



## Polarization-based optical interference approach for differential diagnosis of benign and malignant tumours

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### ABSTRACT

The polarization-based optical interference approach is expanded for an express differentiation between prostate adenocarcinoma with different grades and Gleason scores. The approach is founded on evaluation of local contrast of polarized interference patterns originated by a superposition of reference laser beams and interference of light transmitted through the tissue sample placed in the image plane. The observed polarization-based optical interference patterns are linked directly to the morphology of the biological tissues under investigation. The polarization patterns obtained for three sets of histological sections of the prostate tumour biopsy samples are further processed with the statistical moments of 1<sup>st</sup> to 4<sup>th</sup> order. The developed approach is implemented for assessment of histological sections of the prostate tumour tissues with high, moderately and poorly differentiated adenocarcinomas. The application of the developed polarization-based optical interference approach demonstrates a high (> 90%) level of accuracy.

### 1. Introduction

Prostate cancer is one of the most common (4th place) cancers in men worldwide and, nowadays, is the most common diagnosed type of cancer [1,2]. Early detection of this type of disease is extremely essential and allows significantly improve the patient outcomes [3,4]. Various screening tests, including general and biochemical blood analysis, are used extensively for prostate cancer diagnosis. Nevertheless, early stages of the prostate cancer are still hardly detectable due to no discernible observation of tissue malformations both in sense of biochemical and molecular markers and, therefore, the actual diagnosis can remain unknown for years. Optical imaging diagnostic modalities provide a unique possibility of real-time non-invasive and cost-effective discrimination between different stages of cancer aggressiveness [5]. Apart from evaluation of cancer aggressiveness the differentiation of types of malignant (adenocarcinoma) prostate tissue is another important goal [4].

Last decade polarization imaging has been consistently and successfully developed with the main aim of functional non-invasive imaging and quantitative characterization of biological tissue [6–8]. Tissue polarimetry becomes quite diverse field of research with various approaches, including Mueller matrix polarimetry [9,10], two-dimensional [11–15] and tree-dimensional [16] Mueller matrix mapping using various approximations, polar decomposition of Mueller matrices [17–19], and scattering matrices [20,21]. Quite a number of polarimetric diagnostic modalities are based on the quantitative evaluation of optical anisotropy of biological tissues [15,22,23]. A combined use of polarization and interference is highly promising approach for this purpose, as well as for further developments of Mueller-matrix diagnostics and its functionality [24,25].

However, for the most biological tissues, the efficiency of polarization diagnostics is significantly reduced due to the presence of a high level of depolarized background, which masks the polarization man-

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# Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours

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Nanomedicine and Drug Delivery Stefano Leporatti, 2019-01-17 This book is a printed edition of the Special Issue

Nanocolloids for Nanomedicine and Drug Delivery that was published in Nanomaterials      *Scientific and Technical Aerospace Reports*, 1982 Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database

*Pathology of the Ovary, Fallopian Tube and Peritoneum* Nafisa Wilkinson, 2024-02-23 This heavily revised second edition in the Essentials of Diagnostic Gynecological Pathology series covers the anatomy development histology and normal function of the ovary Detailed descriptions of non neoplastic disorders of the ovary surgery and medical management of ovarian cancer and the use of imaging frozen sections and cytology in ovarian pathology is discussed The work also describes specific disorders of the ovary fallopian tube and peritoneum New chapters cover the latest technologies in relevant imaging techniques along with the application of molecular techniques in diagnostic and management practices Pathology of the Ovary Fallopian Tube and Peritoneum has been written to be useful diagnostically to general as well as specialist gynecological histopathologists and pathologists in training Gynecologists oncologists genitourinary physicians and cancer nurse specialists will find expert insights here that will help in treatment and counselling of their patients

*Interventional Bronchoscopy* Christoph T. Bolliger, Praveen N. Mathur, 2000 This book covers all aspects of diagnostic and therapeutic bronchoscopy which go beyond the techniques of inspection simple lavage and biopsies of the tracheobronchial tree In a first section historical aspects as well as the modern use of both rigid and flexible instruments the set up of a bronchoscopy unit anaesthetic techniques and functional evaluation for patients undergoing interventional bronchoscopy are discussed

A diagnostic section on transbronchial needle aspiration and bronchoscopic ultrasound is followed by extensive coverage of all existing therapeutic techniques foreign body removal laser resection electrocautery argon plasma coagulation cryotherapy brachytherapy photodynamic therapy stenting and a chapter on multi modality treatment of advanced pulmonary malignancies A fourth section deals with percutaneous image guided procedures percutaneous dilatational tracheostomy and transtracheal oxygen therapy The last section provides an in depth look at emerging bronchoscopic technology such as autofluorescence virtual bronchoscopy and gene therapy Written by the world's leading authorities in the field and beautifully illustrated this book presents the state of the art of interventional bronchoscopy It is recommended reading for pulmonologists thoracic or ENT surgeons oncologists and physicians who take an interest in bronchoscopy

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