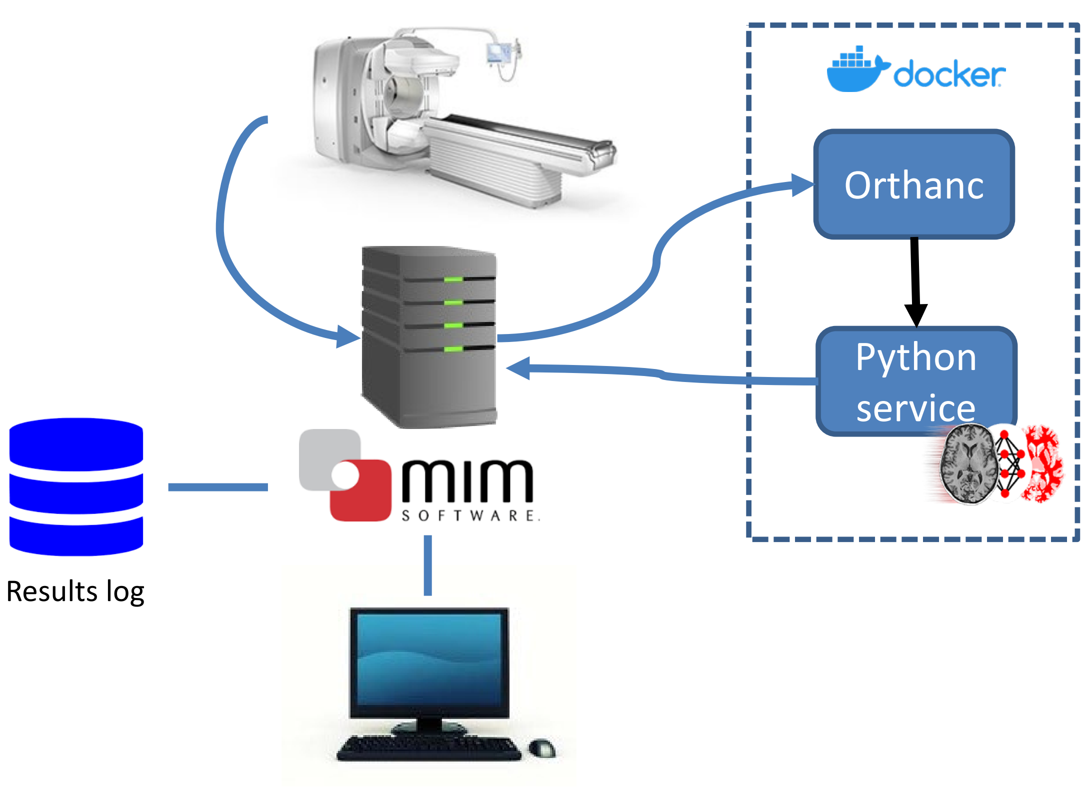
- All MUGA scans @ Sheffield (with contours) saved in local archive (10+ years)
- Multiple scanners
- Consistent sizing – 64 x 64 x 24
- **1793 scans** extracted, converted to nifti format
- 80% train, 10% validation, 10% test

Algorithm development

- Chose well-established U-net methodology
- Ran experiments on validation data with varying parameters
- Optimal algorithm applied to test data
- **Standalone results = mean DICE (vs manual processing) of 0.93, mean difference in EF of 0.01%**



Clinical deployment



GitLab

- Code repository
- Version control

Archive for:

