

DEVELOPMENT OF AUTOMATIC SHAPE ESTIMATION SYSTEM FOR EARLY  
DETECTION OF ABDOMINAL AORTIC ANEURYSMS USING SHORT-AXIS  
ULTRASOUND IMAGES

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**ABSTRACT**

In this study, we developed a blood vessel shape estimation system using ultrasound images for the early detection of abdominal aortic aneurysms. First, we focused on portable ultrasound diagnostic equipment for early detection. As examination problems, he pointed out that scanning and image interpretation depend on skill, that it is difficult to grasp the shape, and that investigators have measurement errors and lack of image knowledge. To solve these problems, we aimed to improve diagnostic accuracy and skill dependence by performing automatic vascular shape estimation. Therefore, we proposed an automatic estimation method for blood vessel position, shape, and maximum diameter. For vessel position estimation, we proposed an estimation method using training data using Faster-RCNN. Furthermore, in the maximum diameter estimation, we focused on the brightness and gradient in the vertical direction of the image, proposed automatic estimation of the three maximum measurement positions. Finally, we verified the accuracy of the system from the subject videos. It was confirmed that accuracy was improved by adding shape and blur as learning features of Faster-RCNN. It was shown that position estimation is possible with a probability of 95% or more from the evaluation using phantom images. It was shown that the maximum diameter can be estimated with  $\pm 1$  [mm], and automatic estimation is possible with half the error of  $\pm 2$  [mm] in manual measurement. In subject video verification, position estimation is possible in 95% or more, and it was shown that maximum diameter estimation with high accuracy is possible by appropriately setting the range.

Based on the above results, we were able to develop a system that presents the position, shape, and maximum diameter of blood vessels only by image input. Both position estimation accuracy and maximum diameter accuracy can be presented with higher accuracy than in manual operation. Ultimately, we thought that using a portable device equipped with this system would be useful for regular checkups for early detection as well as diagnosis in emergencies.