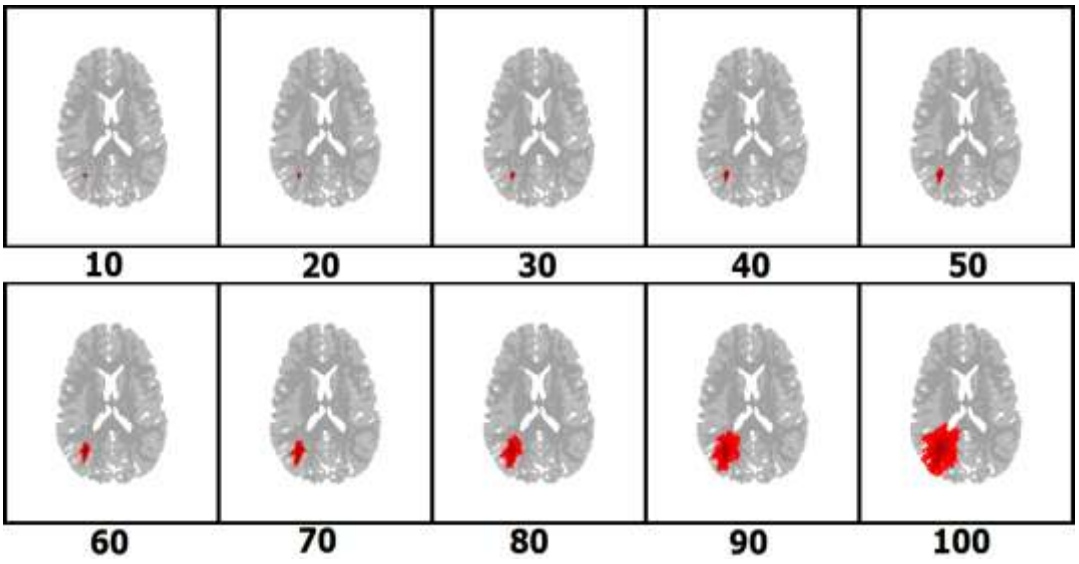
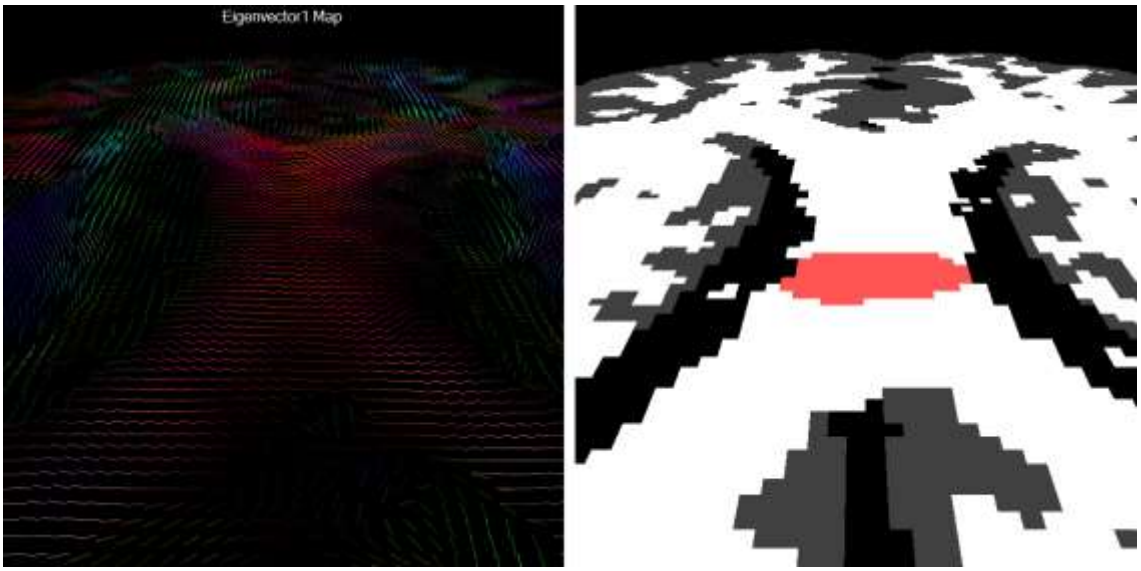
Tumor Growth Simulation Utility

(TG-SU)

