Increasing the efficiency of heart function **Data Science For Social Good Summer Fellowship** assessment and diagnosis through echocardiography Business School | Inclusive Innovation



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An echocardiogram is a heart ultrasound that is fast and non-invasive compared to other scans.

Our pipeline, using state-of-the-art deep learning models of Zhang et. al, estimates left ventricle ejection fraction (LVEF).

Our measurements varied from true values at roughly the same level of doctor measurements.

Heart Patient Journey





Milestones

0. Data

1. View

Classification

3. Measure

Estimation

4. Status

Suggestion

Pipeline

- Extract DICOM metadata of videos for filtering. • Download only 2D grayscale videos from five Processing modern and higher-quality machine types.
 - Obtain view labels for videos using mapping of measurements provided by cardiologists.
 - Predict probabilities for 23 views with VGG model, focusing on A2C, A4C, and PLAX.
- Generate pixel masks of the left ventricle and 2. Chamber atrium using lines manually drawn by doctors. Segmentation
 - Predict masks for heart chambers using different U-Net models for A2C and A4C views.
 - Retrieve left ventricle volumes at two ends of the cardiac cycle to obtain ejection fraction. Estimate measurements by aggregating

calculations over multiple cycles in a video.



None of the patients predicted as normal were actually sick. Our ability to predict normal health means less time for doctors to analyze normal patients and more time caring for sick patients.

To improve on our health status suggestions, we recommend developing models that better segment chambers. If our segmentation models perform better, our measurement estimation should more accurately indicate patient status.

WIEBKE TOUSIAINT

• Recommend patient status of "normal", "greyzone", or "abnormal" based on expert thresholds of left ventricle ejection fraction.

• Compare ground truth and predicted status.

usal_echo Pipeline Overview



Impact

DAILY LIFE IN THE IMAGING UNIT (ECHO) patients every 10 000 40 patients every day $\sim 8 - 10 \min$ for taking measurements (if experienced) + expert decision NEBLE TOUSAN

By helping cardiologists at the University Hospital of Salamanca take measurements to detect normal patients more quickly, we can help doctors spend more time caring for sick patients and making decisions about difficult cases with other doctors.

Problem

Doctors spend 4 to 5 hours daily measuring heart chambers, often for healthy patients.

Solution

We are estimating measurements to suggest patient status, so cardiologists can identify and spend more time with sick patients.

Data

25,000 echocardiograms (10 TB of videos)

25 Anonymized database of measurements

1. Source: World Health Organization - Cardiovascular diseases





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