



# 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 beam 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 tissue 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 adenocarcinoma. 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) cancer 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 three-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 diagnosis 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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**Methods, Instrumentation and Mechanisms for Optical Characterization of Tissue and Treatment of Malignant Tumours** Sara Pålsson, Tekniska högskolan i Lund. Department of Physics, 2003      **Nanocolloids for 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

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## **Table of Contents Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours**

1. Understanding the eBook Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - The Rise of Digital Reading Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Advantages of eBooks Over Traditional Books
2. Identifying Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms

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

---

- Features to Look for in an Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
- User-Friendly Interface
- 4. Exploring eBook Recommendations from Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Personalized Recommendations
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours User Reviews and Ratings
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours and Bestseller Lists
- 5. Accessing Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours Free and Paid eBooks
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours Public Domain eBooks
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours eBook Subscription Services
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours Budget-Friendly Options
- 6. Navigating Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours eBook Formats
  - ePub, PDF, MOBI, and More
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours Compatibility with Devices
  - Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Highlighting and Note-Taking Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours

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

---

- Interactive Elements Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
- 8. Staying Engaged with Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
- 9. Balancing eBooks and Physical Books Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Setting Reading Goals Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Fact-Checking eBook Content of Methods Instrumentation And Mechanisms For Optical Characterization Of Tibue And Malignant Tumours
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks

### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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