

Differentiation between contrast extravasation and hemorrhagic transformation in tomography of acute ischemic stroke after thrombectomy with artificial intelligence

Authors

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Background and Aim

Mechanical Thrombectomy (MT) treats Acute Ischemic Stroke (AIS) removing the thrombus, and improves clinical outcome. However, it uses high quantities of contrast, with risk of Contrast Extravasation (CE), but also Hemorrhagic Transformation (HT), both detected by cranial Computed Tomography (CT). However, to differentiate between them, it is necessary to perform a control CT 72 hours after MT. This study aims to develop a tool capable of differentiating HT from EC in cranial CT.

Methodology

398 CTs were classified into four classes: TH, CE HT with CE, and without HT nor CE. We selected 111 CT performed until 72 hours after angiogram+MT, segmented the images with 3DSlicer. Then, we had 2 approaches: 1) Three classification models were developed based on phenotypic characteristics: Support Vector Machines (SVM), Random Forest (RF) and Logistic Regression (LR); 2) The U-Net, a Convolutional Neural Networks (CNN) model for biomedical image segmentation.

Results

SVM and RF had ROC AUC above 92% for the three classes. Cross-validation demonstrated good accuracy (SVM=0.947±0.064; RF=0.893±0.076; LR=0.956±0.048) and macro-precision (SVM=0.947 ± 0.066. RF=0.901±0.075, LR=0.956±0.049). The U-Net also presented good predictive performance after cross-validation: ROC AUC above 98% for the three classes, accuracy=0.956±0.072 and macro-precision=0.965±0.055.

Conclusion

In this study, we developed a tool with high performance to distinguish between CE and HT with two different approaches, which could help in clinical decision-making, such as introduction of anticoagulants and antiaggregants.