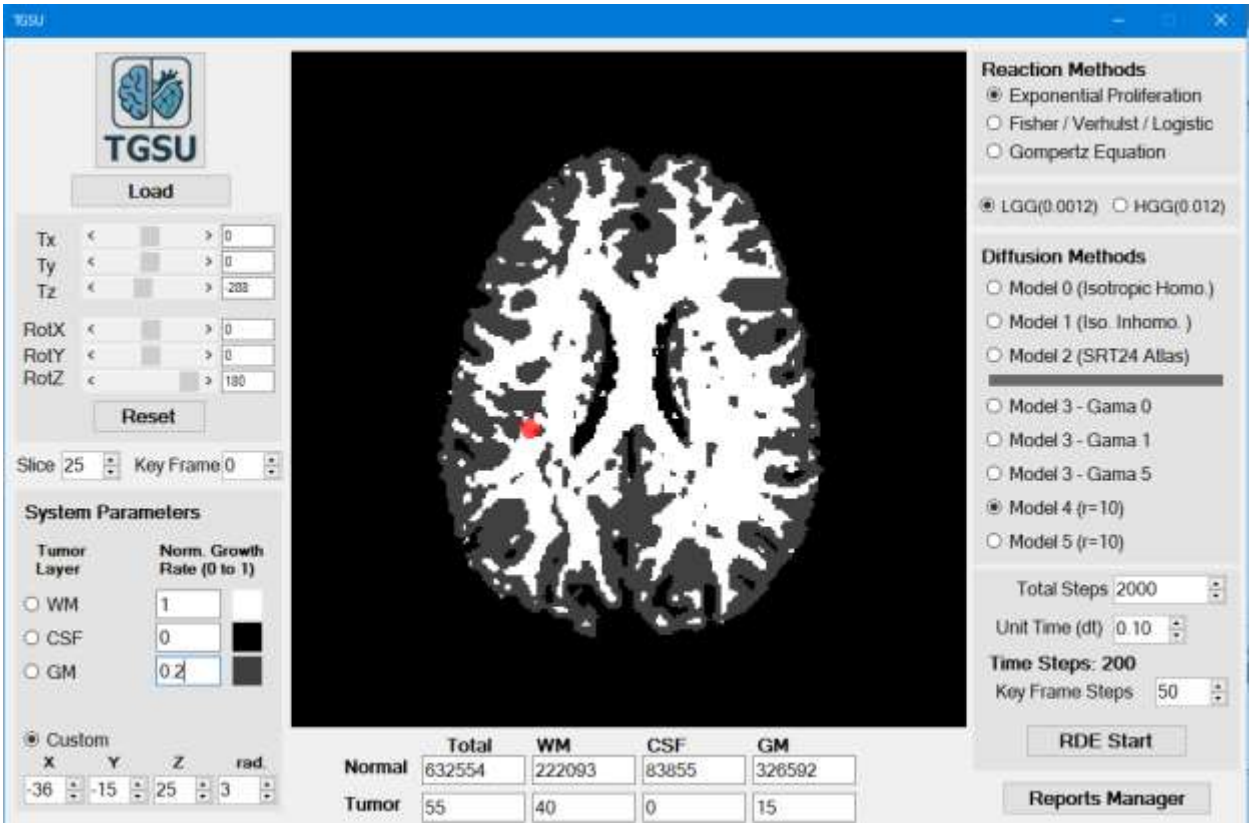
Developed by: Ihab ELAFF (2025)

One Click to Simulate Tumor Growth





1 – Main Interface:



Loading the File: Just load SEG file that is generated by MIS-U application and then you are ready to go.

Normalized Growth Rate : Specify growth rate for each layer (For Brain: WM = 1, CSF = 0 and GM = 0.2).

Tumor Root: The starting spot can either be specified as a sphere in XYZ-R domain or as one of the segmented layers.

Glioma Grade: Either LGG (proliferation rate = 0.0012 mm/day) or HGG (proliferation rate = 0.012 mm/day)

Reaction Methods (Population Method):

