Artificial Intelligence for neurosurgery in Spain

- A Data-Centric Approach to Deep Learning for Brain Metastasis Analysis at MRI
- Current Concepts on Imaging and Artificial Intelligence of Osteosarcopenia in the Aging Spine - A Review for Spinal Surgeons by the SRS Adult Spinal Deformity Task Force on Senescence
- Evaluation of techniques for automated classification and artery quantification of the circle of Willis on TOF-MRA images: The CROWN challenge
- Multinational Attitudes Toward AI in Health Care and Diagnostics Among Hospital Patients
- Use of artificial intelligence in the management of stroke: scoping review
- AI-Driven Advances in Parkinson's Disease Neurosurgery: Enhancing Patient Selection, Trial Efficiency, and Therapeutic Outcomes
- Global, Regional, and National Burden of Nontraumatic Subarachnoid Hemorrhage: The Global Burden of Disease Study 2021
- SLIMBRAIN database: A multimodal image database of in vivo human brains for tumour detection

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Here are some notable institutions and projects in Spain that are integrating AI into neurosurgery and related fields:

Hospital Clínic de Barcelona:

Known for its advanced research in neurosurgery and the use of AI in various aspects of patient care. The hospital has been involved in projects focusing on AI for imaging and predictive analytics in neurosurgery. Hospital Universitario La Paz (Madrid):

This hospital is part of various research initiatives exploring the use of AI in neurosurgery, including improving surgical planning and postoperative monitoring. Barcelona Supercomputing Center (BSC):

BSC collaborates with medical institutions to apply AI and high-performance computing in healthcare. Their projects include using AI for analyzing complex medical images and enhancing diagnostic tools. Instituto de Salud Carlos III (ISCIII):

A major research institution in Spain that supports various projects involving AI in healthcare. They are involved in funding and coordinating research that includes AI applications in neurosurgery. Hospital Universitario de la Ribera (Alzira):

This hospital has been working on AI projects related to improving surgical precision and patient outcomes through the use of advanced imaging and data analysis tools. Fundación Teófilo Hernando:

Focuses on innovation in medical technology, including AI applications in neurosurgery. They support research and development in this field to advance surgical techniques and patient care. These institutions and projects highlight Spain's active role in integrating AI into neurosurgery and related fields, contributing to advancements in medical technology and patient care.

Department of Neurosurgery, Río Hortega University Hospital, Spain.

In this work, a method was developed and evaluated that classifies the OS into three classes - “short”, “medium” and “long”. For this purpose, the four MRI sequences of a person were corrected using bias-field correction and merged into one image. The pipeline was realized by a bagging model using 5-fold cross-validation and the ResNet50 architecture.

Results: The best model was able to achieve an F1-score of 0.51 and an accuracy of 0.67. In addition, this work enabled a largely clear differentiation of the “short” and “long” classes, which offers high clinical significance as decision support.

Conclusion: Automated analysis of MRI scans using deep learning-based image classification has the potential to enable accurate OS prediction in glioblastomas. [1)]

The study represents a promising step towards using AI for predicting glioblastoma patient survival based on MRI data. While the approach is innovative and the clinical relevance is high, the moderate performance metrics, lack of detailed analysis on class imbalance, and model interpretability issues highlight areas for further development. Future work should focus on improving model accuracy, addressing class imbalance, and enhancing the interpretability of predictions to facilitate clinical integration.

5: García-García S, Cepeda S, Arrese I, Sarabia R. A Fully Automated Pipeline Using Swin Transformers for Deep Learning-Based Blood Segmentation on Head Computed Tomography Scans After Aneurysmal Subarachnoid Hemorrhage. World Neurosurg. 2024 Aug 5:S1878-8750(24)01357-3. doi: 10.1016/j.wneu.2024.07.216. Epub ahead of print. PMID: 39111661.

The study presents a promising fully automated tool for blood segmentation in SAH patients, utilizing advanced transformer-based deep learning architecture. The high accuracy, robustness, and potential for real-time application are significant strengths. However, considerations regarding computational demands, clinical integration, and comparative analysis with existing methods would enhance the understanding of the model's practical utility and limitations. Further research and validation across diverse clinical settings are necessary to fully establish the tool's reliability and effectiveness in routine practice.

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