Third International Conference and School on Radiation Imaging and Nuclear Medicine (ICSRI-2025)

BOOK OF ABSTRACTS & SCHOOL PROGRAM

SETIF, OCTOBER 12-16, 2025

Ferhat Abbas-Setif1 University-UFAS

Faculty of Sciences

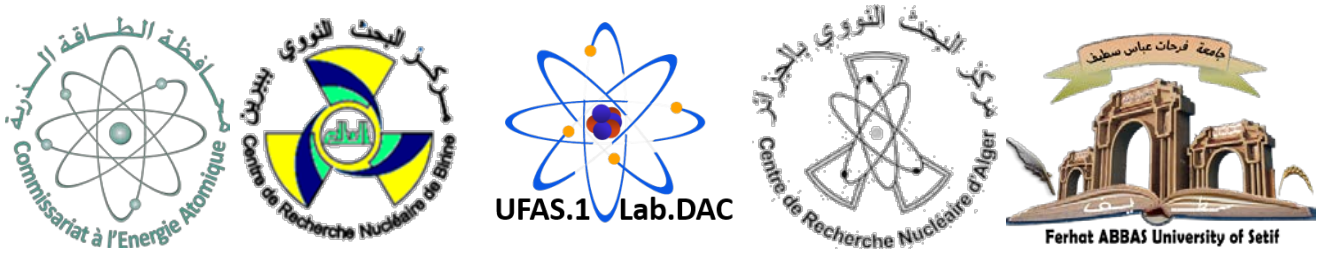
In partnership with:

- **Atomic Energy Commission-COMENA**
- **Department of Radiation Oncology, CLCC-Sétif**
- **Algerian Association of Nuclear Medicine**

ALGERIA

Third International Conference and School on Radiation Imaging and Nuclear Medicine

Setif, October 12-16, 2025



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Third International Conference and School on Radiation Imaging and Nuclear Medicine (ICSRI-2023)
Setif, Algeria
October 12-16, 2025

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Preface

The **Third International Conference and School on Radiation Imaging and Nuclear Medicine (ICSRI-2025)** will be held from **12–16 October 2025** at **Ferhat Abbas–Sétif 1 University (UFAS1), Algeria**, in partnership with the **Algerian Atomic Energy Commission (COMENA)** and its research centers. Building on the success of the first two editions, this conference continues to serve as an international platform where researchers, practitioners, and students come together to share knowledge, present recent advances, and explore future directions in radiation imaging, nuclear medicine, and related scientific domains.

The 2025 conference program features keynote lectures by leading experts and technical sessions covering diverse topics such as radiation detectors and imaging modalities, computational simulations in radiation imaging, image reconstruction and processing, and clinical applications of nuclear techniques. Special sessions will highlight current challenges, innovations, and translational aspects linking research with clinical practice.

In parallel, a **three-day School** is dedicated to students, young researchers, and early-career professionals. The School is focused on **Radiation Dosimetry in Radiation Imaging**, emphasizing its central role in ensuring both patient safety and imaging quality. The main lectures include:

- **Fundamentals of Dosimetry and Quality Control**
- **Advanced Dosimetry and Quality Control Techniques**
- **Clinical Applications and Future Perspectives**

This third edition of ICSRI reflects our continued commitment to academic excellence, capacity building, and international collaboration. We are confident that the lectures, workshops, and discussions will provide valuable opportunities for knowledge transfer, professional networking, and the inspiration of new research initiatives.

The General Chair of the Organizing Committee extends sincere gratitude to the International Scientific Committee, the Local Organizing Committee, and our partners — **the Algerian Atomic Energy Commission (COMENA), the Nuclear Research Centre of Birine (CRNB), the Nuclear Research Centre of Algiers (CRNA), the Fighting Against Cancer Centre of Setif, and The Algerian Association of Nuclear Medicine** — for their outstanding efforts and continued support.

We warmly welcome all participants to **ICSRI-2025** and wish you a fruitful, enriching, and memorable experience in Sétif.

Pr. Fayçal KHARFI
General Chair of the ICSRI-2025 Conference and School
Director of the School on Radiation Imaging and Nuclear Medicine

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ID#2: Machine and Deep learning Techniques for Histological Images Classification

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Abstract

colorectal cancer (CRC) or we can call it colon cancer, it is known among the most common type of cancer in the world,According to the latest statistics, CRC is more common in men compared to women . For early detection, endoscopic imaging is used to determine the presence of colonic polyps , and for accurate confirmation and diagnosis of CRC , a histological examination is used to study and analyse the colonic tissues ,with a purpose to classify the abnormal growth as malignant tumor and the normal growth (colonic polyps) as benign tumor. In this paper, we develop both Machine learning and Deep learning models in supervised frameworks Due to the existence of labeled dataset with the classes of colonic tissues that can classify medical images (histological colonic tissues) to improve the diagnosis and treatment of colorectal cancer In order to be able to make difference between healthy colonic tissue and cells affected by cancer. **Index Terms**—
Colorectal cancer(CRC); Colorectal polyps; Histological images; Machine learning ; Deep learning.

ID#5: The effectiveness of radioactive iodine doses 30 mCi and 50 mCi in the treatment of thyroid gland cancer

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Abstract

Radioiodine therapy, also known as radioactive iodine therapy or RAI therapy, has been a cornerstone in the treatment of thyroid disorders since the early 1940s and is commonly used as a follow-up treatment for thyroid cancer after a surgery.

Thyroid cancer, especially papillary thyroid cancer, is the most common type of thyroid cancer, and it tends to respond well to radioiodine therapy. Radioactive iodine destroys thyroid and cancer cells, reducing recurrence risk. Safe and effective with minimal side effects. Essential for thyroid cancer treatment.

The thyroid gland is one of the most important endocrine organs. The thyroid produces hormones based on the iodine element. Thyroid hormones regulate many functions in the human body.

ID#6: Fully Attention Convolutional Deep Neural Networks for Polyp Segmentation of Colonoscopic Images

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Abstract

The colorectal polyp is an abnormal growth that develops in the inner lining of the colon or rectum. Polyps can be of different sizes and shapes, ranging from small protrusions to larger and more complex tumors. We formulate our problem that is classified among the most common medical problems related to colon cancer, which were included in the framework of artificial intelligence problems to integrate the medical field with AI to obtain more accurate results regarding the Segmentation of colonic polyps in Colonoscopic images ,with a purpose to segment the abnormal growth which represent the colonic polyps. in this contribution study , we develop both Machine learning and Deep learning models in supervised frameworks to make the semantic segmentation of colonolic polyps in endoscopic images,to improve the process od diagnosis and early detection of colorectal cancer,in order to catch the patient in a very early stage of the disease so that the cancer does not spread further.

ID#10: Evaluation of the Spatial Resolution and Noise of Siemens Somatom Emotion 16 CT scanner for different scanning protocols and reconstruction kernels and windows

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Abstract

The spatial resolution and contrast are very important parameters of CT scanner that must be studied and checked periodically. Indeed, they are important in detecting edges of structures, tumors limits, small strange objects, and small bone structures. It also indicates the possibility of a scanner to differentiate low-contrast structures such as white matter and gray matter in cerebral CT scan. These resolutions depend not so much of the signal to noise ratio but of the contrast to noise ratio. Factors that influence

the signal to noise ratio is the reconstruction kernel, the photon flux, the interpolation algorithm and the pitch (in multislice CT).

In this work, we are interested in determining the spatial resolution and noise of the Siemens Somatom Emotion 16 Scanner by establishing its modulation transfer function (MTF) for different scanning protocols and reconstruction kernels and windows.

Keywords: CT-scanner; Reconstruction Kernel; Density windows; MTF; Spatial Resolution; Noise.

ID#11: Hybrid Deep Learning Model for Complex Medical Image Segmentation

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Abstract

Background: Segmenting complex medical images such as ultrasound (US) or magnetic resonance imaging (MRI) remains a significant challenge due to noise, low contrast, and anatomical ambiguities. These challenges are crucial for clinical tasks like diagnosis, volume measurement, and treatment planning.

Objectives: In this work, we introduce a hybrid deep learning architecture that combines the global contextual awareness of Vision Transformers (ViTs) with the fine-grained localization capabilities of U-Net-style convolutional networks.

Methods: Our approach integrates a multi-scale, attention-guided learning strategy to enhance performance in regions that are particularly difficult to segment, such as boundaries distorted by artifacts or anatomical overlaps. To further improve segmentation accuracy, we incorporate a custom loss function that prioritizes errors in these hard-to-segment regions, enabling the model to learn from expert-guided uncertainty. The framework is evaluated on diverse datasets including high-resolution ultrasound of 75 patients and MRI images, containing volumetric scans.

