**Appendix S4: ICTOS calculation formula**

After feature selection, skewness, variance from GLCM (GLCM\_variance), and Long Run High Gray Level Emphasis from GLRLM (GLRLM\_LRHGLE) were identified by a multivariable Cox proportional hazards model using the modified covariate method. Skewness is a measure of the direction and degree of skewness of statistical data distribution. GLCM\_variance and GLRLM\_LRHGLE reflect the tumor’s texture.

The ICTOS model could be obtained using:

, where skewness was obtained from the first order statistics; and GLCM\_variance and GLRLM\_LRHGLE are texture features filtered by XLH. The three features were all derived from the contrast enhanced T1-weighted images and were standardized by the z-score method (mean and standard deviation of skewness: -0.829 and 0.449, GLCM\_variance: 10.373 and 1.396, GLRLM\_LRHGLE: 588.932 and 56.297).

Detailed definitions of the selected features are as follows:

Let:

*X* denote the three dimensional image matrix with *N* voxels,

be the GLCM for distance and direction (0o, 45o, 90o, 135o),

be the number of discrete intensity levels in the image,

be the mean of ,

be the th entry in the given GLRLM for a direction (0o, 45o, 90o, 135o),

be the number of different run lengths.

**Skewness:**

where is the mean of *X*.

**GLCM\_variance:**

**GLRLM\_LRHGLE:**