

ON-LINE APPENDIX

Local Feature Extraction

Gaussian curvature, K ,²⁴ is an extrinsic measure defined as the product of the 2 principal curvatures at each point in the 3D ROI. It quantifies the rate of deviation between one surface and another and is invariant under distance-preserving changes. The mean curvature H is an intrinsic measure of curvature that concerns the differential relationship between different points on the surface.²⁴ It is defined as the mean of the 2 principal curvatures. A total of 4 surface measures are derived from Gaussian and mean curvatures. The first one is a measure of curvature degree, also called curvedness (C), which captures flat regions in the surface with low curvedness values and regions of sharp curvature having high curvedness. The second is a measure of sharpness degree (S), which measures the sharpness of the curvature by relating the mean curvature H to the actual surface. The third measure is the shape index (SI), a number ranging from -1 to 1 that provides a continuous gradation between shapes. It is sensitive to subtle changes in surface shape, particularly in regions where total curvature is very low. For instance, hollow structures have a shape

index of <0 , and inflections and bumps have a shape index of >0 . Finally, a measure of the total curvature (K_T) was computed to obtain the absolute value of the total curvature at each surface voxel.

The 2 principal curvatures for each point on the surface are the following:

$$P_1 = H + \sqrt{H^2 - K},$$

$$P_2 = H - \sqrt{H^2 - K}.$$

The 4 local measures derived from mean and Gaussian curvatures in this work are the following:

$$\text{Curvedness } C = \frac{\sqrt{P_1^2 + P_2^2}}{2},$$

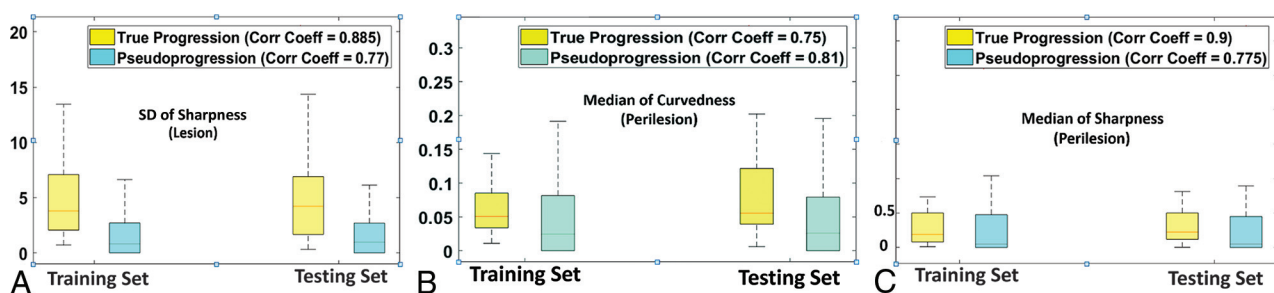
$$\text{Sharpness } S = (P_1 - P_2)^2,$$

$$\text{Shape index } SI = \frac{2}{\pi} \times \arctan\left(\frac{P_1 + P_2}{P_1 - P_2}\right),$$

$$\text{Total curvature } K_T = |P_1| + |P_2|.$$

On-line Table: Description of the 14 global features extracted from enhancing lesion and T2WI/FLAIR hyperintense perilesional compartments

Feature Name	Description
Volume	No. of voxels that compose the shape
Integrated intensity	Sum of the intensity values within the labels of the shape
Elongation shape factor	Square root ratio of the 2 second moments (largest eigenvalues of second-order moments covariance matrix)
Eccentricity	A number that uniquely characterizes the shape of the object (eg, a circle has 0 eccentricity; an ellipse has a value between 0 and 1)
Major axis	The longest diameter of the shape
Minor axis	The shortest diameter of the shape
Elongation	Fraction of major and minor axes
Orientation	The shape orientation angle measured in radians (the angle that is formed between the x-axis and the major axis of the object)
Perimeter	The distance around the outside edge of the object
Roundness	Measure of how the shape is close to a sphere (sphere has a roundness value of 1)
Equivalent spheric radius	Radius of a sphere of an equivalent volume to the shape
Equivalent spheric perimeter	The volume of the sphere that has a radius of the equivalent spheric radius (sphere that is equivalent to the shape)
Flatness	Ratio of first and second moments
Tumor compactness	Ratio between the volume and the surface area of the shape



ON-LINE FIGURE. Boxplots for 3 top features (A, B, C) of the enhancing lesion and T2WI/FLAIR hyperintense perilesional areas for true progression and pseudoprogession cases across the training and testing sets. The boxplots and the reported coefficients reflect consistency in segmentations across the 2 sites as well as the stability of the extracted shape features. Corr Coeff indicates correlation coefficient.