Results: Our approach demonstrates superior generalization and robustness, outperforming existing segmentation models and even human annotators in some complex imaging scenarios, achieving state-of-the-art performance across Dice coefficient and Hausdorff distance metrics.

Conclusions: This work establishes a promising direction for integrating transformer-based architectures into real-world clinical image analysis pipelines.

ID#12: Linking Noise and Training Variance for Breast Cancer Detection Through Deep Learning

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Abstract

In the context of breast cancer detection, deep learning models are increasingly integrated into computer-aided diagnosis (CAD) systems to improve early identification and prognosis. However, the reliability of these models is challenged by variations in image quality, particularly due to noise. This study investigates the link between noise levels in medical images and the training variance observed in deep learning models—specifically, the fluctuation in performance across multiple training runs under identical conditions. Using two widely adopted architectures, DenseNet and InceptionV3, we evaluate performance on histological images with high signal-to-noise ratio (SNR) and ultrasound images, which are more affected by noise. Our experiments reveal that lower SNR in ultrasound data leads to increased training variance, with model accuracies fluctuating notably between runs, while histological data yield more stable training outcomes. DenseNet demonstrates more consistent performance on noisy data, likely due to its dense connectivity and feature reuse, while InceptionV3 benefits from its multi-scale filtering strategy, showing robustness across both modalities. These results emphasize the importance of understanding training variance as a function of noise and highlight the need for architecture-aware design when deploying deep learning models in clinical practice.

ID#13: Empirical Calculation of L X-Ray Fluorescence Cross-Sections for Thorium Excited by Photons at Different Energies

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Abstract

Background: X-ray fluorescence (XRF) is fundamental for numerous practical applications, including elemental analysis using X-ray emission techniques, basic studies of nuclear and atomic processes causing X-ray, as well as dosimetric calculations in medical physics (radiotherapy, diagnostic imaging, radiation protection), irradiation processes, and testing of scientific theories. In this study, we present an empirical method for determining the L-shell X-ray fluorescence cross-sections for Thorium (90Th) across 47 excitation energies ranging from 16.896 to 60 keV. A second-order polynomial regression was employed to interpolate the cross-sections, with calculations based on the direct interpolation of experimental data. The Empirical results of L_l, L_α, L_β and L_γ X-ray fluorescence cross sections (XRFCSs) were

compared to values obtained by the Fundamental atomic Parameters method using two sets from literature, the calculated results based on the Dirac Hartree–Slater (DHS) model by Puri (1995), and experimental data from Singh (1987), Sharma (1996), and Kacal (2011). The present results show good agreement with both experimental data and theoretical calculations.

Objectives: This study aims to achieve the highest levels of accuracy by minimizing measurement error margins, thereby ensuring the reliability of results. The work relies on systematic comparisons between experimental data and previously published theoretical results, employing advanced mathematical models that undergo multiple verification processes. The research makes significant contributions to improving radiation dose calculation models, whether for medical applications such as radiotherapy or industrial applications in radiation protection. It is worth noting that all measurements and ratios mentioned adhere to precise standards, utilizing the latest scientific methodologies in analysis and review, including sophisticated spectroscopic analysis techniques.

Methods: In this paper we calculate the empirical L_l, L_a, L_β and L_γ X-ray fluorescence cross-sections in Thorium (90Th) at 47 energies ranging from 16.896 to 60 keV using a large number dataset. The empirical method was based on experimental values of X-ray fluorescence (XRF) cross-sections taken from the literature. we employed a second-order polynomial regression for interpolation:

$$f(\ln E)=\ln\left[\left(\sigma_{(L_n)}\right)\right]=\sum_{(i=0)}^{2} b_i (\ln E)^i \qquad (1)$$

n=l, a, β, γ.

The fitting coefficients b_i.

A computer program was designed to fit second-order polynomials, This program selects the most suitable polynomial (avoiding overfitting) primarily based on the correlation coefficient. The empirically calculated values are presented.

Results: To thoroughly assess our empirical cross-sections in comparison with experimental and theoretical values, we have documented the results and all values of L_l, L_a, L_β and L_γ were plotted as a function of photon energy E. Overall, our current empirical calculations, derived from Formula (1), show consistency with both experimental and theoretical values. However, marginal differences are observed, 7.72% compared to Mann et al. (1994) for σ_(L_l), 6.27% compared to Kacal et al. (2011) for σ_(L_a), and 7.95% compared to Puri et al. (1995) for σ_(L_β), exception is σ_(L_γ), which shows a larger deviation of 10.80% compared to Sharma et al. (1996). These relative differences ($RD\%$) were calculated using the following expression:

$$(RD\%)=\left|\sigma_{(L_n)}(exp)-\sigma_{(L_n)}(emp)\right|/\left(\sigma_{(L_n)}(emp)\right)\times 100$$

Where σ_(L_n) (exp) represents the experimental values and σ_(L_n) (emp) represents the empirical values.

Conclusions: A new set of empirical calculations for L_l, L_a, L_β, and L_γ X-Ray fluorescence cross-sections for Thorium (90Th) at different excitation energies has been derived using analytical methods. The empirical results show good agreement with data from other research groups. This study confirms the accuracy of key physical

parameters for L-shell XRF in thorium and validates the empirical interpolation approach.

Keywords: X-ray fluorescence (XRF); the Fundamental atomic Parameters; spectroscopic analysis techniques; the fitting; Empirical cross-sections.

ID#14: 3D-Printed Personalized Bolus via Structured Light Scanning for Adaptive Radiotherapy

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Abstract

Conformal dose delivery in external beam radiotherapy often requires the use of tissue-equivalent bolus to compensate for surface irregularities and to increase skin dose. Traditional bolus fabrication methods are time-consuming, imprecise, and lack adaptability to patient anatomy. This study presents an alternative, innovative workflow integrating three-dimensional (3D) structural light scanning, computer-aided design, and 3D printing to fabricate and adjust patient-specific bolus rapidly and accurately. Firstly, a chin bolus was created within the treatment planning system (TPS) by considering Rando anthropomorphic phantom' CT-images and realistic radiotherapy treatment case. Created bolus was then extracted from the TPS, proceeded, 3D-printed, and tested. The bolus model was fabricated via fused-filament 3D printing using tissue-equivalent PLA filament. In order to avoid new CT-scans and additional unsuitable x-ray exposure of the patient, high-resolution inoffensive structural light scanner (SLS) was used to capture the treatment surface of the patient. The resulting point-cloud data was then imported into 3D modelling software to design a custom bolus geometry that conforms exactly to the skin contour. Thus, the workflow also incorporated a rapid re-scanning and re-printing loop to allow intra-fractional or between-fraction adjustments in case of anatomical changes. The 3D-printed bolus demonstrated excellent conformity to the phantom surface. The entire process, from scanning to bolus deployment, was completed in under reasonable time, substantially reducing patient waiting time compared to conventional bolus fabrication. The proposed 3D printing–based workflow for bolus fabrication and adjustment offers a rapid, accurate, and patient specific alternative to conventional methods. By leveraging structural light scanning and digital modelling, this approach enhances conformity, improves dosimetric accuracy, and allows agile adjustments to accommodate anatomical changes, thereby optimizing radiotherapy treatment delivery.

Keywords: Radiotherapy; Patient-Specific Bolus; 3D Printing; Structural Light Scanning; 3D Modelling; Rapid Fabrication and Adjustment.

ID#15: Comparative Analysis of Hybrid Denoising Techniques and DnCNN for Poisson-Gaussian Noise Removal in Brain CT Images

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Abstract

Background and Purpose: Computed Tomography (CT) imaging is critical for accurate diagnosis in neuroradiology, yet it is often degraded by mixed Poisson–Gaussian noise originating from photon-counting statistics and electronic sensor noise. Traditional denoising filters can reduce noise at the expense of blurring fine anatomical details. This work aims to evaluate the efficiency of a hybrid denoising pipeline combining classical and deep-learning methods

Materials and Methods: The proposed methodology utilized a public brain tumor database (BraTS 2015) provided the CT slices, which were normalized to consistent intensity scaling. Mixed Poisson–Gaussian noise was then synthesized to emulate photon-counting fluctuations and electronic sensor noise. Different classical denoising methods were used, including the Generalized Anscombe Transform followed by Wiener filtering, median filtering, and DWT, which were first applied to the noisy CT images. In parallel, a pretrained DnCNN was used to remove noise directly, and additional hybrid pipelines combined each classical preprocessing step with the DnCNN. We evaluated all approaches using PSNR, SSIM and MSE to demonstrate how traditional filters and deep-learning methods can complement each other in preserving anatomical contrast and structural detail.

