

# The Role of Textural Analysis and Quantitative Measurements in Increasing the Accuracy of Imaging Diagnosis

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## ABSTRACT

The habilitation thesis entitled **“The Role of Textural Analysis and Quantitative Measurements in Increasing the Accuracy of Imaging Diagnosis”** synthesizes the most important aspects of scientific research, as well as professional and academic activities carried out since obtaining the PhD in Medicine in 2014, with the doctoral thesis entitled **“Contributions to the Diagnosis of Prostate Cancer Using Endorectal Magnetic Resonance Imaging”**, supervised by Professor Dr. Mircea Marian Buruian (Târgu Mureș).

The thesis is divided into three parts:

The first part is dedicated to presenting the main scientific, professional, and academic achievements;

The second outlines future directions for development;

The third part contains the list of references.

Among the studies conducted during the postdoctoral research period, the current thesis presents six works considered the most relevant to the research activity. These include the three main imaging techniques—ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI)—in both malignant and non-malignant pathologies of the brain and urogenital organs (kidneys, prostate, and adnexa).

The works are structured into two subchapters:

The first subchapter highlights the morphological changes and advanced post-processing findings (textural analysis and radiomics) in prostatic, renal tumor, and ovarian pathology, as demonstrated through ultrasound, CT, and MRI. The second subchapter presents the morphological changes and the contributions of advanced post-processing techniques based on MRI images in the evaluation of cerebral tumor pathology.

In the first subchapter, which addresses imaging techniques in urogenital pathology with a focus on morphological changes and textural analysis, four studies were included:

The first study evaluated signal changes on MRI sequences (T2 and diffusion-weighted imaging) and periprostatic changes in patients under 50 years of age with chronic prostatitis, comparing them with the appearance of the prostate and adjacent tissues in patients without known prostatic pathology in the same age category.

The second study assessed the potential of multiphasic CT to differentiate between benign and malignant renal tumors based on their contrast enhancement characteristics.

The third study evaluated whether texture analysis features extracted from multiphasic MDCT examinations could preoperatively differentiate between WHO/ISUP histopathological grades of clear cell renal carcinoma.

The fourth study, to our knowledge, is the first to evaluate ultrasound textural features of endometriomas and hemorrhagic cysts. This study aimed to determine whether textural parameters could serve as objective diagnostic criteria to distinguish between the two types of lesions and whether these parameters could outperform traditional ultrasound imaging features.

The second subchapter, titled "Quantitative Measurements and Advanced Post-Processing Techniques Based on MRI Images in Cerebral Tumor Pathology", includes two studies:

The first study analyzed the ability of diffusion-weighted imaging and ADC maps to differentiate between glioblastoma multiforma and solitary metastasis, two tumor types with similar imaging characteristics.

The second study represents a continuation of the research into differentiating these two malignant tumors, this time using advanced post-processing methods.

The following two chapters of the first part review the professional and academic achievements.

I am a senior specialist (primary physician) in the field of Radiology and Medical Imaging, having obtained competency certifications in CT and MRI. Since 2020, I have served as chief physician of the Radiology and Medical Imaging Laboratory at the Cluj County Emergency Clinical Hospital. Throughout my career, I have completed multiple training internships abroad, as well as specialized courses focused on urogenital imaging.

My academic career is closely tied to the “Iuliu Hațieganu” University of Medicine and Pharmacy in Cluj-Napoca, where I began working as a university assistant in 2012 on a fixed-term contract, and since 2022 I have held the position of associate professor. During these years, I have been actively involved in teaching students in the Faculty of Medicine—both Romanian and English sections—as well as radiology and imaging residents. I am the author of 18 book chapters published in specialty textbooks and educational materials.

The second part of the thesis outlines future directions for scientific, professional, and academic development: continuing the research directions in urogenital and cerebral imaging, applying for European development projects and research grants to ensure an optimal working environment with state-of-the-art equipment for ongoing studies, and improving the quality of medical care provided to our patients. Additionally, it includes the continued training of young specialists, students, and residents by involving them in our research projects.

The third part is dedicated to the bibliographic references.