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Brain Tumor Prediction

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Background

GOAL: Build website that processes uploaded brain scan images and returns the location, size, and severity of the tumor - if there is one.

Brain Tumor Detection Based on Deep Learning Approaches and Magnetic Resonance Imaging - fine tuned a state-of-the-art YOLOv7 model through transfer learning, significantly improved its performance in detecting gliomas, meningioma, and pituitary brain tumors.

Brain Tumor Detection and Classification Using Deep Learning and Sine-Cosine Fitness Grey Wolf Optimization - CNN (BCM-CNN) is a CNN hyperparameters optimization using an adaptive dynamic sine-cosine fitness grey wolf optimizer (ADSCFGWO) algorithm

Data

Model 1 - Detect brain scans vs non brain scans:

Used kaggle data and a subset of the other model data

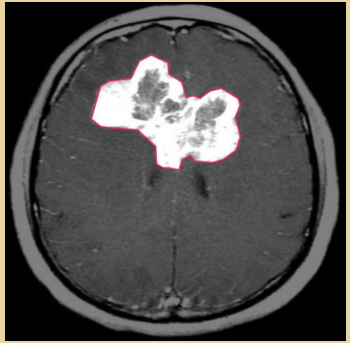
https://www.kaggle.com/datasets/ezzzio/random-images

Model 2 - Tumor vs no tumor:

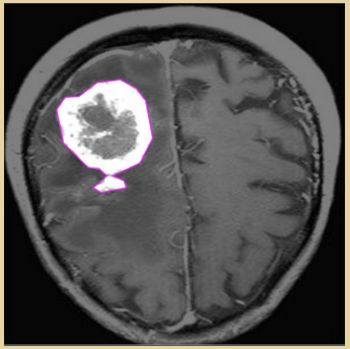
https://universe.roboflow.com/mri-image-dataset/training-69oh4

Model 3 - Segmentation model:

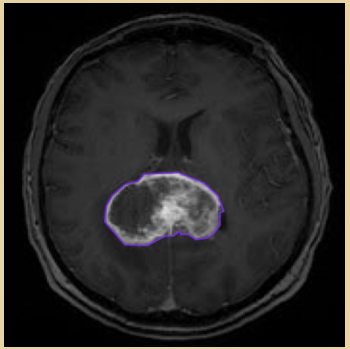
https://universe.roboflow.com/mycollege/tumor-detection-2/dataset/3



less chance



moderate chance



high chance

Use Cases

Doctors: Doctors can use the tool to get an initial review of the brain scan or use it to supplement their own review and diagnosis.

Patients: Patients can use the tool to get a prediction on their own brain scan and find resources about brain tumors.

Researchers: Researchers can use the tool to see how computer vision can be used for brain tumor detection. Additionally, they can train the models with different parameters or datasets to learn how the tool works and to improve the tool.