Results and Discussion: The hybrid DWT + DnCNN pipeline delivered the best overall denoising performance (PSNR = 29.54 dB, SSIM = 0.7501), with standalone DnCNN a very close second (PSNR = 29.49 dB, SSIM = 0.7605). Classical filters like Wiener and median provided modest PSNR gains (up to 27.53 dB) but suffered from lower structural fidelity (SSIM < 0.70), indicative of over smoothing. These results corroborate Zhang et al.'s finding that residual learning CNNs exceed classical denoisers in mixed noise settings (PSNR ≈28 dB).

Conclusion: The integration of DnCNN with classical denoising techniques yields superior suppression of Poisson–Gaussian noise in brain tumor CT imaging, balancing noise removal and detail preservation. While standalone DnCNN achieved near-optimal performance, hybrid pipelines such as DWT + DnCNN demonstrate robustness,

particularly in preserving fine structural details. Future work will extend this evaluation to larger clinical datasets and explore real-time deployment frameworks.

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Keywords: Denoising, Poisson-gaussian noise.

ID#16: L'intelligence artificielle en radiothérapie : état de l'art, défis et perspectives

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Abstract

Background: La radiothérapie externe repose sur une planification précise impliquant plusieurs étapes critiques, dont le contourage des volumes tumoraux (CTV) et des organes à risque (OAR). L'automatisation du contourage constitue un enjeu majeur pour améliorer l'efficacité, la reproductibilité et la précision du plan de traitement. Les avancées en intelligence artificielle, notamment en deep learning, offrent des perspectives prometteuses dans ce domaine.

Objectives: La bonne segmentation des volumes cibles (tumeurs) et des organes à risque est cruciale pour une meilleure planification radiothérapique.Les modèles U-Net et dérivés (3D U-Net, Attention U-Net, nnU-Net) dominent la littérature actuelle avec des performances de segmentation élevées.

Methodes: Les modèles U-Net et dérivés (3D U-Net, Attention U-Net, nnU-Net) dominent la littérature actuelle avec des performances de segmentation élevées. L'intégration de Transformers, d'apprentissage auto-supervisé ou multi-site renforce la robustesse des modèles.

Les métriques utilisées sont principalement le Dice coefficient et la Hausdorff Distance. Les meilleurs modèles atteignent des Dice > 0.9 pour certains organes.

Results: Les méthodes comme nnU-Net se distinguent par leur auto-configuration et leur capacité de généralisation. La validation clinique reste cependant limitée, et la métrique Dice peut ne pas refléter la pertinence clinique.

Conclusion: l'intégration clinique de l'ia nécessite une validation rigoureuse, une compatibilité avec les systèmes existants, et une acceptabilité par les cliniciens. les approches ia, en particulier basées sur les cnn, ont un potentiel élevé pour automatiser

le contourage en radiothérapie. malgré des résultats prometteurs, des validations cliniques et techniques restent nécessaires avant une adoption généralisée.les modèles hybrides, associant ia et validation humaine, semblent aujourd'hui les plus pragmatiques pour une intégration sûre et efficace.

Keywords: intelligence artificielle, radiothérapie,L'apprentissage profond, segmentation automatique, planification, radiometrie.

ID#17: Impact of CT Acquisition Parameters on Radiomics-Based Classification of Brain Tumors and Intracerebral Hemorrhage

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Abstract

Accurate differentiation between brain tumors and intracerebral hemorrhage (ICH) on computed tomography (CT) imaging is critical for clinical decision-making. In this study, we investigate how CT acquisition parameters—such as Hounsfield Unit (HU) values, single-energy or dual-energy CT (SECT/DECT) mode, tube voltage (kVp), tube current (mAs), pitch, slice thickness, and radiation dose—influence the radiomics feature extraction and classification process. A dataset of CT scan images (130 patients, few of brain tumor, few with ICH, and few healthy) was retrospectively analyzed. Regions of interest (ROIs) were segmented, and radiomics features, including first-order statistics and gray-level co-occurrence matrix (GLCM) texture features, were extracted using the 3D Slicer platform. Imaging acquisition metadata were incorporated into the feature set to account for real-world variability. Machine learning models were trained to classify lesions, and feature importance analysis was performed to assess the influence of acquisition parameters on radiomics performance. Our findings suggest that acquisition factors significantly impact radiomics-based classification, underscoring the need to standardize imaging protocols or correct for acquisition variability when developing robust CT-based radiomics models for brain lesion characterization.

Keywords: Radiomics, CT imaging, Brain Tumor, Intracerebral Hemorrhage, Machine Learning.

ID#18: Recent advances in ophthalmological exploration

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Abstract

The eye has the advantage of being easily accessible for the exploration of its different segments, mainly due to the transparency of its tissues. Therefore, the imaging modalities in ophthalmology are numerous, with varied techniques using different physical principles. Thanks to the latest advances in optics, many ophthalmological explorations can explore different tissues at the micrometric scale, such as OCT (optical coherence tomography) or adaptive optics. In addition, the eye is the organ of choice for the application of laser, used for the treatment of both the retina and the cornea. Ultrasound also benefits from recent advances allowing a more precise exploration of the eye when the optical media are not clear. Finally, artificial intelligence plays an important role in optimizing the results of these explorations. The objective of this topic is to present an overview of recent advances in ophthalmological exploration based on different physical properties.

ID#20: Machine learning models to asses patient specific quality assurance for pelvic cancers

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Abstract

Background: Volumetric Modulated Arc Therapy (VMAT) is a state-of-the-art technique for the accurate treatment of cancers in the pelvic region (cancers of the cervix , rectum, prostate). A machine revolves around the patient, precisely aiming at the tumor and leaving healthy tissue alone. The incorporation of Artificial Intelligence (AI), particularly machine learning, into VMAT further improves its treatment plan and side effect prediction and ultimately brings about better patient results. **Objectives:** our work studies and compares the performance of different machine learning techniques for VMAT. We will concentrate on improving the planning and treatment of pelvic cancers, such as of the cervix, rectum or prostate. Our primary aims are to improve the accuracy of treatment, to minimize planning time without compromising treatment quality and to further advance patient outcomes utilizing sophisticated AI technology. Methods: Our study used Elekta's Monaco treatment planning system to generate VMAT plans, the dose calculation of which was performed using both Monte Carlo and collapsed cone algorithms. These were then delivered on Elekta Versa HD, Infinity 1, and Infinity 2 accelerators. Dosimetric

measurements using an EPID phantom and Delta⁴ were taken for quality assurance and were analyzed using Dosi-Soft for gamma index evaluation. We also quantified plan complexity with indicators such as PMU, MAD, MFA, MD, and C/A. Support Vector Machine and Random Forest machine learning models will finally be employed to analyze this entire set of parameters.

Results: Both Random Forest and Support Vector Machine (SVM) models established a connection between complexity and gamma values, though SVM's performance was superior in doing this. C/A and MD would have the greatest influence, whereas PMU, MAD, and MFA would be less influential.

Conclusions: The Random Forest and Support Vector Machine models should be further improved to maximally enhance their explanatory power, which is important for drawing more informative and deeper insights into the intricate factors influencing treatment complexity.

Keywords : VMAT; PELVIS; MACHINE LEARNING; GAMMA INDEX

ID#21: Intelligent Patch-Level label Sampling using Deep Learning on Histopathological Whole Slide Images for the Perspective of Predicting Breast Cancer Recurrence

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Abstract

This study proposes an intelligent patch-level sampling approach using deep learning to predict breast cancer recurrence from H&E-stained histopathological whole slide images (WSIs). By assigning a Discriminative Score (DS) to each patch via a CNN-based scorer, the most informative regions are selected and used to estimate Oncotype DX (ODX) scores. Using 150 WSIs with known ODX scores, the method reduces data complexity while preserving relevant diagnostic features, enhancing model interpretability and predictive performance. The results highlight the potential of this non-invasive, image-based strategy as an alternative to genomic assays for recurrence risk assessment.

ID#22: New values of 2P1/2 subshell fluorescence yields for heavy elements

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Abstract

The L-shell fluorescence yields of various elements have numerous uses in physical chemistry and medical research, theoretical, experimental, and analytical methods for calculating these yields are crucial. The fluorescence yields are critical in developing trustworthy theoretical models for fundamental inner-shell processes. Numerous practical applications, such as elemental analysis using the X-ray emission technique, fundamental research on the atomic and nuclear processes that result in the emission of X-rays and Auger electrons, and dosimetry calculations for medical physics and irradiation processing, depend on experimental, theoretical, and empirical data pertaining to X-ray fluorescence (XRF) cross sections and fluorescence yields. The empirical values were derived by directly interpolating the experimental data of the Transition fluorescence yields.

