

EASyExamAI: An Artificial Intelligence for Pattern Recognition of Point of Care Ultrasound

Megan Weigand¹, Megalan Tso¹, Gregory Dixon², Ramneet Kaur², Saad Waheed², Dr. Jonathan Muckell, PhD²,
Dr. Nibras Bughrara, MD³

¹Albany Medical College, ²University at Albany, ³Albany Medical Center

Introduction

- Point-of-care ultrasound (POCUS) allows for rapid and versatile evaluation of patients
 - Limited by user-dependent image quality and interpretation
- Our novel POCUS protocol, Echocardiography Assessment using Subcostal only view (EASy), can be performed by novice, minimally trained users
 - EASy Exam consists of three views: subcostal four-chamber, IVC, and lung view
 - Patients are assigned to one of three main hemodynamic clusters, each with varying treatment courses
- We tested the ability of artificial intelligence (AI) software, EASyExamAI, to categorize images according to the EASy protocol and further increase POCUS user accessibility

Aims

- Determine the ability of EASyExamAI to be trained on our novel EASy protocol and assign clusters to subcostal four-chamber view POCUS images.
- Assess the efficacy of EASyExamAI by testing the software with a validation set of POCUS images.

Methods

- EASy Exam images were assigned to one of three clusters according to bi-ventricular size, function, and wall thickness:
 - 361 exams to Cluster 1 (small/normal cavity)
 - 174 exams to Cluster 2 (decreased global contractility)
 - 53 exams to Cluster 3 (isolated enlarged right ventricle)
- During the training phase, EASyExamAI was given 80% of the images from each cluster along with their respective assignment to teach the software to recognize the appropriate features of each cluster.
- During the validation phase, EASyExamAI was given the remaining 20% of images from each cluster without assignment and tasked with assigning a cluster to each image.

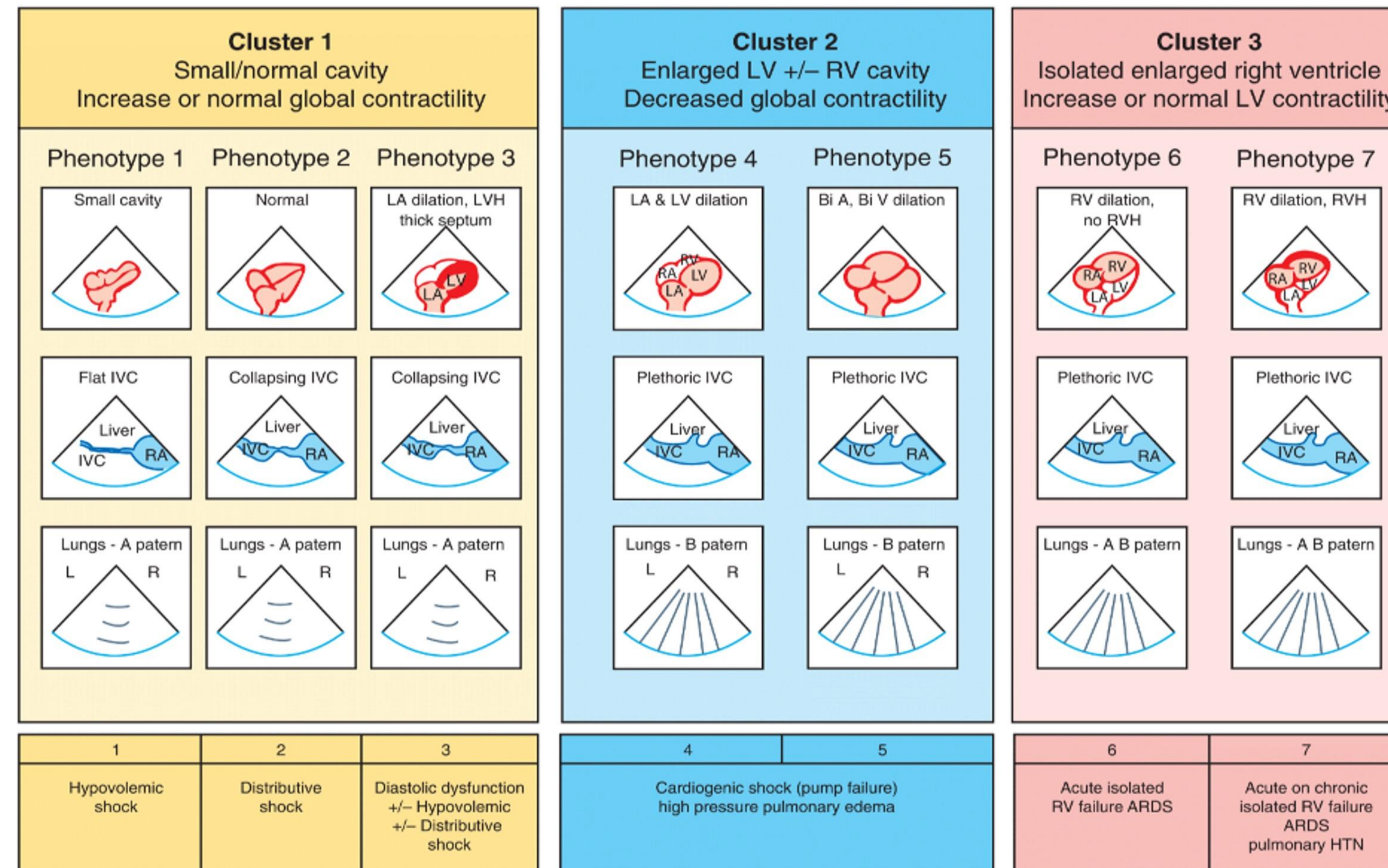


Figure 1. EASy phenotypes are based on the subcostal four-chamber view (top row), subcostal IVC view (middle row), and lung evaluation in the upper lung fields (bottom row). Cardiac assessment assesses myocardial performance, IVC evaluation provides an estimate of fluid responsiveness, and lung examination defines fluid tolerance (A pattern) and intolerance (B pattern).

