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PROVA 1

- Negli studi di classificazione basato sulla radiomica, quali sono i passaggi fondamentali nella fase di costruzione dell'algoritmo di classificazione
- Cos'è un software Open Source e in cosa si distingue dagli altri?
- Si traduca l'abstract dell'articolo sottostante

Radiomics: the bridge between medical imaging and personalized medicine

Philippe Lambin[1], Ralph T.H. Leijenaar[1], Timo M. Deist[1]*, Jurgen Peerlings[1,2], Evelyn E.C. de Jong[1], Janita van Timmeren[1], Sebastian Sanduleanu[1], Ruben T.H.M. Larue[1], Aniek J.G. Even[1], Arthur Jochems[1], Yvonka van Wijk[1], Henry Woodruff[1], Johan van Soest[3], Tim Lustberg[3], Erik Roelofs[1,3], Wouter van Elmpt[3], Andre Dekker[3], Felix M. Mottaghy[2,4], Joachim E. Wildberger[2] and Sean Walsh[1]*

Abstract | Radiomics, the high-throughput mining of quantitative image features from standard-of-care medical imaging that enables data to be extracted and applied within clinical-decision support systems to improve diagnostic, prognostic, and predictive accuracy, is gaining importance in cancer research. Radiomic analysis exploits sophisticated image analysis tools and the rapid development and validation of medical imaging data that uses image-based signatures for precision diagnosis and treatment, providing a powerful tool in modern medicine. Herein, we describe the process of radiomics, its pitfalls, challenges, opportunities, and its capacity to improve clinical decision making, emphasizing the utility for patients with cancer. Currently, the field of radiomics lacks standardized evaluation of both the scientific integrity and the clinical relevance of the numerous published radiomics investigations resulting from the rapid growth of this area. Rigorous evaluation criteria and reporting guidelines need to be established in order for radiomics to mature as a discipline. Herein, we provide guidance for investigations to meet this urgent need in the field of radiomics.

11/3/22

Riccardo Pasenus

PROVA ESTRATTA

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PROVA 2

- Negli studi sui gliomi basati sulla radiomica, quali sono i passaggi fondamentali nella fase di preprocessing delle immagini ed estrazione delle features
- Cos'è Matlab e a cosa serve?
- Si traduca l'abstract dell'articolo sottostante

Review

Making Radiomics More Reproducible across Scanner and Imaging Protocol Variations: A Review of Harmonization Methods

Shruti Atul Mali [1,*], Abdalla Ibrahim [1,2,3,4], Henry C. Woodruff [1,2], Vincent Andrearczyk [5], Henning Müller [5], Sergey Primakov [1], Zohaib Salahuddin [1], Avishek Chatterjee [1] and Philippe Lambin [1,2]

1 The D-Lab, Department of Precision Medicine, GROW—School for Oncology, Maastricht University, Maastricht, Universiteitssingel 40, 6229 ER Maastricht, The Netherlands; a.ibrahim@maastrichtuniversity.nl (A.I.); h.woodruff@maastrichtuniversity.nl (H.C.W.); s.primakov@maastrichtuniversity.nl (S.P.); z.salahuddin@maastrichtuniversity.nl (Z.S.); a.chatterjee@maastrichtuniversity.nl (A.C.); philippe.lambin@maastrichtuniversity.nl (P.L.)
2 Department of Radiology and Nuclear Medicine, GROW—School for Oncology, Maastricht University Medical Center+, P.O. Box 5800, 6202 AZ Maastricht, The Netherlands
3 Department of Medical Physics, Division of Nuclear Medicine and Oncological Imaging, Hospital Center Universitaire de Liege, 4000 Liege, Belgium
4 Department of Nuclear Medicine and Comprehensive Diagnostic Center Aachen (CDCA), University Hospital RWTH Aachen University, 52074 Aachen, Germany
5 Institute of Information Systems, University of Applied Sciences and Arts Western Switzerland (HES-SO), rue du Technopole 3, 3960 Sierre, Switzerland; vincent.andrearczyk@hevs.ch (V.A.); henning.mueller@hevs.ch (H.M.)
* Correspondence: s.mali@maastrichtuniversity.nl