ID#23: Comparative Study of Natural Radioactivity in Domestic Ceramic Products

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Abstract

Household ceramic products, including plates, bowls, and glazed kitchenware, are widely used for food consumption and storage. These materials, like traditional pottery utensils, may contain naturally occurring radionuclides, which can pose long-term radiological health risks due to prolonged human exposure. The aim of this study is to assess and compare the radiological hazards of commercial household ceramics and traditional pottery items commonly used in domestic settings.

Representative samples of glazed ceramics and unglazed pottery were collected from local markets and artisanal sources. Natural radioactivity was measured using a High-Purity Germanium (HPGe) detector. Radiological parameters as the radium equivalent activity and the excess lifetime cancer risk were calculated based on the measured specific activities of radium 226Ra, thorium 232Th and potassium 40K.

The results indicate that most glazed household ceramics exhibit higher levels of radioactivity than traditional unglazed pottery utensils. However, both household ceramics and pottery utensils fall within acceptable radiological safety margins.

Nevertheless, glazed ceramics tend to exhibit higher radionuclide content, likely due to their raw materials and manufacturing processes. Regular monitoring and quality

control are recommended, particularly for imported or artisanal glazed products used in food-related contexts.

ID#25: MRI Segmentation and Prognostic Analysis Framework for Brain Cancer Using Foundation Models

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Abstract

Background: Cancer, especially in the brain, involves complex tumor structures that make diagnosis and treatment planning challenging. Accurate segmentation techniques assist doctors in making better decisions by precisely identifying tumors. Recent advances in deep learning have significantly improved medical image segmentation, offering more reliable and efficient tools for clinical use. By combining segmentation results with clinical and genetic data, prognostic analysis becomes more effective, helping to predict tumors and support clinical decision-making.

Objectives: This study aims to build an effective brain tumor segmentation and prognostic analysis pipeline. It compares deep learning methods and explores adapting general-purpose segmentation tools for brain MRI. The goal is to combine image, clinical, and genetic data to estimate survival probability and assess risk levels, supporting better medical decisions.

Methods: We implemented several segmentation models: a standard U-Net for baseline comparison, a DeepResUNet with residual connections to improve feature learning, and a VGG19-based U-Net using pre-trained weights. We also fine-tuned the Segment Anything Model (SAM) on brain MRI data to adapt them for medical imaging, and we also implemented the Medical Segment Anything Model (MedSAM). After segmentation, tumor features such as size and location were extracted and combined with clinical and genetic data. These features were then used in a prognostic analysis pipeline, where a classifier was trained to estimate survival probability and assess patient risk.

Results: MedSAM achieved the highest Dice Score (87.46%) and IoU (77.71%), outperforming other models in brain tumor segmentation from MRI images. For prognostic analysis, SVM was most effective in detecting high-risk patients, with an F1-score of 69.70% and an accuracy of 77.27%, enabling early identification of severe cases. XGBoost performed best for low-risk patients, with an F1-score of 65.08%, and an accuracy of 77.27%, supporting reliable risk assessment and personalized treatment planning.

Conclusion: This study confirms the effectiveness of combining traditional CNN-based architectures such as U-Net, DeepResUNet, VGG19 U-Net, and foundation models like SAM and MedSAM for brain tumor segmentation. Leveraging these hybrid networks, fine-tuning SAM and using MedSAM's model weights enables accurate and scalable tumor delineation. Integrating segmentation outputs into a survival prediction pipeline

demonstrates the important role of segmentation in supporting personalized brain cancer prognosis.

ID#26: Artificial Intelligence based CAD for Early Prostate Cancer Diagnosis and Classification

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Abstract

With the rapid advancement of deep learning technologies, computer-aided diagnosis (CAD) systems have evolved significantly, now leveraging deep neural networks capable of autonomously extracting the most informative features directly from raw magnetic resonance (MR) images. These sophisticated models eliminate the need for manual feature engineering, enabling more accurate and efficient image interpretation. In particular, deep learning-based CAD systems have shown outstanding performance in medical image classification tasks, contributing notably to the early detection and diagnosis of life threatening conditions such as prostate cancer, where timely intervention can significantly improve patient outcomes.

ID#27: Neuro-Symbolic Integration of Deep Learning and Association Rule Mining for Interpretable Analysis of HIV Protein Sequences

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Abstract

The high genetic variability of HIV-1, its rapid mutation rate, its ability to integrate into the DNA of the host and the persistence of latent viral reservoirs have challenged the development of drugs and vaccines. In this study, we proposed a neuro-symbolic framework that combines deep learning with association rule mining to uncover meaningful patterns in HIV-1 protein sequences. By leveraging the representational power of neural networks and the interpretability of symbolic reasoning via association rule mining, the method aimed to identify amino acid changes associated with drug resistance and disease progression. Our model used a convolutional network to encode viral protein sequences and simultaneously applied association rule mining to discover frequent amino-acid motifs associated with resistance phenotype. We applied our approach method to real HIV-1 protease/reverse-transcriptase (PR/RT)

sequence datasets from the Stanford HIV Drug Resistance Database with known resistance profiles.

The hybrid model leveraged the strength of neural networks in feature extraction with the interpretability of symbolic rules to produce a model that is both accurate and explainable.

Keywords: HIV; drug resistance; neuro-symbolic deep learning; association rule mining; model interpretability.

ID#28: Protection des professionnels de santé exposés aux rayonnements ionisants (RI) : cadre réglementaire et missions du médecin du travail

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Abstract

Le secteur médical a été le premier à utiliser les rayonnements ionisants (radiodiagnostic, radiothérapie), toutefois, ces derniers présentent beaucoup d'effets indésirables sur la santé du personnel professionnellement exposé.

Les effets biologiques dus aux RI peuvent être déterministes (effets immédiats) ou stochastiques (effets à long terme, comme le cancer).

Vu ces risques, il a été créé depuis 1928 une commission internationale de protection contre les rayonnements (CIPR) dans le but d'analyser les études et d'édicter des recommandations qui serviront de base aux différentes dispositions réglementaires.

La radioprotection se définit comme l'ensemble des mesures prises pour assurer la protection des travailleurs et leur environnement de travail contre les dangers de ces rayonnements ionisants (RI). Cette radioprotection s'impose puisque l'effet des doses d'exposition reçues tout au long d'une vie est cumulatif.

Dans cette présentation, nous allons exposer certains articles de la réglementation Algérienne qui encadre l'exposition professionnelle aux rayonnements ionisants :

- Décret présidentiel n° 05-117 du 11 avril 2005, relatif aux Mesures de protection contre les rayonnements ionisants.

- La signalisation particulière des zones réglementées (zone contrôlée et zone surveillée) et les conditions d'utilisation des dosimètres individuels détaillées dans l'Arrêté interministériel du 20 janvier 2011.

- Le rôle du médecin du travail dans la surveillance médicale des travailleurs exposés aux rayonnements ionisants (Arrêté du 10 novembre 2015) ainsi que les tâches

attribuées à la personne compétente en radioprotection (PCR) (Arrêté n° 50 du 02 Juillet 2016).

Les difficultés rencontrées par le médecin du travail dans l'application de ses missions seront également abordées.

ID#29: Deep Learning for Dose Prediction in Radiotherapy: A Comprehensive Review

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Abstract

Background: In the field of radiotherapy, precise prediction of dose distribution plays a central role for effective treatment planning and delivery. This critical stage, which traditionally relied on labor-intensive manual procedures, time consuming and expert knowledge, is now significantly improved using deep learning (DL) techniques.

Objectives: The objective of this review is to identify the most effective deep learning (DL) models for dose prediction in radiotherapy, and to extract information on the cancer types targeted, datasets employed, as well as the models' advantages, limitations, and overall performance.

Methods: This review is based on a selection of scientific publications focused on the application of deep learning (DL) techniques for dose prediction in radiotherapy. Studies published between 2019 and 2025 were identified through academic databases such as PubMed, IEEE Xplore, ScienceDirect and Google Scholar, using keywords including 'radiotherapy', 'dose prediction', and 'deep learning' …etc.

Results: Most of the reviewed methods were based on the U-Net architecture (CNN-based) and generative adversarial networks (GANs), which demonstrated the best performance in terms of prediction accuracy. Among the used architectures, 3D U-Net, HD U-Net, DoseGAN, and ACGAN have all shown promising results, each contributing uniquely to the advancement of dose prediction. A significant number of studies employed the Open Knowledge-Based Planning (OpenKBP) dataset containing CT images, structure contours, and dose distributions for head-and-neck cancer.