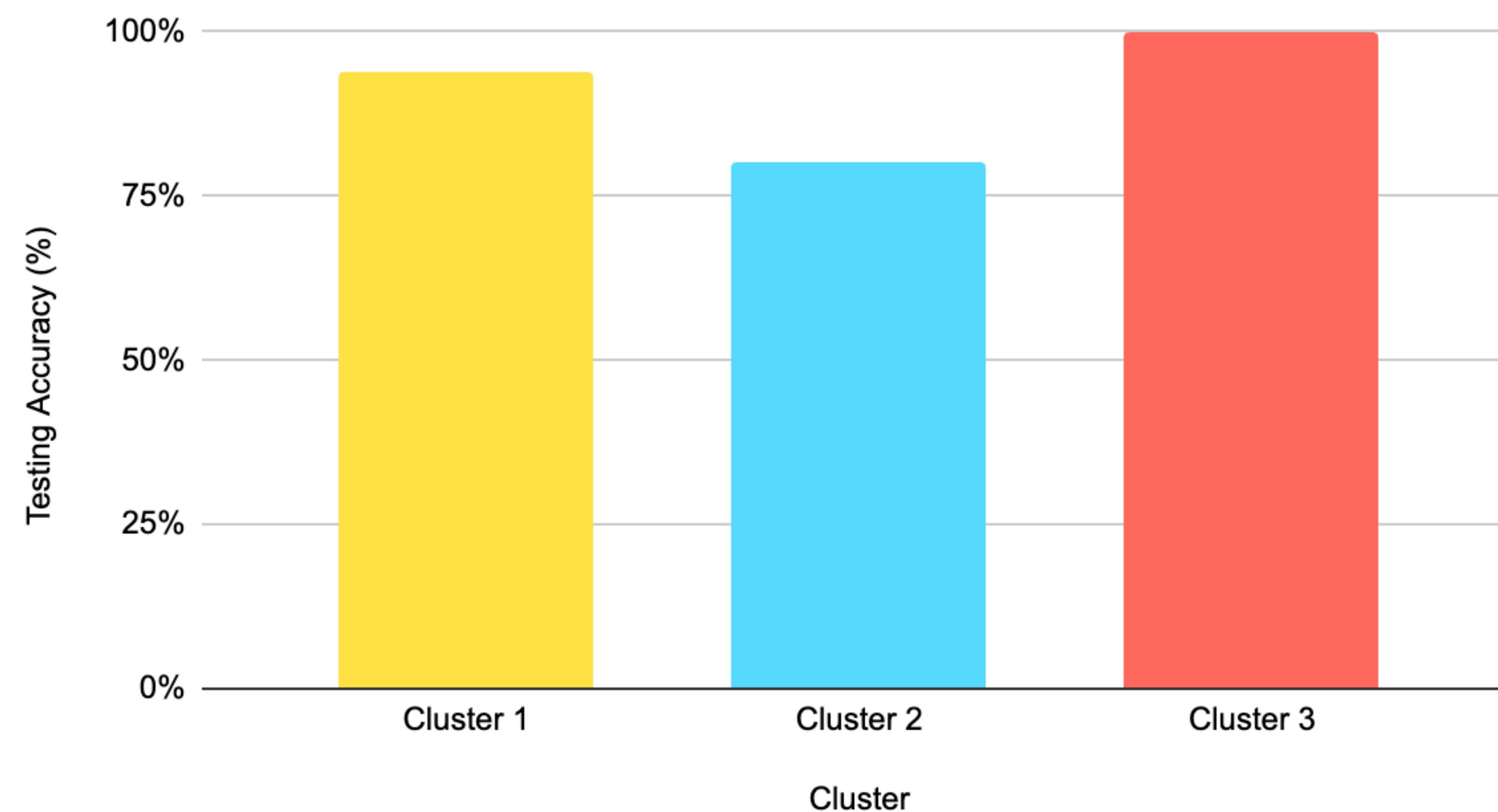


Figure 2. Testing accuracy of the training phase per cluster.

Results

- Testing accuracy of the training phase:
 - Cluster 1: 94%
 - Cluster 2: 80%
 - Cluster 3: 100%
- Overall training accuracy was 89% with 0.25 loss
- Overall validation accuracy was 75% with 0.64 loss
- Validation accuracy improved with increasing dataset size

Discussion

- The EASy protocol can be taught to novice users and increase POCUS accessibility
- EASyExamAI can learn the hemodynamic patterns of the EASy Exam
- EASyExamAI is capable of assigning correct cluster identification to new images
- AI cannot act as a substitute for expert opinion in clinical decision-making, however, it can act as a supplement to assist clinicians in making the safest decisions for their patients
- Future direction includes increasing the sample size of images provided to EASyExamAI

Acknowledgment & References

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References:

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