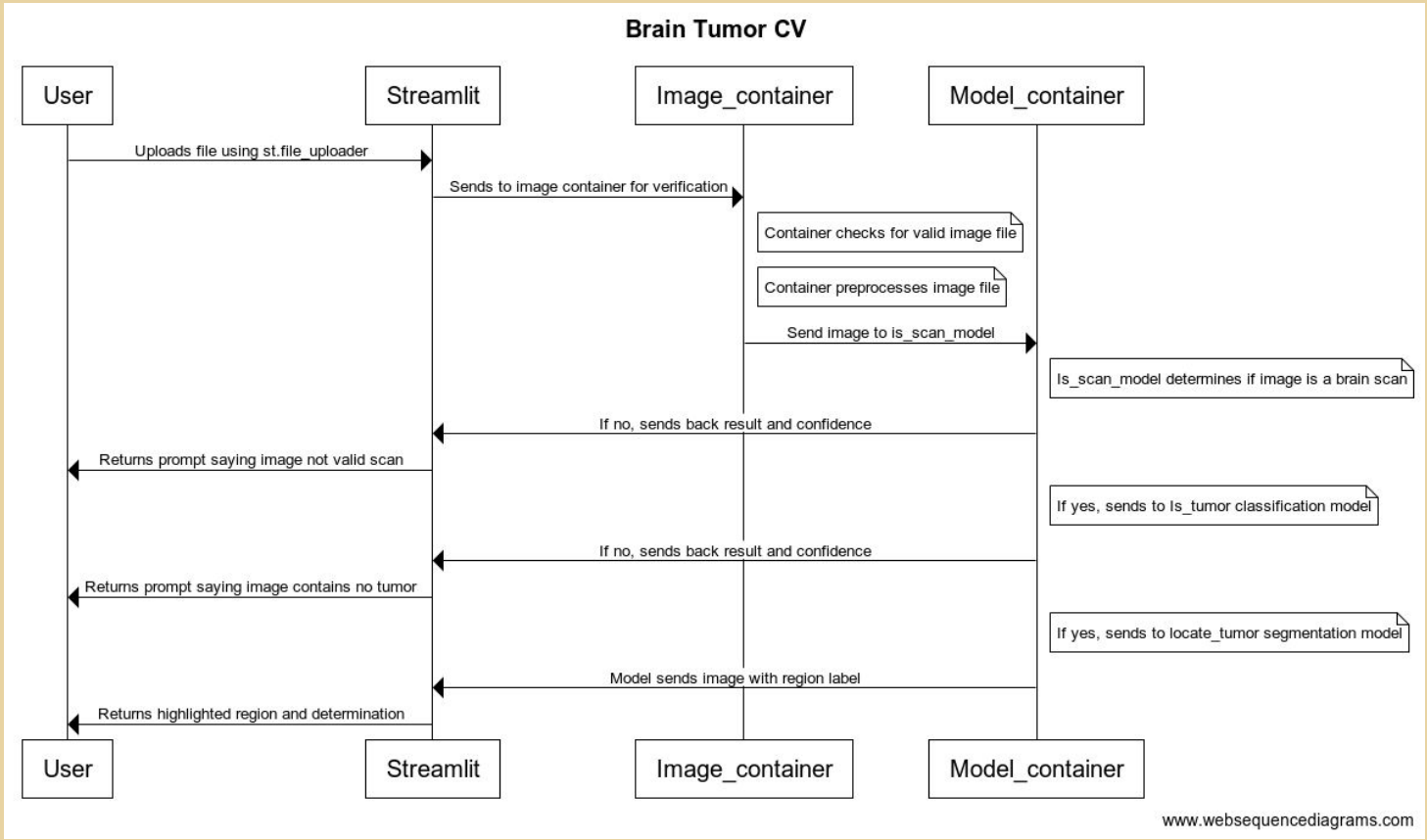
Design

- Brain Tumor Information
  - Streamlit to display relevant information (signs/symptoms) and link to additional resources

