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PROGRAM AND ABSTRACT BOOK

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SP-10.05 - Breast tissue diagnosis using artificial intelligence applied to FTIR spectroscopy images

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The estimative of new breast cancer cases was of 2.1 million of new breast cancer cases in 2018, hence being the most incident type of cancer in women. The improvement of its diagnosis has been the aim of many researchers, including vibrational spectroscopy teams. With the advancement of the artificial intelligence, a field of computer science to enhance intelligence into computer systems, specially of the deep learning, big data acquired from spectroscopy image has entered a new era. Therefore, the proposal of this work was to diagnose breast tissue samples as malignant (cancer) or benign (adenosis) using deep learning techniques. Micro-FTIR spectroscopy images were acquired from BR804b human breast tissue microarray (Biomax, USA), resulting in more than 100 thousand spectra for each group. A k-means approach was established to separate spectra into three clusters: tissue, paraffin and slide. A preprocessing step was applied by the following pipeline: outlier removal; biofingerprint truncation; Savitzky–Golay filter to smooth and to obtain the second derivative; extended multiplicative signal correction to correct spectra and remove the paraffin contribution. The deep learning algorithm was built using two-layers of one-dimensional convolutional neural network (CNN) connected to a two-layers (100 and 50 neurons) feedforward network (FFN). Both networks used dropout layers of 50% and rectified linear unit activations. CNN kernel size was set to 5. The output neuron used a sigmoid activation. Adam optimizer was applied to train the networks, using a binary cross-entropy loss to improve the weights. A 4-fold cross-validation of 20 epochs and batch size of 250 was performed. The networks exhibited an accuracy of (97.8 ± 0.4)% during the training stage, and (96.9 ± 0.8)% during the testing stage, demonstrating a generalized classification. Accuracies of almost 100% indicates this approach as a potential technique for the breast diagnosis.

Keywords: FTIR images, artificial intelligence, breast cancer.
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