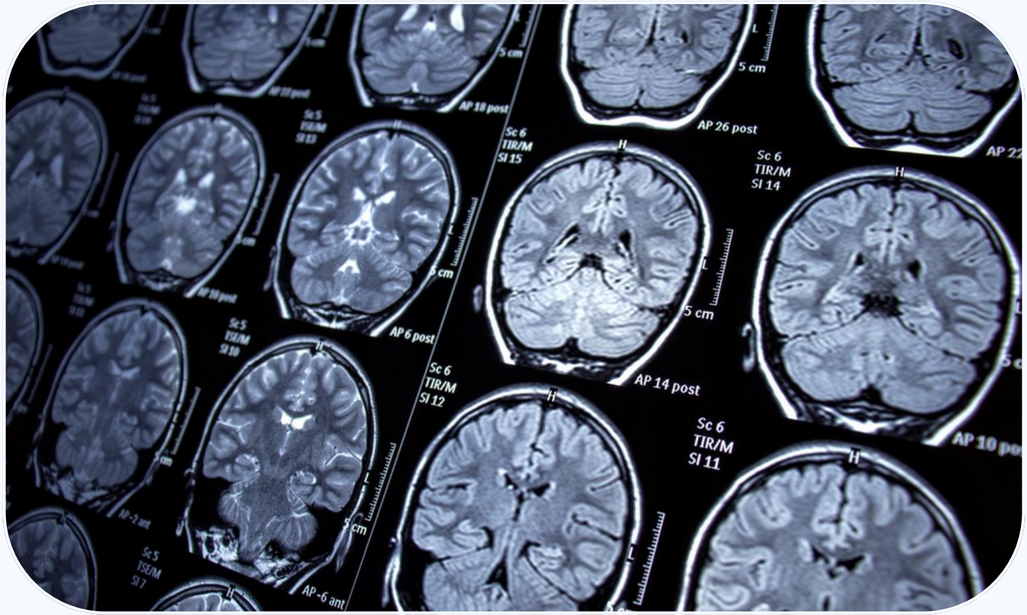
UNIVERISTY OF TRENTO
DEPARTMENT OF INFORMATION ENGINEERING AND COMPUTER SCIENCE

BRAIN MRI ANALYSIS



PROJECT PRESENTATION
SIGNAL, IMAGE AND VIDEO

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OBJECTIVE

- Develop a program that can segment brain images from an MRI dataset using image processing techniques only.
- Use the processed images to generate a 3D model of the segmented brain structures.

Image Adjustment

Denoising and histogram equalization.

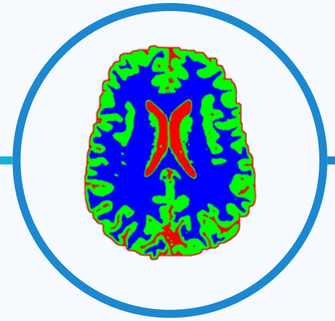
Skull Removal

Eliminating the skull by delineating contours and discarding larger ones.

Brain Adjustment

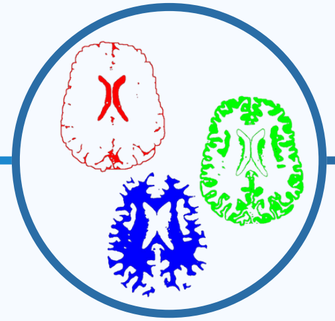
Analyze overlooked details and understand whether they belong to the brain.

Segmentation



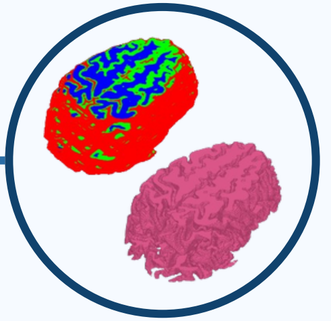
Segmenting the processed image using the K-Means algorithm.

Classification



Examining colored pixel counts to classify segments into cerebrospinal fluid, grey matter, and white matter.

3D Graph Plot

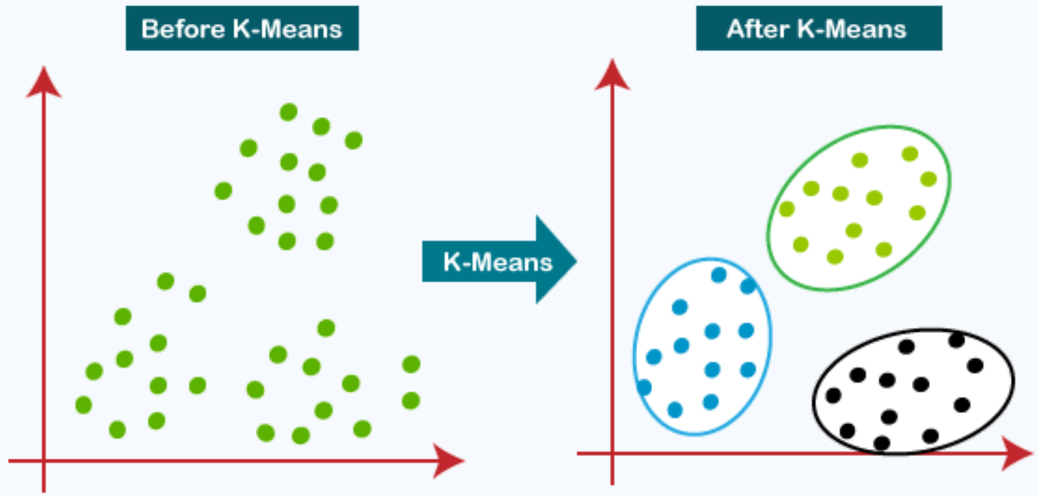


3D graphs are created to visualize reconstructed 360-degree brains.

