



ENCONTRO DE OUTONO **2021**
SOCIEDADE BRASILEIRA DE FÍSICA
21 a 25 de junho de 2021

24/06/2021 - Oral Sessions (10:30-12:00)

MEDICAL PHYSICS IV - BIOPHOTONICS AND MAGNETISM IN MEDICINE

Chair: Susana de Souza Lalic

Co-Chair: Rogério Matias



10:30 VIBRATIONAL SPECTROSCOPY OF BIOLOGICAL TISSUES

- *Luciano Bachmann, Thiago Martini Pereira, Denise Maria Zezell, Joaquim Cezar Felipe*

11:00

11:00 A DEEP LEARNING APPROACH FOR BREAST TISSUE MALIGNANCY DIAGNOSIS USING MICRO-FTIR HYPERSPECTRAL IMAGING

11:15 *Matheus del-Valle, Moises Oliveira dos Santos, Sofia Nascimento dos Santos, Emerson Soares Bernardes, Denise Maria Zezell*

11:15 Female dog mammary cancer diagnosis by nonlinear optical images

- *Luana A. Reis, Egleidson F. A. Gomes, Giovanna Paranhos, Ana P. V. Garcia, Geovanni D. Cassali, Francis G. J. Longford, Jeremy G. Frey, Ana M. de Paula*

11:30

11:30 An open-source platform for robotized transcranial magnetic stimulation

- *Renan H. Matsuda, Thais Cunha Marchetti, Oswaldo Baffa, Victor Hugo Souza, Risto J. Ilmoniemi, Daisuke Araki, Glauco Augusto de Paula Caurin*

11:45

11:45 Electronic control of the stimulus orientation induced in the human brain with multi-channel magnetic stimulation

12:00 *Victor Hugo Souza, Jaakko O. Nieminen, Sergei Tugin, Lari M. Koponen, Risto J. Ilmoniemi, Oswaldo Baffa*



VIBRATIONAL SPECTROSCOPY OF BIOLOGICAL TISSUES

Luciano Bachmann

Universidade de São Paulo

Thiago Martini Pereira

Universidade Federal de São Paulo

Denise Maria Zezell

Instituto de Pesquisas Energéticas e Nucleares

Joaquim Cezar Felipe

Universidade de São Paulo

The vibrational modes of molecules in biological tissues can be assessed by either Raman spectroscopy, through inelastic scattering, or infrared spectroscopy, through direct measurement of transmittance or reflectance. When combined with mathematical methods, vibrational spectroscopic techniques have shown promising results for evaluation of biochemical changes in biological samples, and such combination can be used to develop new tools for medical diagnosis. Here, we provide an overview of the infrared spectral imaging techniques we use to characterize biological tissues and describe how we employ these techniques to diagnose cancer and to evaluate inflammatory processes. In the last decade, we have studied thyroid and colon cancer tissues as well as inflammatory processes attributed to an early stage of cancer. All the samples were obtained from human biopsy embedded in paraffin and cut according to the usual procedures in pathology. The sample slides were deposited over a Calcium Fluoride window that is transparent in the infrared spectral region. An FTIR spectrometer with 4-cm^{-1} resolution coupled to a microscope with 6×6 microns of effective pixel size was employed. Pre-processing algorithms were necessary to remove unwanted absorption bands such as water vapor, carbon dioxide, and paraffin absorption bands. After that, the data of hyperspectral images were processed to classify and to predict tissue regions by using machine learning techniques. More recently deep learning algorithms have been employed to pre-diagnose colon and thyroid cancer. Aiming to identify tissue changes, deep neural networks can be trained under a supervised process by using the spectral values in different frequencies. The proposed study can be extended to other tissues and applied to a wide range of samples. A good dataset of samples to train the algorithms is key to achieving higher accuracy.