- Exponential Proliferation
- Fisher / Verhulst / Logistic
- Gompertz Equation

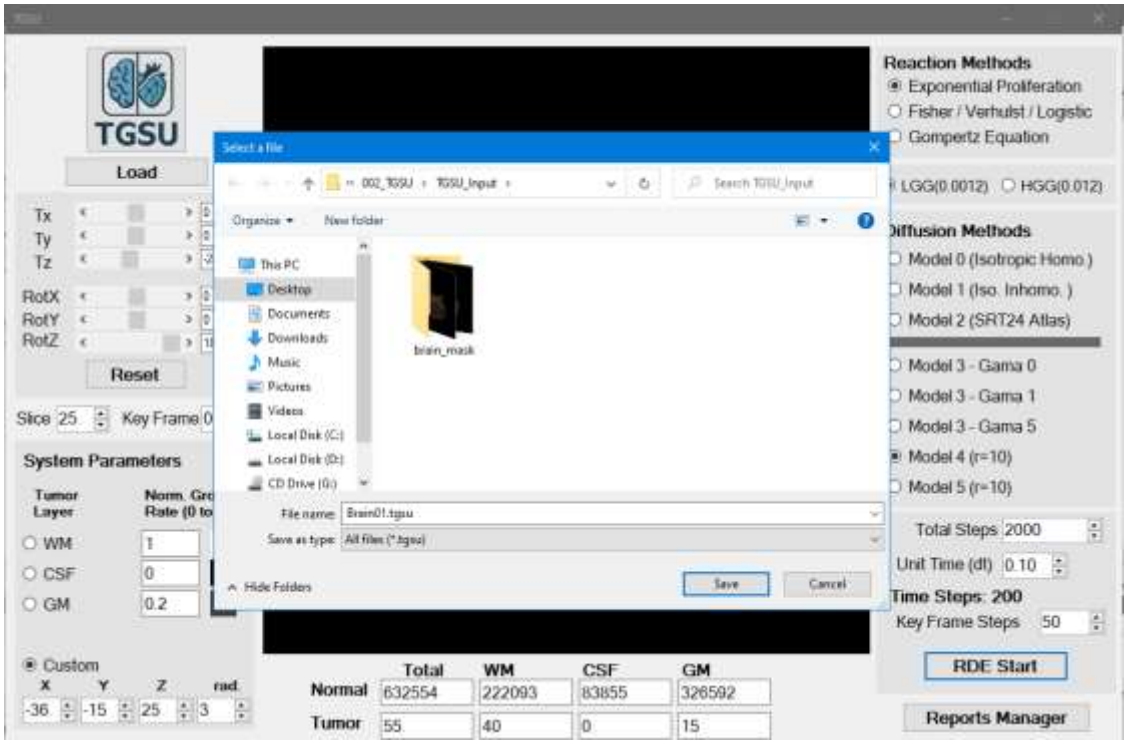
Diffusion Models:

- Diffusion Model 0 (Iso. Homo.)
- Diffusion Model 1 (Iso. Inhomo.)
- Diffusion Model 2 (SRT24 Atlas)
- Diffusion Model 3 - Gama = 0
- Diffusion Model 3 - Gama = 1
- Diffusion Model 3 - Gama = 5
- Diffusion Model 4 (r=10)
- Diffusion Model 5 (r=10)