Conclusions: Deep learning has significantly advanced the accuracy and efficiency of dose prediction in radiotherapy, reducing reliance on manual processes and enabling more consistent treatment planning. These methods show promise for future use in clinical practice.

ID#30: Réinsertion professionnelle post-irathérapie chez une manipulatrice de radiologie

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Abstract

Introduction: Les rayonnements ionisants (RI) sont largement utilisés en milieu médical à des fins diagnostiques et/ou thérapeutiques. Leurs effets sur la santé peuvent survenir à court terme (effets déterministes) ou à long terme (effets aléatoires ou stochastiques).
Le secteur médical possède le plus grand nombre de travailleurs potentiellement exposés à ce risque physique. Nous rapportons le cas d'une manipulatrice de radiologie (exposition professionnelle aux rayons X) et qui a subi deux cures d'irathérapie suite à sa maladie. Le but de décrire ce cas, est de démontrer les difficultés rencontrées par le médecin du travail lors de la prise de décision d'aptitude de certaines catégories professionnelles.

Observation : Il s'agit d'une manipulatrice de radiologie, âgée de 32 ans, mariée et mère de 03 enfants et qui occupe ce poste dans un EPSP (établissement de santé de proximité) à Sétif depuis 2015. Elle a découvert un cancer de la thyroïde en août 2021 et a subi son ablation (thyroïdectomie) un mois après. Un curage ganglionnaire a été réalisé en octobre 2021. En novembre, la patiente a bénéficié d'une activité thérapeutique de 110 mCi d'iode 131 et d'un balayage corps entier au 3ème jour.
En juillet 2022, une deuxième cure d'une activité thérapeutique de 100 mCi d'iode 131 et un balayage toto-corporel post-thérapeutique au 3ème jour ont été réalisés.
Ce deuxième balayage n'a pas mis en évidence d'anomalies de fixation du radiotraceur sur l'ensemble des champs explorés. La patiente a bénéficié de trois ans de maladie longue durée, et est en invalidité depuis septembre 2024.

Conclusion : Le poste de manipulateur de radiologie expose de façon chronique aux rayons X et nécessite le suivi dosimétrique et le respect strict des règles de radioprotection. La combinaison de l'exposition aux rayons X (professionnelle externe) et de l'irathérapie (thérapeutique interne) devra obligatoirement être prise en compte par le médecin du travail lors de la visite de reprise de la patiente, notamment en ce qui concerne la dose cumulée reçue et les risques potentiels à long terme.

ID#31: The contribution of PET scan in the management of lung cancer

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Abstract

Background: The positron emission tomography (PET scan) provides a three-dimensional image of the distribution of a positron-emitting isotope. A combination of functional and morphological approaches produced by radiology, often using FDG (fluorodeoxyglucose).It has been used in thoracic oncology since the 2000s.

Objectives: to study the impact of PET scan on treatment decisions in lung cancers.

Methods: This was a prospective, analytical, epidemiological study of 21 patients with bronchial cancer, hospitalized in the Pulmonology department, university hospital center Saadna abdennour of Setif, from January 2016 to December 2018.

Results: All patients were male, with a median age at diagnosis of 59.75 years and 100% active smoking. According to the TNM classification, two patients were diagnosed at stage II A, nine at stage II B, and ten at stage III A. PET scans were carried out on an ambulatory basis by the patients using their own resources.

The treatment decision after an interdisciplinary consultation meeting was:

Surgery required after PET scan with chemotherapy and radiotherapy in 11 patients whose survival time was 2 years.

Conclusion: Although lung cancer remains the leading cause of cancer mortality worldwide, however, its treatment and prognosis have improved significantly since the introduction of PET scan.

Keywords: lung cancer; PET scan; TNM stage; prognosis

ID#33: A Hybrid Vision Transformer with LBP for Robust Facial Expression Recognition Using Local Texture Features

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Abstract

Background: Vision Transformers (ViTs) have recently shown strong performance in image classification tasks, leveraging self-attention mechanisms to capture global context. However, their reliance on raw pixel patches may limit the extraction of fine-grained texture details crucial for facial expression recognition and other nuanced visual tasks. Local Binary Patterns (LBP) is a powerful, handcrafted feature descriptor known for capturing local texture and spatial information.

Objectives: This study aims to enhance the Vision Transformer's ability to recognize facial expressions by integrating LBP features, hypothesizing that combining texture-based descriptors with ViT's global attention can improve classification accuracy compared to the basic ViT model.

Methods: We propose a hybrid model that fuses LBP texture information with the standard Vision Transformer pipeline. LBP features are extracted from input images and integrated at the embedding level, allowing the transformer to attend not only to raw pixel information but also to discriminative texture patterns. The rest of the ViT architecture remains unchanged. Both models were trained and evaluated under the same conditions using benchmark facial expression dataset namely Chon Kanade Plus (CK+).

Results: The baseline Vision Transformer achieved a macro average precision of 0.80, recall of 0.74, and F1-score of 0.73, with an overall accuracy of 75%. In comparison, the proposed ViT+LBP model achieved higher macro average values: 0.84 precision, 0.78 recall, and 0.77 F1-score, with an overall accuracy of 79%. These improvements indicate that incorporating LBP features enhances the model's ability to capture discriminative local textures, resulting in better generalization across all facial expression classes.

Conclusions: Integrating handcrafted texture descriptors such as LBP with Vision Transformers effectively complements global attention with local texture information, yielding superior performance in facial expression recognition tasks. This hybrid approach offers a promising direction for enhancing ViT models in applications requiring detailed texture analysis.

ID#34: Breast cancer recurrence prediction using machine learning

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Abstract

Background: Breast cancer remains one of the leading causes of cancer-related mortality among women worldwide. Despite advancements in early detection and treatment, recurrence poses a significant challenge. Accurate prediction of recurrence is critical for improving personalized treatment plans. In recent years, machine learning (ML) has demonstrated potential in enhancing predictive accuracy in oncology.

Objectives: This study aims to develop a machine learning-based predictive model to estimate breast cancer recurrence using publicly available clinical data.

Methods: We utilized a well-established open-access breast cancer dataset comprising clinical, demographic, pathological and imaging features. XGboost, as a supervised ML algorithm was evaluated. Model performance was assessed using cross-validation and standard metrics such as accuracy, precision, recall, and area under the ROC curve.

Results: The used ML algorithm achieved a high predictive performance, with an accuracy of 93% and an AUC of 0.82. Feature importance analysis revealed Tumor staging T, N and molecular subtype as key features for predicting breast cancer recurrence based on clinical data.

Conclusions: The results show the utility of machine learning in predicting breast cancer recurrence. Such models can support clinicians in risk stratification and decision-making. Future work may include hybridization of models using clinical data and imaging features.

Keywords: Breast cancer recurrence; Machine learning; XGboost; Predictive models.

ID#35: Connaissances en radioprotection du personnel expose aux rayonnements ionisants d'un centre hospitalo-universitaire algerien: evaluation qualitative

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Abstract

Introduction: L'usage des radiations ionisantes (RI), bien que nécessaire dans le domaine médical, comporte des risques prouvés pour la santé humaine, justifiant la mise en place d'un système de radioprotection. En Afrique, cette radioprotection reste préoccupante à cause d'un cadre réglementaire souvent inexistant ou inadéquat. Des études menées en Iran, en Europe, au Cameroun et en Tunisie ont mis en évidence un déficit important de connaissances en radioprotection chez les professionnels exposés, en lien avec un manque de formation. En Algérie, plusieurs études algériennes confirment cette carence. L'hôpital de notre terrain d'étude, possède un matériel radiologique exposant le personnel à un risque réel. La surveillance médicale y reste inférieure à 50%. Cela soulève la question suivante : ce faible taux est-il lié à un manque de connaissances en radioprotection ?

Objectif: L'objectif de cette étude est d'évaluer les connaissances du personnel en radioprotection et de formuler des recommandations pour leurs amélioration.

Matériels et méthodes : L'étude a ciblé le personnel exposé aux RI dans les services de radiologie et les blocs opératoire d'un hôpital dans l'est Algérien. Un questionnaire auto-administré a été utilisé auprès du personnel affecté de manière permanente ou occasionnelle.

Résultats et discussion: Sur 120 travailleurs des agents ciblés, 68 ont répondu au questionnaire (56.6%). La majorité des travailleurs qui ont participé à l'étude étaient les travailleurs des services de radiologie, 54.4% étaient des travailleurs de la catégorie A. Les résultats révèlent un déficit de connaissances, notamment sur la réglementation (94.12%) et les moyens de protection. Le taux de présence à la visite médicale périodique et régulière est de 39.7% qui représentent presque le tiers de la population.

