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# Reciprocal Landmark Detection and Tracking with Extremely Few Annotations

Anonymous CVPR 2021 submission

Paper ID 1251

## 1. Failed Cases Analysis

There are still a few failure cases in our current result. An example is shown in Fig. 1. The result is with the maximum LDE (LDE of AL: 5.02 cm, LDE of IL: 8.07 cm, LD: 0.48cm). We hypothesize that the reason for such failure is as follows: During the image acquisition, the operator appears to have zoomed the ultrasound image on the LV. Hence, no other cardiac chamber is clearly visible and the appearance of the image is substantially different from a typical PLAX image. A much larger training data set will be required to avoid failure in such cases.

If we set 2 cm error for the average LDE (average of IL and AL) as the critical point for failure, for the end-systolic frame the failure percentage is 6.1%, while for the end-diastolic frame the percentage is 3.7%. These are promising results, compared with the results in [1] whose failure is 6.7%. We note that the model in [1] is trained by densely annotated sequences, instead of sparsely annotated sequences as in our method.

## References

- [1] Andrew Gilbert, Marit Holden, Line Eikvil, Svein Arne Aase, Egil Samset, and Kristin McLeod. Automated left ventricle dimension measurement in 2d cardiac ultrasound via an anatomically meaningful cnn approach. In *Smart Ultrasound Imaging and Perinatal, Preterm and Paediatric Image Analysis*, pages 29–37. Springer, 2019.

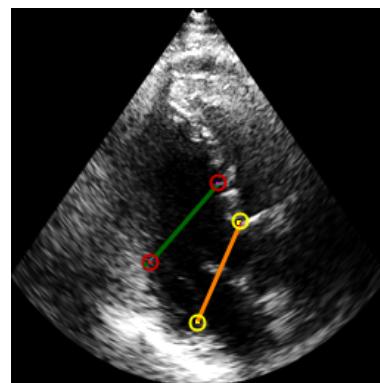


Figure 1: An example of a discrepant case. This PLAX view is suboptimal and has been imaged at a low imaging window on the chest resulting altered axis of the LV. The ground truth LVID label (shown in green color), used clinically, has been placed in an atypical position based on operator judgment (closer to the apex) to account for the altered geometry. The predicted LVID is the orange color line with landmarks in yellow color. It should be noted that despite relatively large LDE error, both measurements are likely clinical acceptable, as the distance between AL and IL, rather than their absolute image coordinates, is the main metric used to measure EF.