NINTH INTERNATIONAL
CONFERENCE ON RADIATION
IN VARIOUS FIELDS OF RESEARCH

June 14 - 18, 2021 | Hunguest Hotel Sun Resort | Herceg Novi | Montenegro

BOOK OF ABSTRACTS

rad-conference.org

Quantitative analysis of the breast tissue chemical composition based on the spectral decomposition of X-ray tomographic breast images

Stevan Vrbaski[1,2], Renata Longo[1,3], Adriano Contillo[2]

1 University of Trieste, Trieste, Italy
2 Elettra Sincrotrone Trieste, Trieste, Italy
3 INFN, Trieste, Italy

https://doi.org/10.21175/rad.abstr.book.2021.17.8

Breast cancer accounts for the largest number of malignancies in women worldwide. The diagnostic outcome of conventional X-ray imaging relies heavily on relative attenuation differences in nearby tissues. Since the contrast difference between cancerous and glandular tissues is often not evident, the diagnosis is mainly based on morphological characteristics. Recently, advanced imaging techniques were being developed making the extraction of quantitative information a feasible task. We aim to exploit a technique of spectral decomposition to quantify the difference in chemical composition between healthy and malignant dense tissues.

Our very first study, based on the tissue-equivalent custom-made phantom, showed promising results in extracting an effective atomic number and density from multi-energy CT images. Although being very useful in mimicking the attenuation properties of breast tissues, plastic inserts fail to reproduce the valid local inhomogeneity observable in organic tissues. In this communication the first attempt to quantitatively describe breast mastectomy samples was reported. Imaging was performed at Elettra, the Italian synchrotron facility, using monochromatic beams of several energies in the breast CT energy range (22-38 keV). With help of a radiologist, the regions of interest for quantitative evaluation were selected. Three samples were processed by a spectral decomposition algorithm, resulting in composition maps in terms of a selected pair of basis materials. Using a dedicated mathematical procedure, we managed to decouple the information about the material density and its chemical composition. Finally, a calibration allowed us to retrieve the effective atomic number and density associated with each reconstructed voxel.

The range of effective atomic numbers among the plastics matched the slight differences among tissue regions within the breast mastectomies. The region-based decomposition procedure is an important intermediate step toward the application of the method to the full sample volume. The presence of structural noise, coming from the intrinsic variability of the tissue region was observed. However, its presence did not affect the overall stability of our decomposition method. The procedure allowed an accurate discrimination of the chemical composition of considered anatomical regions.

The decoupling of the information about the chemical composition allows very accurate discrimination of similar tissues composing the breast, opening the possibility of significant contributions to a breast cancer diagnosis.

TITLE: Book of Abstracts

EDITOR: Prof. Dr. Goran S. Ristić

PROOF-READING: Saša Trenčić, MA

TECHNICAL EDITING: Saša Trenčić, MA

COVER DESIGN: Vladan Nikolić, PhD

YEAR OF PUBLISHING: 2021

PUBLISHER: RAD Centre, Niš, Serbia

FOR THE PUBLISHER: Prof. Dr. Goran S. Ristić

CD BURNING AND COPYING: RAD Centre, Niš, Serbia

PRINT RUN: Electronic edition - 50 CDs (CD-R)

ISBN: 978-86-901150-2-0

www.rad-conference.org

CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

539.16(048)(0.034.2)
57+61(048)(0.034.2)

INTERNATIONAL Conference on Radiation in Various Fields of Research (9 ;2021 ; Herceg Novi)

Book of abstracts [Elektronski izvor] / Ninth International Conference on Radiation in Various Fields of Research, R9, [RAD 2021], June 14 - 18, 2021, Herceg Novi, Montenegro ; [editor Goran S. Ristić]. - Niš :RAD Centre, 2021 (Niš : RAD Centre). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. - Tiraž 50.

ISBN 978-86-901150-2-0

a) Јонизујуће зрачење - Дозиметрија - Апстракти b) Биомедицина - Апстракти

COBISS.SR-ID 43884041