Conclusion: Le déficit des connaissances, attribué principalement au manque du temps (63.4%) et à une faible application de la réglementation, explique le faible taux de surveillance médicale. Une meilleure formation et implication des employeurs est indispensable.

Mots clés: radioprotection, connaissances en radioprotection, personnel exposé aux RI.

ID#36: Évaluation des risques professionnels liés à l'exposition aux radiations ionisantes chez les femmes travaillant en radiothérapie

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Abstract

Introduction: Bien que les services de radiologie connaissent des progrès constants en matière d'équipement, l'évaluation des risques d'exposition professionnelle et la surveillance du personnel exposé demeurent problématiques. Dans ce contexte, cette étude a été menée pour évaluer l'état de santé des femmes exposées aux radiations ionisantes, examiner leur connaissance des risques auxquels elles sont confrontées et analyser les mesures de protection disponibles en radiothérapie.

Matériels et méthodes: Pour répondre à ces objectifs, une étude descriptive transversale a été réalisée au service de radiothérapie d'un centre anti-cancer, portant sur 20 praticiennes. La collecte des données s'est basée sur un questionnaire structuré comprenant les caractéristiques socioprofessionnelles du personnel, l'évaluation des mesures de protection en place et l'identification des pathologies présentes. L'analyse statistique des données recueillies a été effectuée à l'aide de Microsoft Excel.

Résultats : Les résultats de cette investigation révèlent plusieurs aspects préoccupants concernant la situation du personnel étudié. Plus de 80% du personnel ont une moyenne d'âge de 25 ans avec une durée de travail moyenne de 3 à 5 ans, exerçant exclusivement de jour pendant 5 à 10 heures. Les données indiquent que seulement 25% du personnel bénéficiait d'une classification selon les normes en vigueur, répartis entre 15% en catégorie A et 10% en catégorie B. Parallèlement, 65% avaient reçu une formation spécialisée et 85% bénéficiaient d'une surveillance médicale annuelle. L'évaluation des équipements de protection révèle une disponibilité satisfaisante des dosimètres pour 95% du personnel et des paravents fixes pour 80% d'entre elles. Sur le plan sanitaire, l'étude a mis en évidence que 30% du personnel présentaient des pathologies médicales, dominées par les affections dermatologiques représentant 20% de l'effectif total, suivies des antécédents de cancer chez 15% des praticiennes et de cancers actuels chez 5% d'entre elles, ainsi que l'anémie. Concernant les aménagements de travail, bien que 70% du personnel connaître leurs droits d'aménagement, seulement 25% en avaient effectivement bénéficié.

Conclusion : Cette étude met en évidence des lacunes critiques dans la protection et la surveillance du personnel féminin exposé aux radiations ionisantes en radiothérapie. Les défaillances identifiées appellent à des mesures correctives urgentes et ciblées.

Mots-clés : Radiations ionisantes, exposition professionnelle, radioprotection, personnel féminin.

ID#38: Simulation of Plasmonic Nanoantenna Arrays for Intracellular Sensing

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Abstract

Monitoring biochemical activity within living cells is crucial for early disease diagnostis. Traditional imaging methods, such as fluorescence labeling, often interfere with cell behavior and are unsuitable for continuous observation. This has led to growing interest in alternative, non-invasive approaches.

ID#39: Deep Learning Approaches In Nuclear Imaging: A Systematic Review In Recent Decade

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Abstract

Background: Nuclear medicine imaging (NMI) is an important diagnostic modality in modern medicine, and plays a central role in the diagnosis, detection, and monitoring of various diseases, including cancer, cardiovascular disease, neurological diseases, and endocrine abnormalities. Using small amounts of radioactive tracers (radiopharmaceuticals) that produce gamma rays, NMI techniques such as positron emission tomography (PET) and single-photon emission computed tomography (SPECT) provide functional and molecular data on disease processes early in their development, often before structural changes can be seen on conventional imaging modalities such as X-rays or MRI. This enables precise disease characterization, treatment planning, and therapeutic response assessment, making NMI invaluable in precision and personalized medicine.

Objectives: This paper aims to systematically review the application of deep learning (DL) in NMI, focusing on its role in enhancing diagnostic accuracy, efficiency, and workflow automation. Key objectives include evaluating DL algorithms for image reconstruction, disease detection, and quantification in PET and SPECT, assessing methodological rigor across studies, and identifying gaps in validation and clinical integration. By synthesizing evidence from peer-reviewed literature, this work seeks to provide a comprehensive resource for researchers and clinicians leveraging AI in nuclear medicine.

Methods: This systematic review adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure methodological rigor, transparency, and reproducibility. Relevant studies were identified through structured database searches, followed by screening, eligibility assessment, and data extraction.

Bibliometric analysis and keyword co-occurrence mapping were performed using VOSViewer software to visualize research trends and collaborations in DL applications for NMI.

Results: The systematic review analyzed several studies, revealing that DL significantly enhances NMI in tasks such as image classification, lesion detection, and quantitative analysis. VOSViewer bibliometric analysis highlighted key research clusters, with convolutional neural networks (CNNs) and transformer models dominating recent advancements. However, variability in validation protocols and limited clinical translation were identified as major challenges in the field.

Conclusions: This systematic review demonstrates that DL holds significant potential to enhance NMI, yet standardized validation and clinical integration remain critical challenges. Future research should prioritize robust, multi-center studies to bridge the gap between AI innovation and real-world clinical adoption.

ID#40: Contrôles qualité des TEPSCAN

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Abstract

Le Centre Hospitalo Universitaire de Bab El Oued est doté de deux TEP/SCAN : appareil d'imagerie médicale qui permet d'observer le métabolisme cellulaire en temps réel (imagerie moléculaire) en injectant un produit radiopharmaceutique produit au niveau du centre (18FDG et 68Ga-peptides)

Pour assurer la fiabilité des résultats de ces appareils et garantir leur conformité ;des contrôles qualité sont réalisés périodiquement (quotidien, mensuel et annuel).

L'objectif de ce travail est de mettre en évidence l'importance des contrôles qualité des TEPSCAN conformément aux normes d'assurance qualité.

ID#41: Radiobiology-Informed Dosimetry for Personalized Nuclear Medicine Therapy

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Abstract

Therapeutic nuclear medicine relies mainly on standardized activity prescriptions derived from clinical trials, without fully accounting for inter-patient biological variability. The objective of this work is to highlight the integration of radiobiological parameters into patient-specific dose calculations. Methodologically, we propose to

collect individual biokinetic data, including serial measurements of activity in target and critical organs following radionuclide administration. These data allow estimation of time–activity curves and residence times, which are then combined with radiobiological models to calculate the Biological Effective Dose (BED). Parameters such as the Lea–Catcheside factor and the α/β ratio are incorporated to correct for variations in dose rate and exposure time. This approach enables the definition of BED-based tolerance limits for sensitive tissues, ensuring both therapeutic efficacy and biological safety. Preliminary analysis demonstrates that two patients receiving the same administered activity in MBq may exhibit different treatment outcomes due to variations in uptake, clearance, or α/β values. By moving beyond purely physical dosimetry, this methodology provides a more accurate representation of treatment effectiveness and supports the development of personalized and fair protocols in radionuclide therapy.

ID#42: Validation of Li-CHx thin target for high dose distribution in LPA.

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Abstract

This work focuses on optimizing the Spread-Out Bragg Peak (SOBP) dose distribution in laser-plasma acceleration based proton therapy using the Target Normal Sheath Acceleration (TNSA) mechanism. The objective was to design and implement a complete approach, from target fabrication to beam dose optimization, adapted to specific tumor characteristics.

The methodology integrates three main stages. First, double-layer Li-CH_x target were fabricated at the CDTA using Pulsed Laser Deposition (PLD), allowing precise control over composition and thickness to enhance proton yield. The specific properties of these targets required an adaptation of the semi-analytical TNSA model, in which laser parameters: intensity, pulse duration, and spot size were optimized to maximize both proton energy spectrum and particle flux. These optimized proton spectra were then used as input for Monte Carlo simulations performed with GATE/Geant4 to model the SOBP formation and evaluate its conformity to tumor volume requirements.

Results show that selecting lightweight targets with optimized thickness, coupled with finely tuned laser parameters, significantly improves both the depth and uniformity of the delivered dose. The integrated target model simulation workflow demonstrates the potential of this approach to enhance clinical applicability of laser-plasma acceleration proton therapy, making it more adaptable and efficient for patient specific treatments.

