Learning-based beamforming for acoustic and ultrasonic applications

Reference No: B77199

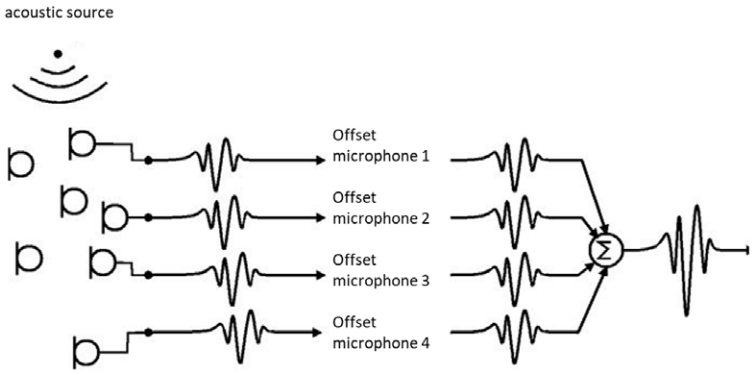
CHALLENGE

Beamforming is employed in signal processing of acoustic waves to improve the directivity as well as the sensitivity of resulting data. An important aim of the beamforming process is that by controlling the joint emission and reception of the array of transducer elements, the properties of the transmitted acoustic or electromagnetic waves can be optimized. By this means characteristics such as spatial resolution of distinguishable objects, signal-to-noise ratio, contrast or similar measures of an ultrasound image can be influenced and the quality of the wave can be increased.[1]

Currently, delay-and-sum beamforming is the most common implementation for ultrasound beamforming.[2] The main advantage of delay-and-sum beamforming is its relatively low computational complexity while providing reasonable image quality. However, a need for ultrasound imaging with high image quality without sacrificing real-time imaging capabilities at high processing speeds does still exist.[1]

INNOVATION

The innovation employs a deep learning method to realize high quality real-time ultrasound imaging at high processing speeds. It could be demonstrated that a machine learning based receive beamforming model generated ultrasound images of very high quality in real time. Furthermore, tissue properties such as speed of sound, attenuation, and non-linearity can be quantitatively inferred from received radio frequency measurments. The quality of the ultrasound images is mainly limited by the quality of the training data, and hence the beamforming that was applied in the training data. Both a deep convolutional neural network or a recurrent neural network have successfully tested for end-to-end beamforming.[1]



Beamforming principle for acoustic waves[3]

COMMERCIAL OPPORTUNITIES

The innovation has benefits for ultrasound imaging in medical and nondestructive testing but is not limited to this field of application. It is applicable for telecommunication and acoustics as well. The technology delivers maximum image quality in real time measurements without any constraints in data processing time.

DEVELOPMENT STATUS

Prototype

REFERENCES:

1 Patent application WO2019238850 „Method and Apparatus for Ultrasound Imaging with Improved Beamforming“

2 Thomenius, ICE.: Evolution of ultrasound beamformers. In: IEEE Ultrasonics Symposium. Volume 2. IEEE (1996) 1615-1622.

3 https://de.wikipedia.org/wiki/Beamforming

BayPAT

Technische Universität München

Technology from
TECHNICAL
UNIVERSITY
OF MUNICH

IP rights:
EP and US filed

Contact:
Dr. Bettina Keilhofer
+49 (0) 89 5480177 – 32
bkeilhofer@baypat.de

Bayerische Patentallianz GmbH
Prinzregentenstr. 52
80538 München
www.baypat.de