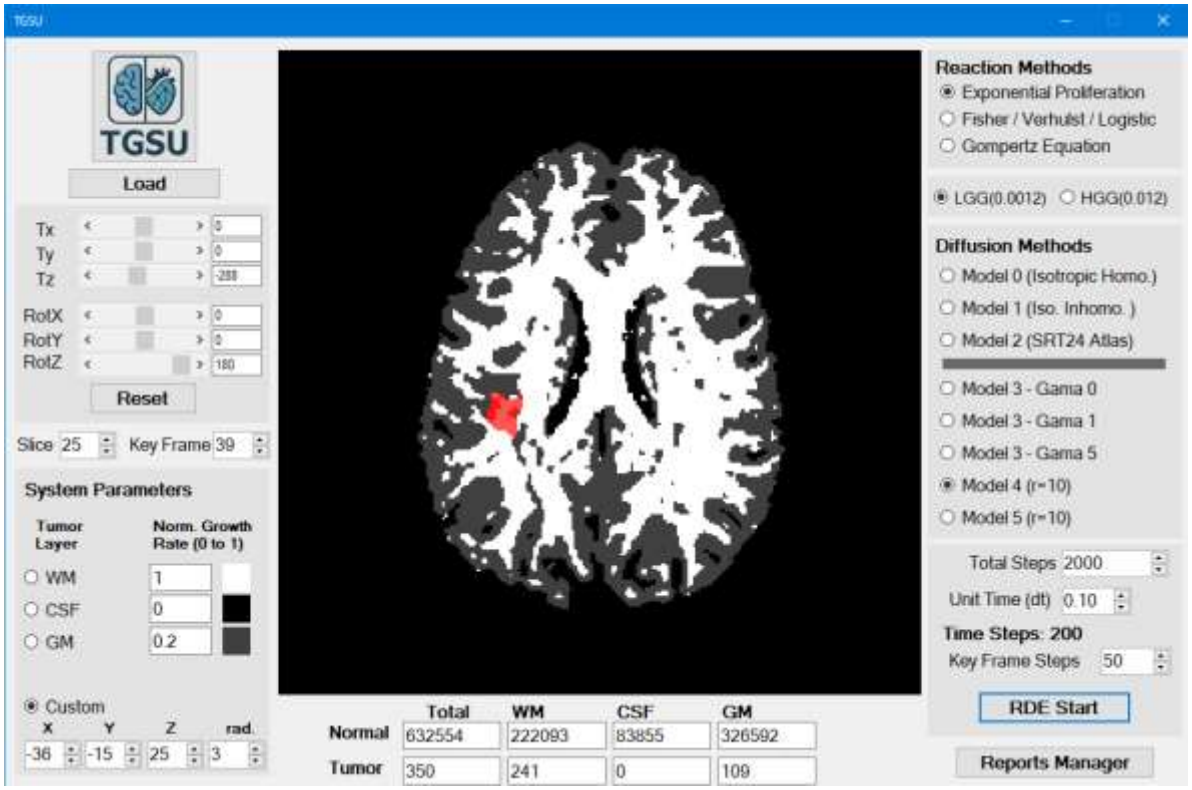
Define Timing Parameters

Click on RDE

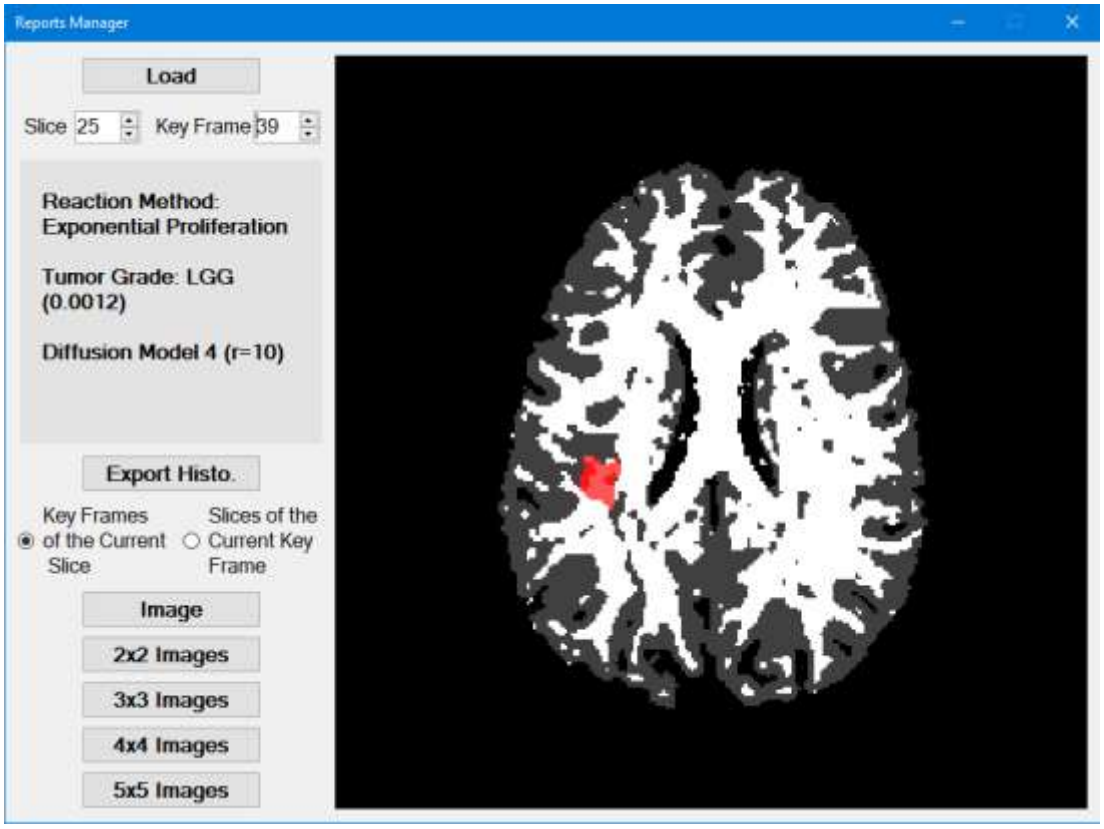
Wait .....



Save the File .....



