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# INTEGRATING VALIDATION INCREMENTAL NEURAL NETWORK AND RADIAL-BASIS FUNCTION NEURAL NETWORK FOR SEGMENTING PROSTATE IN ULTRASOUND IMAGES

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Abstract. *Prostate hyperplasia usually affects male adults in developed countries. Transrectal ultrasound (TRUS) imaging is widely used to diagnose prostate disease. Ultrasonic images have primitive echo perturbations and speckle noise, which may confuse physicians during inspection. Therefore, this study proposes an automatic prostate segmentation system for TRUS images to eliminate the process of manual outlining the prostate region. The proposed automatic segmentation system combines the active contour model (ACM) with a prostate classifier. The prostate classifier consists of a validation incremental neural network (VINN) and a radial-basis function neural network (RBFNN). Experimental results show that the proposed method has higher accuracy than that of the regular ACM method.*

**Keywords:** Transrectal ultrasound images, Radial-basis function neural network, Active contour model

1. **Introduction.** The prostate is a compound tubuloalveolar exocrine gland of the male mammalian reproductive system. Prostatic hyperplasia usually affects older men in developed countries. An enlarged prostate often results in difficulty in urination. It may turn into prostate cancer and further spread in the body. It is the eighth most common cancer in Taiwan, so early inspections for pathological changes have recently become manditory. There are many diagnostic methods for prostate cancer, including the prostate specific antigen (PSA) blood test, biopsy and medical imaging. Although the PSA blood test has high accuracy, incidences of finding prostate cancer in early stages are rare. In contrast to blood tests, medical images, such as ultrasound (US), magnetic resonance imaging (MRI) and computerized tomography (CT) are easy to apply and can be used to visualize the integral prostate without biopsy. MRI and CT can obtain clear images, however, their cost is very high and they expose patients to high ionized radiation. Advantages of ultrasound imaging include low cost and easy application. Hence, it is widely used in clinical inspections, such as for prostate [3, 4, 9, 11], breast tumors [8] and thyroid nodules [1].

To identify the prostate in US images, the probe has to be put into the rectum near the prostate. The images acquired using this technique are called transrectal ultrasound (TRUS) images. TRUS imaging was firstly introduced by Watanabe in 1971 [15]. The image is acquired using reflection, refraction, and deflection of ultrasound beams from various types of tissue that have different acoustic impedances.