Translational Medicine
ISSN: 2161-1025
OPEN ACCESS Freely available online
Opinion Article

Radiomics in Translational Medicine for Quantitative Imaging and Personalized Clinical Assessment

Elena Kovács*

Department of Biomedical Imaging Sciences, Danube Institute of Health Research, Budapest, Hungary

DESCRIPTION

Radiomics has become an important field within translational medicine because it converts medical images into large collections of quantitative data that describe tissue characteristics beyond what can be recognized through visual inspection alone. Conventional interpretation of computed tomography, magnetic resonance imaging, positron emission tomography, ultrasound, and other imaging modalities depends largely on the expertise of radiologists who evaluate structural abnormalities, anatomical relationships, and disease progression. Radiomics extends this process by extracting hundreds or even thousands of numerical imaging features representing tissue texture, shape, intensity, spatial distribution, and structural organization. Translational medicine applies these quantitative measurements to improve disease characterization, estimate clinical outcomes, evaluate therapeutic response, and support individualized patient management.

Medical imaging has remained an essential component of healthcare for many decades because it provides noninvasive visualization of internal organs and pathological processes. Technological improvements have produced highly detailed images with increasing spatial resolution and anatomical accuracy. Despite these advances, many biological differences among tissues remain difficult to recognize through visual assessment alone. Computational image analysis identifies subtle imaging characteristics that reflect microscopic tissue organization, vascular structure, cellular density, metabolic activity, and biochemical composition. These quantitative features create opportunities to associate imaging findings with underlying molecular and physiological processes.

Oncology has become the leading area of radiomics research because malignant tumors frequently display considerable biological diversity both among different patients and within individual lesions. Conventional imaging identifies tumor size, anatomical location, and involvement of surrounding tissues, but quantitative image analysis reveals additional information concerning internal heterogeneity, vascular patterns, tissue organization, and treatment-related changes. These imaging signatures may correspond with molecular alterations, cellular proliferation, immune activity, and metabolic characteristics that influence disease progression and therapeutic response. Brain tumors present another valuable application because neurological tissues display considerable structural complexity. Magnetic resonance imaging provides detailed visualization of intracranial lesions, surrounding edema, blood flow, and tissue integrity. Radiomic analysis identifies quantitative differences within tumors that may correspond with cellular density, necrosis, vascular development, and infiltrative growth. Such information assists researchers in distinguishing tumor subtypes, estimating biological behavior, and evaluating therapeutic response following surgery, radiation therapy, or systemic treatment.

Radiomics has expanded beyond oncology into cardiovascular medicine. Computed tomography and magnetic resonance imaging generate detailed anatomical representations of the heart and blood vessels. Quantitative image analysis evaluates myocardial texture, ventricular geometry, vascular calcification, plaque composition, and tissue remodeling. These measurements may improve assessment of coronary artery disease, cardiomyopathy, heart failure, and inflammatory cardiovascular disorders. Researchers continue investigating whether radiomic biomarkers contribute to earlier recognition of patients at increased cardiovascular risk. Respiratory medicine increasingly incorporates radiomics for evaluation of chronic pulmonary disorders. Computed tomography images obtained from patients with chronic obstructive pulmonary disease, pulmonary fibrosis, asthma, and infectious lung diseases contain extensive quantitative information describing airway morphology, lung texture, and regional tissue alterations. Computational analysis detects subtle structural differences associated with disease severity and progression. These findings support clinical research aimed at improving disease classification and individualized treatment planning.

Several technical considerations influence radiomic research. Imaging parameters, scanner manufacturers, reconstruction algorithms, patient positioning, and image acquisition protocols

Correspondence to: Elena Kovács, Department of Biomedical Imaging Sciences, Danube Institute of Health Research, Budapest, Hungary, E-mail: elena.kovacs@dihrbiomed.hu

Received: 26-May-2026, Manuscript No. TMCR-26-43685; **Editor assigned:** 28-May-2026, PreQC No. TMCR-26-43685 (PQ); **Reviewed:** 11-Jun-2026, QC No. TMCR-26-43685; **Revised:** 18-Jun-2026, Manuscript No. TMCR-26-43685 (R); **Published:** 25-Jun-2026, DOI: 10.35248/2161-1025.26.16.394

Citation: Kovács E (2026). Radiomics in Translational Medicine for Quantitative Imaging and Personalized Clinical Assessment. Trans Med. 16:394.

Copyright: © 2026 Kovács E. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

may affect quantitative feature measurements. Standardization of imaging procedures and analytical methods therefore remains essential for reliable comparison among research institutions. International organizations continue developing recommendations supporting reproducible radiomic investigations across diverse healthcare environments. Validation represents another important requirement before widespread clinical implementation. Candidate radiomic biomarkers identified within one patient population must demonstrate consistent performance across independent clinical cohorts representing different geographical regions and healthcare systems. Large multicenter studies provide opportunities to confirm reproducibility while identifying factors influencing analytical accuracy. Continued validation strengthens confidence in imaging-derived biomarkers before routine clinical adoption.

CONCLUSION

Radiomics continues expanding the contribution of translational medicine by transforming routine medical imaging into detailed sources of quantitative biological information. Through advanced computational analysis, imaging studies provide insight into tissue organization, disease behavior, and therapeutic response that complements molecular biology and clinical evaluation. Continued advances in imaging technology, artificial intelligence, computational science, and international scientific cooperation will further strengthen the clinical value of radiomics across numerous medical specialties, supporting more individualized diagnosis, treatment selection, and long-term patient care.