SEGMENTATION

In MRI brain imaging, segmentation is employed to partition medical images into multiple segments, facilitating the identification of key brain regions for further analysis.

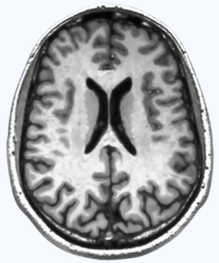
K-means is an unsupervised machine learning algorithm that partitions data points into k clusters. This method can be effectively utilized for segmentation tasks.



HOW IT WORKS

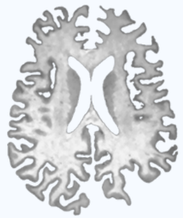
IMAGE ADJUSTMENT

- Denoise image
- Histogram equalization for more uniform colors.
- Minor adjustments for overall positive impact on segmentation.



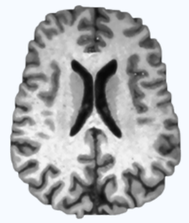
SKULL REMOVAL

- Delineating contours and discard the larger one.



BRAIN ADJUSTMENT

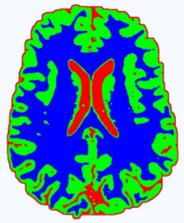
- Identify missed brain details by intersecting their contours with the one of the brain.
- Trace the final brain contour and utilize it as a mask on the original image for adjustment.



HOW IT WORKS

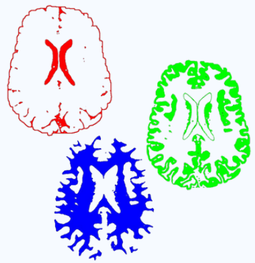
SEGMENTATION

- Segment the processed image using the K-Means algorithm.



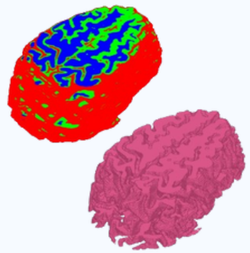
CLASSIFICATION

- Classify segments based on the amount of colored pixels: lower values with cerebrospinal fluid, followed by grey matter, and finally white matter.

