Correction to “Rotation and Gray-Scale Transform-Invariant Texture Classification Using Spiral Resampling, Subband Decomposition, and Hidden Markov Model”

Wen-Rong Wu

In the above paper,[1] a spiral resampling scheme was used to convert two-dimensional texture images to one-dimensional signals. Uniform spiral samples are obtained by a transformation between the Cartesian coordinates (r, θ) and (x, y). It was found that the transformation is identical to the one proposed by Soumekh [1] dealing with image reconstruction with spiral data in the frequency domain.

REFERENCES

[1] M. Soumekh, “Reconstruction and sampling constrains for spiral data,” *IEEE Trans. Acoust., Speech, Signal Processing*, vol. 37, pp. 882–891, June 1989.

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[1] W. R. Wu and S. C. Wei, *IEEE Trans. Image Processing*, vol. 5, pp. 1423–1434, Oct. 1996.

Estimation of Shape of Binary Polygonal Object from Scattered Field

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Abstract—**We present a method of estimating the shape of a weakly scattering binary convex polygonal object from the backscattered field. We use the concept scattering centers where it has been possible to model the scattered field as a sum of complex sinusoids. All corners of an object could be estimated with three or more illuminations, out of which at least two are in orthogonal directions. Using the amplitude of the sinusoids, we have also resolved the ambiguity in joining the corners when there are more than one object.**

Index Terms—**Broadband illumination, diffraction tomography, pairing algorithm, shape estimation.**

I. INTRODUCTION

If the boundary of an object is piecewise linear, the corner points are sufficient for pattern recognition, image compression and coding, and shape analysis, etc. [1]–[6]. The presently available corner detection algorithms work on spatial image data, that is, a photograph. The present work is aimed at corner detection from the scattered wavefield (acoustic or electromagnetic). When an object whose refractive index is slightly different with respect to that of the surrounding medium is illuminated with a plane wave, the scattered field measured around the object is proportional to the Fourier transform of the object. Thus, the shape information is buried in the scattered field. It is of some interest in medical diagnosis, in subsurface imaging, and in nondestructive testing to be able to recognize the shape of the buried object from the scattered acoustic or electromagnetic field, particularly when only a few limited views are permitted. We shall show (Section II) that when the object is binary, convex, and having a nondegenerate polygonal cross section, the scattered field is a sum of sinusoids, a function of wave number and corners of the polygon. The object is illuminated with a broadband plane wave and the scattered field is measured as a function of wavenumber. The frequencies of the sinusoids are estimated from the scattered field using an algorithm described in [7] and [8] (Section IV). The approach has been extended to a multiobject scene in Section V, where we shall assume that the number of objects present is known; only shape and location are unknown. Finally, some computer simulation results are presented in Section VI.

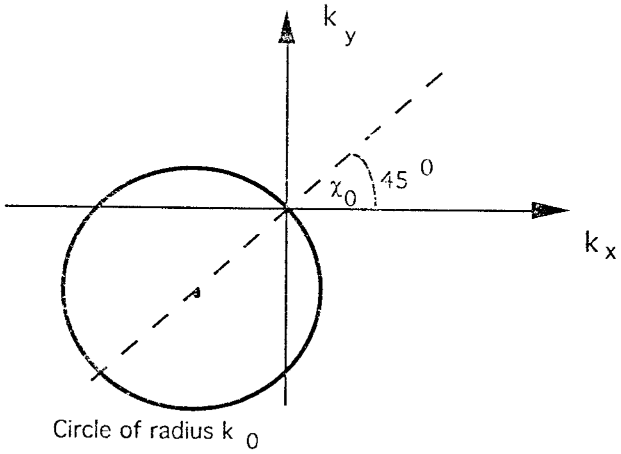

Fig. 1. For an angle of incidence, $\chi_0 = 45°$, the scattered field received by a circular array is proportional to the object Fourier transform on a circle as shown.

Though we consider only the cases where the spatial Fourier data is obtained through DT imaging, the mathematical results and the ideas presented in this work can be well utilized for even straight line tomography or in any other imaging modality that provides spatial Fourier information.

II. DIFFRACTION TOMOGRAPHY

Diffraction tomography refers to the cross-sectional imaging of objects from diffracted or scattered wavefield [9], [10]. An object is illuminated from various directions with a diffracting source of energy such as acoustic waves, whose wavelength is comparable with the scale of inhomogeneities. The incident wave energy is scattered in all directions by diffraction process. Usually, a long linear array of sensors facing the incident wave field is used to record the forward scatter, but the backscatter is lost. A circular array transceivers was proposed to capture both forward and backward scatter [11]. It is shown in [11] that the scattered field measured by a circular array is proportional to two-dimensional (2-D) Fourier transform of the object profile taken on the circumference of a circle of radius equal to the wave number and centered at $(-k_0 \cos \chi_0, -k_0 \sin \chi_0)$, where χ_0

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