ID#43: Quantum Holography Imaging

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Abstract

Quantum holography uses entangled photons to create ultra clear, noise free 3D images, offering a safer, non-invasive alternative to classical methods especially promising for advanced medical imaging and future quantum technologies.

ID#44: In the Fight against Nasopharyngeal Carcinoma, Which Wins: Sequential or Integrated Boost?

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Abstract

This report presents a detailed comparison of two radiotherapy plans for a single patient with nasopharyngeal carcinoma, treated using Volumetric Modulated Arc Therapy (VMAT) on a Trilogy machine. The patient was treated with a total dose of 70 Gy in 35 fractions, with a prescribed dose of 2 Gy per fraction. The plans compared are the Integrated Boost (IB) plan and Sequential boost (SB) plan.

ID#45: Impact des innovations des 4P (Produit, Processus, Positionnement, Paradigme) sur la performance des techniques d'imagerie en médecine nucléaire

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Abstract

Résumé: L'imagerie en médecine nucléaire est un domaine essentiel de la santé moderne, nécessitant des innovations technologiques et méthodologiques constantes pour améliorer la précision diagnostique et les résultats thérapeutiques. Le

cadre des 4P de l'innovation — Produit, Processus, Positionnement et Paradigme — offre une approche globale pour analyser l'impact des innovations.

Objectifs: Cette étude vise à analyser comment les innovations dans les dimensions des 4P améliorent la performance des techniques d'imagerie en médecine nucléaire, en mettant l'accent sur la précision diagnostique, l'optimisation des doses de radiation et l'intégration de l'intelligence artificielle.

Méthodes: Une revue qualitative et quantitative des avancées récentes en imagerie médicale nucléaire a été réalisée, analysant des cas d'études et essais cliniques illustrant les améliorations des produits (nouveaux dispositifs et traceurs), des processus (protocoles d'acquisition et reconstruction), du positionnement (applications cliniques et industrielles) et des paradigmes (intégration de l'IA et de la radiomique).

Résultats: Les innovations produits ont permis une meilleure résolution spatiale et sensibilité. Les innovations processus ont optimisé les protocoles, réduisant l'exposition aux radiations des patients. Le repositionnement stratégique a étendu les applications à la thérapeutique (théranostique). Les changements de paradigme, notamment l'IA et la radiomique, ont significativement amélioré l'analyse d'images et la prise de décision.

Conclusions : Le cadre des 4P permet de saisir efficacement les multiples améliorations qui font évoluer l'imagerie en médecine nucléaire. L'adoption d'innovations dans ces quatre dimensions est essentielle pour maximiser la performance clinique et les résultats pour les patients.

Mots-clés: Innovation ; Imagerie en médecine nucléaire ; Cadre 4P ; Intelligence artificielle ; Optimisation de la performance.

ID#46: Artificial Intelligence in Ophthalmic Image Processing: Advances and Challenges

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Abstract

Background: Ophthalmology is a medical specialty that relies heavily on imaging techniques for the diagnosis, monitoring, and treatment of ocular diseases. Structures such as the retina, optic nerve, and cornea can be visualized in high detail using modalities like retinography, Optical Coherence Tomography (OCT), and fluorescein angiography(FA). Traditionally, the interpretation of these images has been performed manually by ophthalmologists. However, this process can be subjective, time-consuming, and prone to inter-observer variability. To address these limitations, digital image processing and artificial intelligence (AI) have been increasingly integrated into ophthalmology to provide objective, reproducible, and automated analysis tools.

Objectives:The primary goal of ophthalmic image processing is to enable early detection of eye diseases, many of which are asymptomatic in their initial stages but can lead to irreversible vision loss if not treated in time.

Methods: Advanced image analysis techniques allow for:

- Segmentation of ocular structures (e.g., blood vessels, optic disc, macula),
- Detection of pathological features (e.g., microaneurysms, exudates, hemorrhages),
- Classification of diseases (e.g., diabetic retinopathy, glaucoma, age-related macular degeneration).

Results: Although final results are pending, we expect that image processing and AI techniques will show strong performance in segmenting ocular structures, detecting pathological features, and classifying diseases. These methods are anticipated to improve diagnostic accuracy, reduce variability, and support earlier detection of vision-threatening conditions.

Conclusions: In summary, ophthalmic image processing represents a major advancement in precision medicine, offering fast, standardized, and often more sensitive analysis of ocular images—improving both clinical outcomes and healthcare efficiency.

Keywords: Ophthalmic image- Imaging treatment- segmentation- Artificial intelligence.

ID#47: Real-Time Imaging for Beam Control in Hadrontherapy

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Abstract

Background: Hadrontherapy allows for highly precise radiation dose delivery due to the characteristic Bragg peak of charged particle beams, which enables accurate dose deposition at a defined depth. However, anatomical changes or patient motion during treatment can introduce uncertainties that may compromise the precision and safety of dose delivery.

Objectives: This study explores both current and emerging methods for real-time, in vivo monitoring of dose deposition in particle therapy, aiming to enhance treatment precision and adapt more effectively to clinical challenges.

Methods: This study offers a review of key technologies developed to support evidence-based approaches for real-time verification of beam range and dose delivery in particle therapy. It highlights several monitoring modalities, including prompt gamma imaging (PGI), in-beam positron emission tomography (PET), and ionoacoustic imaging — a technique that detects acoustic signals generated by the unique energy deposition patterns of ion beams.

Results: Each monitoring technique demonstrates unique advantages: PGI enables high-temporal-resolution range verification during irradiation, in-beam PET allows for post-treatment visualization of dose distribution, and ionoacoustic imaging provides spatially precise localization of Bragg peak regions. Nonetheless, their integration into real-time hadrontherapy workflows is constrained by current limitations in spatial resolution, acquisition latency, and the ability to accurately interpret signals in anatomically complex regions.

Conclusions: Real time dose monitoring modalities are important parts of the process of reducing the uncertainties that underpins hadrontherapy processes and the potential they offer. The integration of these processes into clinical practices in service the necessities of growing and recovering patient population really needs to stimulated as real-time monitoring applications, particularly are patiently and clinically stimulating.

Keywords: Hadrontherapy, real-time imaging, beam control.

ID#48: Neurological solution using AI applied to Dyslexia

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Abstract

The idea was to solve the dyslexic problem using deep brain stimulation because the dyslexia is a neurological condition must be treated with a neurological procedure using AI. The procedure known as deep brain stimulation is used for more than 15 years to treat movement disorders, such as parkinson's disease in that case they're targeting the brain's motor system. It's used also to target Area 25 for patients with severe depression. Talking about Areas, a German neurologist Korbinian Brodman mapped the cerebra cortex into 52 distinct regions based on the cytoarchitecture the cellular composition and organisation of the brain's cortex. The spect scan of neural system for reading in the brain's left hemisphere shows the Broca's area (BA 44,45) (word analysis) is larger in size for Dyslexic brain, besides the week connection between the parieto-temporal (sound analysis)(auditory cortex) and occipito-temporal (word form) (visual cortex) , those two areas are not activated in the dyslexic brain and that

week connection causes struggling with letter-sound Mapping and then reading influently. AI helps better understand the disease process on molecular level, how can we create technology that can help people really meaningfully contribute with all sorts of abilities.

ID#49: Dosimetric Evaluation of Custom 3D-Printed Boluses for Surface Tumors

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Abstract

Background: Accurate surface dose delivery is essential in modern radiotherapy, particularly when treating superficial tumors such as those found in the breast, head, or pelvic regions. These tumors often require the use of a bolus—a tissue-equivalent material placed on the skin surface to ensure that the prescribed dose reaches the tumor effectively. However, conventional boluses frequently fail to conform to the patient's anatomical surface, especially in areas with complex contours. This leads to the creation of air gaps between the skin and the bolus, resulting in dose uncertainty and a potential reduction in treatment effectiveness.

Objectives: This study aims to evaluate and validate the dosimetric accuracy, surface conformity, and clinical reliability of 3D-printed, patient-specific boluses made from thermoplastic polyurethane (TPU).

Methods: Three clinical sites were selected: frontal region, breast region, and inguinal area. Using CT data of RANDO phantom, customized boluses were modeled and printed. Dosimetric planning was performed using two treatment planning systems (TPS): Eclipse and Monaco. Each plan was evaluated using key dosimetric parameters including D98%, D95%, D50%, D2%, mean dose, homogeneity index (HI), and conformity index (CI). The fit of the bolus to the phantom was verified via post-placement CT scans.

Results: The results showed a high degree of agreement between the dose distributions using virtual TPS-generated boluses and the physical 3D-printed ones. For example, the CI reached 0.998, indicating nearly perfect conformity, and the HI ranged between 0.05 and 0.15, confirming excellent dose homogeneity. Air gaps were virtually eliminated.