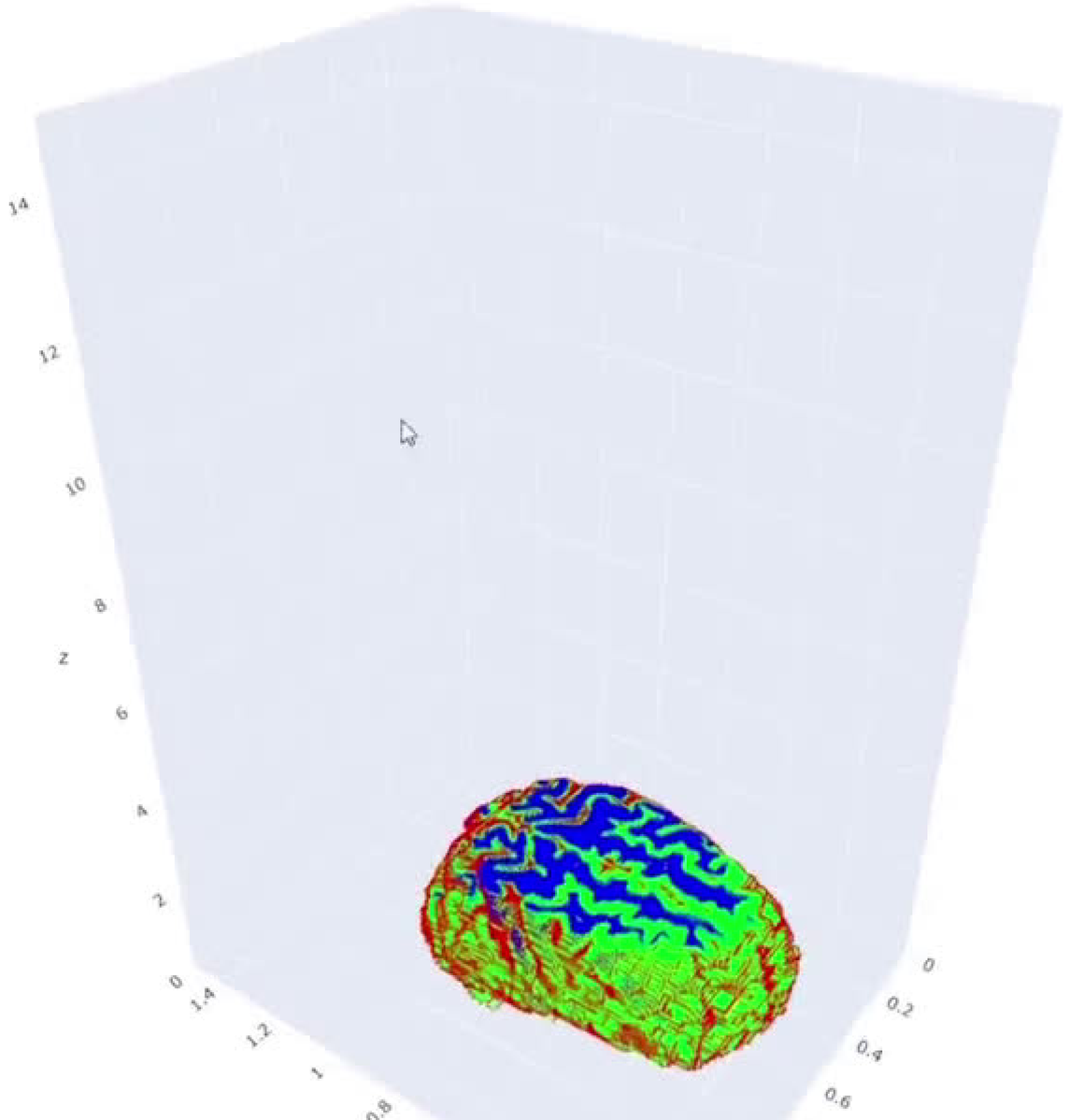


PLOT 3D GRAPH

- Use the resulting images to create 3D graphs and display them in a web view.



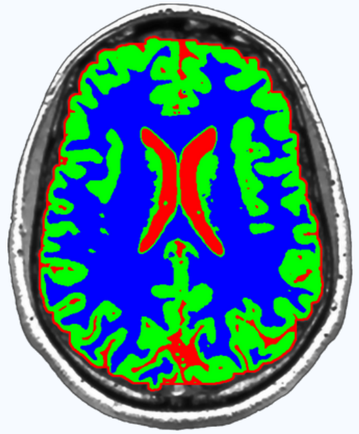
DEMO

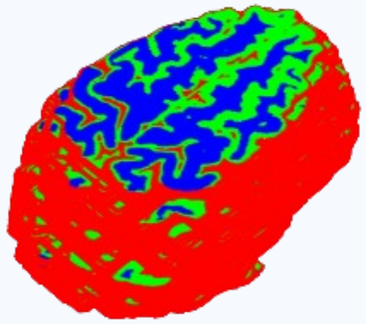


RESULTS AND CONCLUSION

This project primarily employs image processing algorithms, excluding advanced techniques like machine learning, except for a basic application of K-Means in segmentation.

Nonetheless, the achieved results show promising outcomes akin to real medical results, even with images not belonging to the dataset.

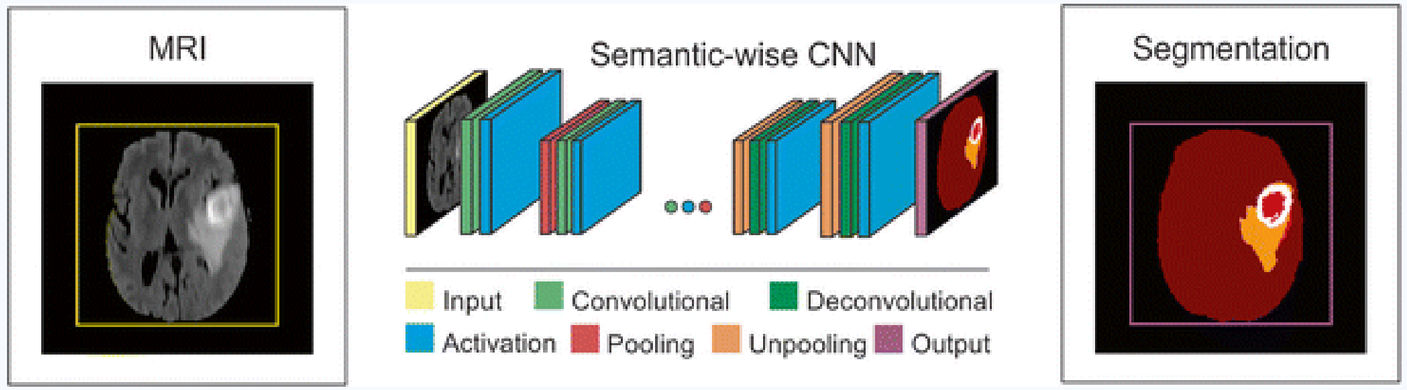




FUTURE WORKS

Some possible improvements might be:

- Use more advanced machine learning techniques for more accurate MRI segmentation.
- Train models to automate identification of structures and tumors.
- Integrate multi-modal data for improved accuracy.



THANKS FOR THE ATTENTION!

CONTACT US:

https://github.com/christiansassi/signal-image-and-video-project

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