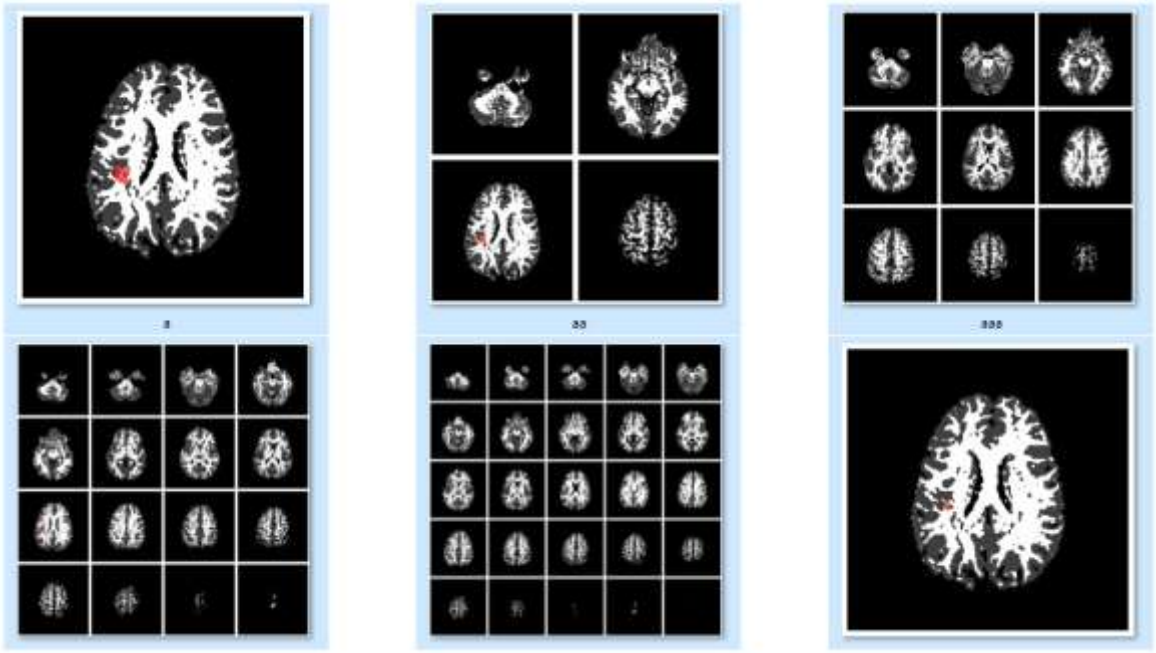
Scroll Slice and Key Frame to display results .....



Click on Reprot Manager .....

Loaf the saved TGSU file ....

Export Histogram of growth as CSV (Excel file) Or Export Images



About TG-SU

- TG-SU (Tumor Growth Simulation Utility) is developed using SharpDevelop under the GNU General Public License.
- It uses OpenTK for graphics rendering and visualization.

License

This project is licensed under the MIT License for **academic and educational use only**.

Acknowledgments

- SharpDevelop– IDE used for development (GNU GPL).
- OpenTK– Open Toolkit Library for OpenGL graphics.
- MRI Studio– For dataset samples and diffusion imaging tools.

Citation

If you use TG-SU software in your research, you must cite the following and add the utility URL:

[1] Elaff I "Comparative study between spatio-temporal models for brain tumor growth" Biochemical and biophysical research communications, 2018. 496 (4): 1263-1268. https://doi.org/10.1016/j.bbrc.2018.01.183

[2] ELAFF I "TTumor Growth Simulation", Bioinformatics Of The Brain, 2024. https://doi.org/10.1201/9781003461906-5

[3] ELAFF I, EL-KEMANY A, and KHOLIF M "Universal and stable medical image generation for tissue segmentation (The unistable method)," Turkish Journal of Electrical Engineering and Computer Sciences: Vol. 25: No. 2, Article 32, 2017. https://doi.org/10.3906/elk-1509-100

[4] Elaff I, "Medical Image Enhancement Based on Volumetric Tissue Segmentation Fusion (Uni-Stable 3D Method)", Journal of Science, Technology and Engineering Research, vol. 4, no. 2, pp. 78–89, 2023. https://doi.org/10.53525/jster.1250050.

[5] Elaff I "Brain Tissue Classification Based on Diffusion Tensor Imaging: A Comparative Study Between Some Clustering Algorithms and Their Effect on Different Diffusion Tensor Imaging Scalar Indices". Iran J Radiol. 2016 Feb 28;13(2):e23726. https://doi.org/10.5812/iranjradiol.23726

[6] El-Aff I "Human brain tissues segmentation based on DTI data," 2012 11th International Conference on Information Science, Signal Processing and their Applications (ISSPA), Montreal, QC, Canada, 2012, pp. 876-881, https://doi.org/10.1109/ISSPA.2012.6310677