Conclusions: 3D-printed boluses provide a reliable, accurate, and customizable alternative to traditional bolus materials, offering superior surface fit and consistent dose delivery for superficial radiotherapy treatments.

Keywords: 3D-printed bolus; Surface dose accuracy; Patient-specific bolus; Radiotherapy conformity

ID#50: Le risque d'exposition radiologique en médecine dentaire : étude technique, comportementale et dosimétrique

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Abstract

Background: Le manque de données sur le risque d'exposition d 'origine professionnelle chez les médecins dentistes nous a incité à réaliser cette étude qui vise les dispositifs radiogènes, les locaux d'installation et les manipulateurs. Une étude dosimétrique a été réalisé et un bilan de radioprotection a été élaboré.

Objectives: L'objectif de l'étude était d'évaluer les facteurs de risque d'exposition radiologique en médecine dentaire.

Methods: Il s'agit d'une étude transversale descriptive, exhaustive au niveau des structures de médecine dentaire de la commune d'Oran, de novembre 2017 à février 2018. Elle concernait 154 dispositifs de radiologie, implantés dans 114 locaux. Des mesures dosimétriques ont été réalisées chez 198 manipulateurs selon un protocole standard, des points ont été ciblés pour l'emplacement des Geiger Muller préalablement étalonnés. Ces derniers ont été fixés au niveau de thorax, au niveau de la main manipulatrice et au niveau de l'œil (organe biologiquement très radiosensible).

Results: La majorité de dispositifs ne sont ni déclarés auprès des instances responsables, ni contrôlés par des personnes qualifiées. La majorité des locaux d'installation ne sont pas conformes aux règles de radioprotection. Les doses enregistrées dépassaient le seuil tolérable réglementaire chez 43 manipulateurs. Le positionnement des manipulateurs par rapport aux dispositifs radiologiques notait dans le secteur d'activité un OR de 2,76 [1,09-6,99], le sexe avec un OR de 2,48 [1,18-5,19], l'ancienneté avec un OR de 1,99 [0,99-4,02] et l'âge avec un OR de 0,55 [0,28-1,12], étaient significativement liés au risque d'exposition radiologique.

Conclusions : Le bilan présenté contribue à l'identification des facteurs du risque d'exposition radiologique observés en dentisterie. Ces résultats nous incitent à

sensibiliser les médecins dentistes à l'usage des moyens de radioprotection afin de réduire ce risque. Il est temp d'établir une stratégie, de programmer des actions et de responsabiliser les acteurs dans le domaine médico-dentaire.

Keywords : Dispositif radiologique, Radioprotection, Dose, Risque.

ID#51: Risques professionnels et radioprotection dans les services d'imagerie médicale et de médecine nucléaire

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Abstract

Introduction: Les professionnels exposés aux rayonnements ionisants dans les services d'imagerie médicale et de médecine nucléaire sont confrontés à des risques spécifiques, tant physiques que psychosociaux. L'exposition chronique, les contraintes organisationnelles et le stress lié à la sécurité radiologique constituent des enjeux majeurs en santé au travail.

Objectifs: Évaluer les principaux risques professionnels en médecine nucléaire et en radiologie interventionnelle en mettant l'accent sur la dosimétrie, la charge mentale, et les stratégies de radioprotection ainsi qu'identifier les défaillances organisationnelles influant sur la sécurité des opérateurs.

Méthodes: Une revue de la littérature scientifique a été menée sur les dix dernières années (2015–2025) à partir de bases de données comme PubMed et ScienceDirect. Les publications retenues concernent à la fois la dosimétrie professionnelle, le vécu du personnel.

Résultats: Les données montrent que malgré les normes internationales, une exposition significative persiste, en particulier chez les manipulateurs, les radiologues interventionnels et le personnel de médecine nucléaire, le stress professionnel ainsi que le manque de formation continue et l'inadéquation des équipements de protection sont des facteurs aggravants. Les taux d'exposition dépassent les seuils annuels dans certains contextes, surtout en absence de surveillance dosimétrique stricte.

Discussion: Une approche multidisciplinaire intégrant médecine du travail, physique médicale et ingénierie hospitalière est indispensable. La formation en radioprotection, la culture de sécurité et l'évaluation régulière des postes de travail doivent être systématisées pour prévenir les effets sanitaires à long terme.

Conclusion: La prévention des risques liés aux rayonnements ionisants représente un enjeu majeur de santé publique, le rôle du médecin du travail est central pour évaluer les risques, recommander des mesures préventives et promouvoir une culture de sécurité radiologique.

ID#52: Clinical Evaluation of Automatic Brain Segmentation in CT Images

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Abstract

Background: Le manque de données sur le risque d'exposition d 'origine professionnelle chez les médecins dentistes nous a incité à réaliser cette étude qui vise les dispositifs radiogènes, les locaux d'installation et les manipulateurs. Une étude dosimétrique a été réalisé et un bilan de radioprotection a été élaboré.

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Conclusions: Le bilan présenté contribue à l'identification des facteurs du risque d'exposition radiologique observés en dentisterie. Ces résultats nous incitent à sensibiliser les médecins dentistes à l'usage des moyens de radioprotection afin de

réduire ce risque. Il est temp d'établir une stratégie, de programmer des actions et de responsabiliser les acteurs dans le domaine médico-dentaire.

Keywords: Dispositif radiologique, Radioprotection, Dose, Risque.

ID#53: AgenticRad: A Task-agnostic framework for automated and autonomous radiotherapy workflows

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Abstract

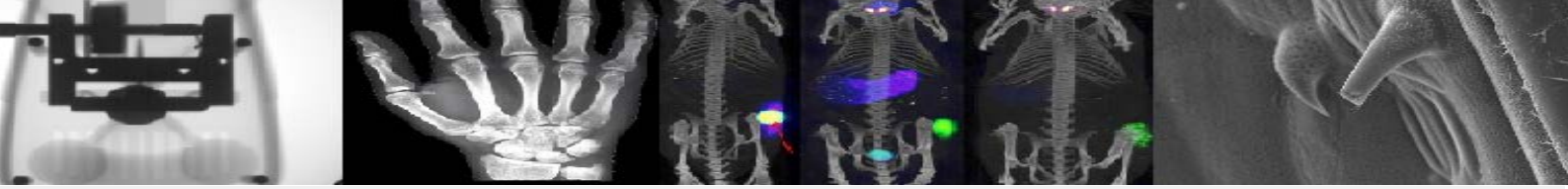
Background: Heterogeneous radiotherapy (RT) datasets and toolchains limit reproducibility and slow translation of general-purpose AI into clinical RT workflows. Objectives: To create a unified, extensible platform that standardizes heterogeneous radiotherapy (RT) data and orchestrates end-to-end, automated workflows—serving both research and prototype clinical automation.

Methods: AgenticRad ingests multi-modal imaging (CT, CBCT, MRI, PET) and DICOM-RT objects (RTSTRUCT, RTPLAN, RTDOSE, REG), harmonizing them into structured JSON sidecars. A modular agentic layer provides automatic data loading, registration, segmentation, image-to-image synthesis, dose calculation, and plan analytics. The GUI integrates 2D/3D viewers, advanced visualization, and analysis tools (DVHs, gamma, rendering), with built-in provenance and automation. Foundation models, LLMs, and VLMs can directly interact with the framework through standardized APIs, enabling real-time, multi-task orchestration.

Results: Early results demonstrations across public datasets show feasibility for automated pipelines supports both reproducible research and prototyping of real-time, automatic RT workflows

Conclusions: AgenticRad is a framework that unifies RT data harmonization, visualization, and automation within an agentic architecture. Beyond research, it represents a step toward software-driven, autonomous radiotherapy workflows, accelerating translation of foundation models into clinical contexts.

Keywords: Radiotherapy automation, DICOM-RT, agentic AI, registration, segmentation, dose analysis, CBCT, MRI, foundation models, workflow orchestration



The Third International Conference and School on Radiation Imaging and Nuclear Medicine (ICSRI-2025) will be held from 12–16 October 2025 at Ferhat Abbas–Sétif 1 University (UFAS1), Algeria, in partnership with the Algerian Atomic Energy Commission (COMENA) and its research centres. Building on the success of the first two editions, this conference continues to serve as an international platform where researchers, practitioners, and students come together to share knowledge, present recent advances, and explore future directions in radiation imaging, nuclear medicine, and related scientific domains.

The 2025 conference program features keynote lectures by leading experts and technical sessions covering diverse topics such as radiation detectors and imaging modalities, computational simulations in radiation imaging, image reconstruction and processing, and clinical applications of nuclear techniques..

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