# Autonomous Ultrasound-Based Ascites Recognition for Robotic Assisted Image-Guided Paracentesis

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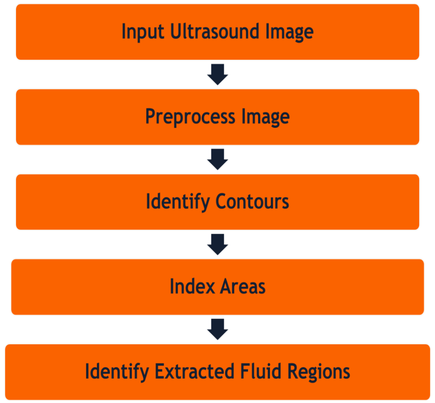
## INTRODUCTION

**Only 40% of patients with ascites due to cirrhosis received a timely paracentesis.**[1] Possible complications from untreated ascites include cirrhotic cardiomyopathy and spontaneous bacterial peritonitis.[2] Increased access to paracentesis for underserved populations could lead to improved health outcomes.

The objective of this project is to develop an **algorithm that can reliably identify and localize ascites on abdominal ultrasound images.**

## METHOD

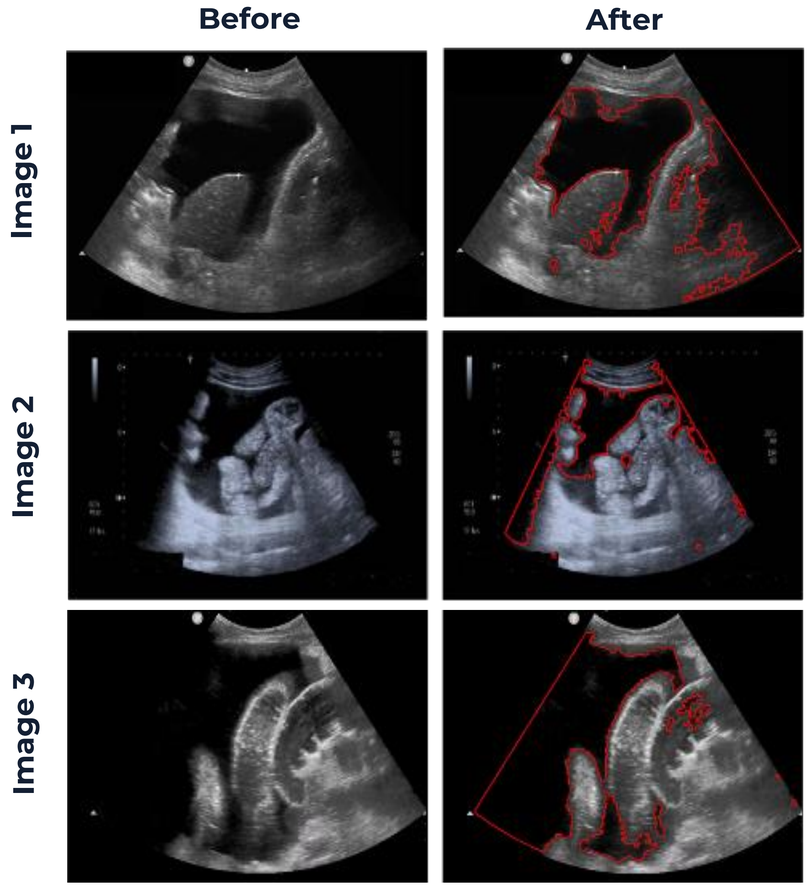
- A high-fidelity algorithm via OpenCV image processing library on python software was used to identify regions of ascites on 16 abdominal ultrasound images.
- Various image acquisition techniques granted the team the ability to parse out irrelevant landmarks and localize anechoic regions.




- The algorithm was tested and verified against acquired images of a phantom model.

## RESULTS

- The algorithm successfully illustrated its ability to identify ascitic regions after each ultrasound image was acquired. **Overall, the algorithm identified 100% of ascitic regions on the 16 images.** However, its identification of minuscule or inaccessible fluid pockets will require more refinement.
- The algorithm was tested and verified against acquired images of a phantom model. The phantom model used was a water filled Ziploc bag and an inserted needle for validation.




**All ascites on each image are highlighted in red**

## CONCLUSION

**Proven Reliability:** This project shows that an algorithm that identifies ascites during ultrasound-guided paracentesis procedures is a reliable tool for ascites detection. Further study and refinement of this algorithm is planned using Carle-acquired images.

**Increase Accessibility:** With refinement, this algorithm has the potential to help identify abdominal fluid collections. Improving the speed and accuracy of ascites fluid identification may help to increase availability and ease of percutaneous drainage procedures.

**Future Innovation:** The team plans to the integrate this algorithm into an electromechanical model for autonomous recognition of ascitic regions on ultrasound with a comparable accuracy to manual interpretation.

## REFERENCES

[1] Orman E. S., Hayashi P. H., Bataller R., Barritt, A. S. Paracentesis is Associated with Reduced Mortality in Patients Hospitalized with Cirrhosis and Ascites. Clinical Gastroenterology and Hepatology: the Official Clinical Practice Journal of the American Gastroenterological Association. 2013; 12:496-503.

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