Needle biopsy is a primary diagnostic tool for cancerous tumors, especially in the breast and prostate. Needles are also used in a number of tumour treatments such as cryosurgery, brachytherapy, interstitial laser photocoagulation and photodynamic therapy. Ultrasound, because of its ease of use and low cost is becoming the technique of choice to guide and monitor these minimally invasive procedures, but is highly operator dependent. This problem may be overcome by automatically detecting and displaying the needle in the ultrasound image. This will allow the operator to place the needle consistently thereby providing more accurate tumour biopsy or dose calculation.

To segment the needle, the needle contrast was improved by applying a variance filter. A binary image was then created by a threshold operation creating clusters of pixels. Morphological operations are then applied to eliminate small clusters and join neighbouring clusters. Finally, needle clusters are identified and classified according to slope and intercept using principle component analysis.

The optimum variance kernel size was determined to be 11x11. An automated method to decide on the threshold level was also found. A device was constructed to test this algorithm. Using this device, it is possible to insert a needle a known distance at a predetermined angle into a block of tissue-mimicking agar. Ultrasound images were taken with needles at angles between 0 and 15°. Preliminary analysis comparing the operator determined segmentation with that of the algorithm shows agreement to within 2° in 72% of the images.