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Abstract: Radiomics converts medical images into mineable data via a high-throughput extraction of quantitative features used for clinical decision support. However, these radiomic features are susceptible to variation across scanners, acquisition protocols, and reconstruction settings. Various investigations have assessed the reproducibility and validation of radiomic features across these discrepancies. In this narrative review, we combine systematic keyword searches with prior domain knowledge to discuss various harmonization solutions to make the radiomic features more reproducible across various scanners and protocol settings. Different harmonization solutions are discussed and divided into two main categories: image domain and feature domain. The image domain category comprises methods such as the standardization of image acquisition, post-processing of raw sensor-level image data, data augmentation techniques, and style transfer. The feature domain category consists of methods such as the identification of reproducible features and normalization techniques such as statistical normalization, intensity harmonization, ComBat and its derivatives, and normalization using deep learning. We also reflect upon the importance of deep learning solutions for addressing variability across multi-centric radiomic studies especially using generative adversarial networks (GANs), neural style transfer (NST) techniques, or a combination of both. We cover a broader range of methods especially GANs and NST methods in more detail than previous reviews.

Keywords: radiomics; harmonization; feature reproducibility; deep learning; medical imaging

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Ricordi Bruno

PROVA NON ESTRATTA

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PROVA 3

- Illustrare un'opportuna procedura di analisi per costruire e valutare le performance di un algoritmo di machine learning
- Cos'è Excel e a cosa serve?
- Si traduca l'abstract dell'articolo sottostante

scientific reports

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MRI-based clinical-radiomics model predicts tumor response before treatment in locally advanced rectal cancer

Andrea Delli Pizzi[1], Antonio Maria Chiarelli[1], Piero Chiacchiaretta[1*], Martina d'Annibale[1], Pierpaolo Croce[1], Consuelo Rosa[2], Domenico Mastrodicasa[3], Stefano Trebeschi[4], Doenja Marina Johanna Lambregts[4], Daniele Caposiena[5], Francesco Lorenzo Serafini[1], Raffaella Basilico[1], Giulio Cocco[6], Pierluigi Di Sebastiano[7], Sebastiano Cinalli[8], Antonio Ferretti[1], Richard Geoffrey Wise[1], Domenico Genovesi[2], Regina G. H. Beets-Tan[4,9,10] & Massimo Caulo[1]

Neoadjuvant chemo-radiotherapy (CRT) followed by total mesorectal excision (TME) represents the standard treatment for patients with locally advanced (≥T3 or N+) rectal cancer (LARC). Approximately 15% of patients with LARC shows a complete response after CRT. The use of pre-treatment MRI as predictive biomarker could help to increase the chance of organ preservation by tailoring the neoadjuvant treatment. We present a novel machine learning model combining pre-treatment MRI-based clinical and radiomic features for the early prediction of treatment response in LARC patients. MRI scans (3.0 T, T2-weighted) of 72 patients with LARC were included. Two readers independently segmented each tumor. Radiomic features were extracted from both the "tumor core" (TC) and the "tumor border" (TB). Partial least square (PLS) regression was used as the multivariate, machine learning, algorithm of choice and leave-one-out nested cross-validation was used to optimize hyperparameters of the PLS. The MRI-Based "clinical-radiomic" machine learning model properly predicted the treatment response (AUC = 0.793, $p = 5.6 \times 10^{-5}$). Importantly, the prediction improved when combining MRI-based clinical features and radiomic features, the latter extracted from both TC and TB. Prospective validation studies in randomized clinical trials are warranted to better define the role of radiomics in the development of rectal cancer precision medicine.

11/3/22

Riccardo Rasetto

PROVA NON ESATTA