Probe sector matching for freehand 3d ultrasound reconstruction. Sensors (Switzerland), 20(11). https://doi.org/10.3390/s20113146 ARTICLES

Systems with dedicated 3D

the probe makes it difficult to

obtain clean images of hidden

structures under bones or gas.

These probes are larger and

heavier than 2D probes, and

because B-scan images are

locations and orientations, it

is not guaranteed that the

their scanning ranges are

limited by their size

captured at arbitrary

physical image pixel

voxel positions.

locations will match the

Speckle noise is typically

distributed throughout B-scan

images. Speckle noise also shows

unique patterns according to the

materials, but it is distributed all over images with high frequency

compared to other artifacts. This

viewers to interpret these images

and make diagnoses. Therefore,

speckle noise reduction is an important issue in ultrasound

One significant drawback of reconstruction methods is thatthey may not preserve

image analysis.

object boundaries.

results in degradation of the image quality and makes it difficult for

probes are more expensive, and the large contact surface of Prevost, R., Salehi, M., Jagoda, S., Kumar, N., Sprung, J., Ladikos, A., ... Wein, W. (2018). 3D freehand ultrasound without external tracking using deep learning. Medical Image Analysis, 48, 187–202. <a href="https://doi.org/10.1016/j.media.2018.06.003">https://doi.org/10.1016/j.media.2018.06.003</a>

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**MOTIVATIONS** 

Ultrasound imaging plays an important role in clinical diagnosis, in which the locations of the abnormalities need to be detected accurately [10,11]. Compared with other diagnostic methods, ultrasound imaging has several advantages, including its promptness, non-invasiveness and low cost. In addition, the ultrasound imaging probe works with low power consumption and causes no harm to patients and operators. Therefore, ultrasound-based diagnostic methods are used widely for screening and preventive health care, such as the regular prenatal care checkups for pregnant women and their

Ultrasound imaging (US) combines a number of advantages as amedical modality: it is affordable, safe for both the patient and the clinician, and is convenient to set up and use. This unique com-bination of properties makes it one of the most popular imaging modalities for both diagnostic and interventional applications.

Ultrasound 3D imaging has received significant attention inmany diagnostic areas, particularly obstetrics [1] and cardiology [2] . Not only 3D visualizations, such as in volume and surface ren- dering, but also 2D sectional images at various orientations, may provide helpful clues for diagnoses. In addition, many studies have demonstrated the applicability of 3D ultrasound imaging to image-guided surgery and interventions, e.g., neurosurgery [3], biopsy [4], and radiation therapy [5].

The use of regional anaesthesia (RA) is increasing due to the benefits over general anaesthesia (GA) such as reduced morbidity and mortality, reduced postoperative pain, earlier mobility, shorter hospital stay, and lower costs [9]. Despite these clinical benefits, RA remains less popular than GA. One reason for this is that GA is far more successful and reliable than RA.

Here, we introduce an alternative Existing model-based approaches approach that relies on a statistical such as speckle decorrelation only analysis rather than physical partially capture the underlying models, and use a convolutional complexity of ultrasound image neural network (CNN) to directly formation, thus producing estimate the motion of successive reconstruction accuracies ultrasound frames. incompatible with current clinical requirements. we introduce a novel approach to the problem of the trajectory Even with IMU orientation estimation of a hand-held data available, the translatory ultrasound probe. Such a portion of a transducer's system would be extremely motion path needs to be beneficial for many applications estimated by relying solely (e.g. Lang et al., 2012; Salehi et on the ultrasound images al., 2017 ), and in particular themselves. point-of-care ultrasound. This is especially true as there seems to be a trend toward portable ultrasound scanners that are directly connected to and recorded on a smartphone.

probe through the target volume

while acquiring the position and

orientation information from a

images. To obtain a better

reconstruction result, noise and

artifacts should be considered

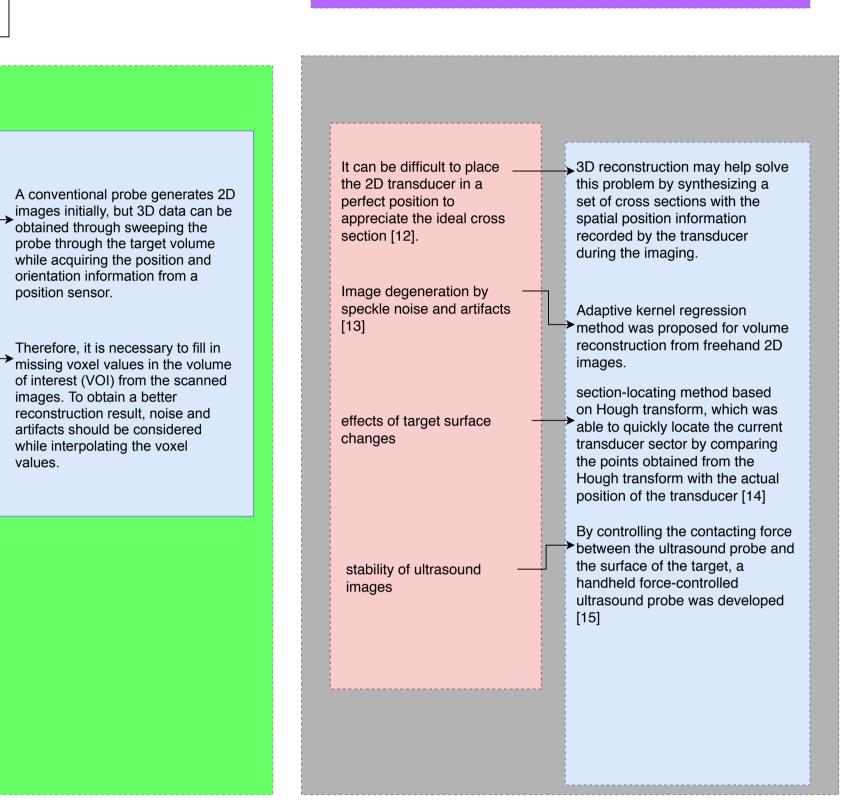
while interpolating the voxel

position sensor.

values.

RA can be a challenging technique, especially for The RASimAs project inexperienced physicians (Regional Anaesthesia Simulator and Assistant) is a and in difficult cases. Good theoretical, practical and European research project non-cognitive skills are which aims at providing a needed in order to achieve virtual reality simulator to confidence in performing RA improve the training of doctors and to keep complications to performing RA, as well as an a minimum. Studies indicate assistant to lessen the that RA education focusing cognitive burden and help on illustrations and text performing RA procedures. alone is not sufficient [6]. Several methods for However, in this work the segmentation of the crossgoal is to segment the section of vessels in 2D femoral artery in real-time on ultrasound have been reported, using methods such as level a sequence of ultrasound sets [7], fuzzy c-means clustering [8] and evolutionary algorithms [9]. These methods focus on segmenting a single image.

ISSUES AND SOLUTIONS



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