- Training data
- Models
- Results

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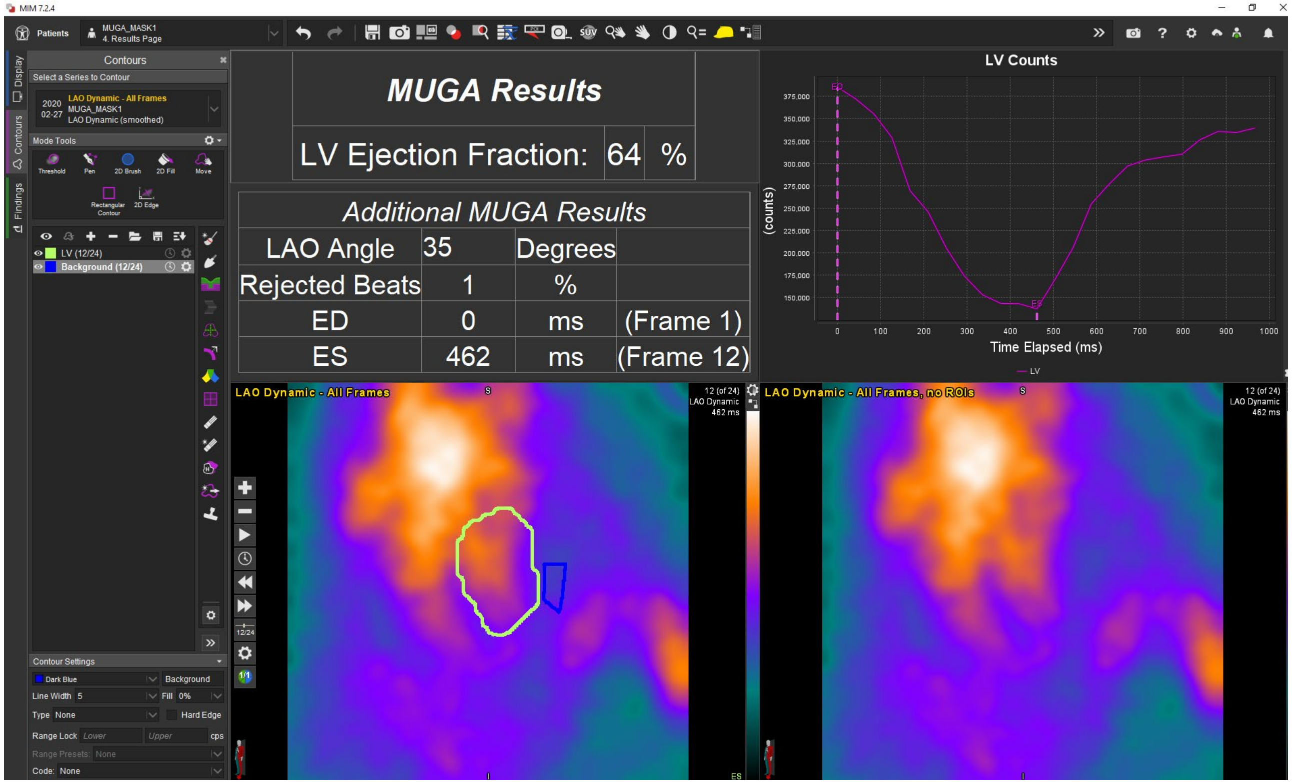
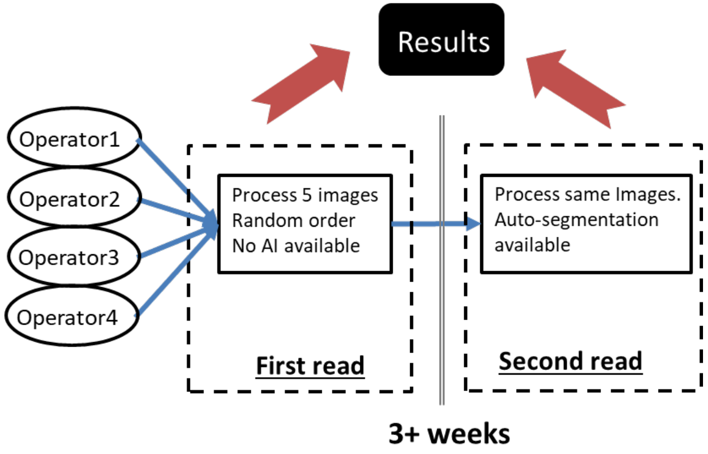
Clinical deployment (autocontours viewed / edited in MIM)



Clinical evaluation and post-deploy auditing

- To directly compare manual and AI-assisted approach get humans to process twice:
  - From scratch using existing NM (MIM) tools
  - Then using MIM again but with auto-segmentation result shown first

- To evaluate performance in clinic, summarise results at 6 months post-deployment



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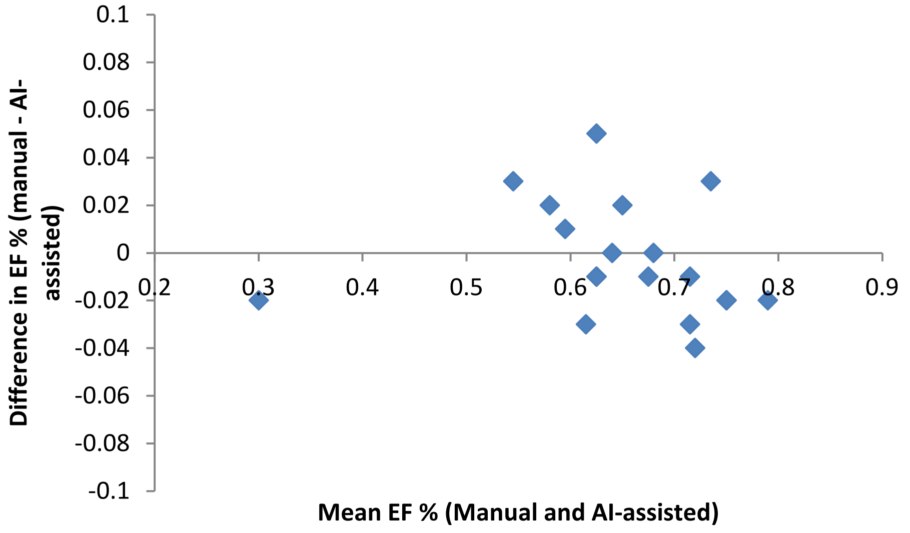
Results

- Clinical evaluation:
  - Mean EF difference of 0.0 +/- 2.9% for manual vs AI-assisted
  - Mean time per case of manual processing = 9.7 mins (n=20)
- Post deployment:
  - Mean time per case of AI-assisted processing = 3.5 mins (n=92).
- **Time saved from AI assistance = 6.2 mins per case**
- **Users made minimal changes to AI auto-contours**



Discussion

- An AI tool for LVEF calculation was successfully trained, deployed and audited
- ~3 days staff time saved in 6 months post-deployment AND results are now more consistent
- Results provide impetus for other AI quality improvement projects (especially autosegmentation)