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Title: Rapid diagnosis of the etiology of patients infections as bacterial or viral using infrared spectroscopy of leukocytes and machine learning algorithms

Abstract:

Human viral and bacterial infections are responsible for a variety of diseases that are still the main causes of death and economic burden for society across the globe. Despite the different responses of the immune system to these infections, some of them have similar symptoms, such as fever, sneezing, inflammation, vomiting, diarrhea, and fatigue. Thus, physicians usually encounter difficulties in distinguishing between viral and bacterial infections based on these symptoms. Rapid identification of the etiology of infection is highly important for effective treatment and can save lives in some cases. The current methods used for the identification of the nature of the infection are mainly based on growing the infective agent in culture, which is a time-consuming (over 24 h) and usually expensive process. The main objective of this study was to evaluate the potential of mid-infrared spectroscopic method for rapid and reliable identification of bacterial and viral infections based on simple peripheral blood samples. White blood cells (WBCs) and plasma were isolated from the peripheral blood samples of patients with confirmed viral or bacterial infections. The obtained spectra were analyzed using multivariate analysis: principle component analysis (PCA) followed by linear discriminant analysis (LDA), to identify the infectious agent type as bacterial or viral in a time span of about 1 h after the collection of the blood sample. Our preliminary results showed that it is possible to determine the infectious agent with high success rates of 82% sensitivity and 80% specificity based on the WBC data.

Biography

Dr. Shaul Mordechai (Ph.D.) is a Professor of Physics and Head of the Biomedical Spectroscopy Laboratory at the Department of Physics, Ben Gurion University, Israel. His research interests include Medical Physics, Cancer Diagnosis, Biomedical Optics, FTIR-Microscopy, FTIR-Imaging, dementia with Lewy bodies, Alzheimer's disease, and machine learning. He was a Visiting Scientist at the University of Texas at Austin, Los Alamos National Laboratory, and the University of Pennsylvania, Philadelphia, Pa. He has co-authored many papers in Biomedical Optics, Tissue Microscopy, Optical Diagnostics, and Applications of Monte Carlo Simulations in Biomedical Optics.