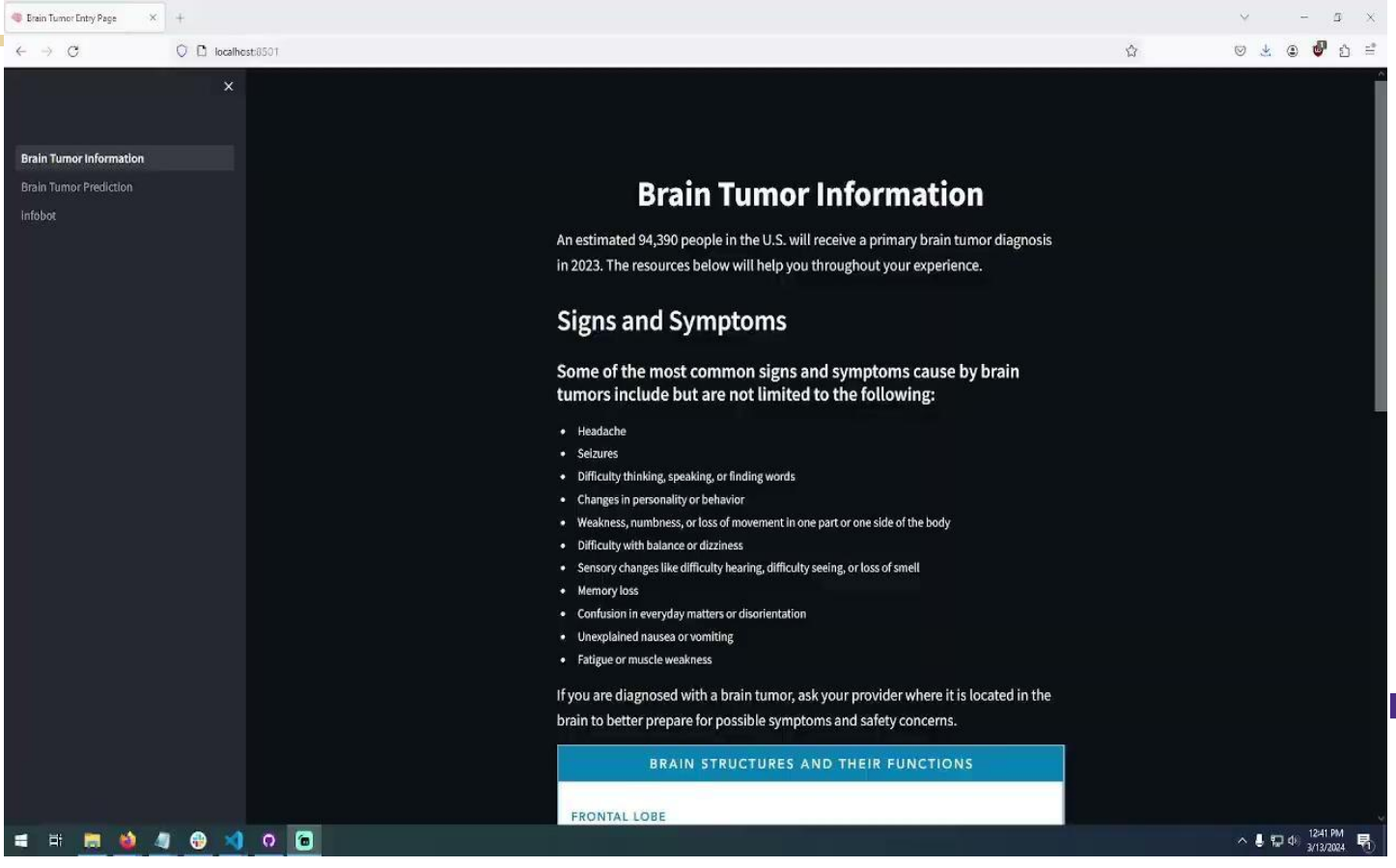
- Brain Tumor Prediction
  - Streamlit file_uploader accepts image file input
  - OpenCV for uploaded image preprocessing
  - Input image and get a prediction
  - Three trained YOLOv8 models
    - Classification model to determine if image is a suitable brain scan
    - Classification model to determine if brain contains a tumor
    - Segmentation model to determine location of tumor in scan

- Interactive Bot
  - Provides an interactive way to use the website and learn about additional resources

Design


Brain Tumor CV
User
Streamlit
Image_container
Model_container
Uploads file using st.file_uploader
Sends to image container for verification
Container checks for valid image file
Container preprocesses image file
Send image to is_scan_model
Is_scan_model determines if image is a brain scan
If no, sends back result and confidence
Returns prompt saying image not valid scan
If yes, sends to Is_tumor classification model
If no, sends back result and confidence
Returns prompt saying image contains no tumor
If yes, sends to locate_tumor segmentation model
Model sends image with region label
Returns highlighted region and determination
User
Streamlit
Image_container
Model_container
www.websequencediagrams.com

Demo


Brain Tumor Entry Page
localhost:8501
Brain Tumor Information
Brain Tumor Prediction
Infobot
Brain Tumor Information
An estimated 94,390 people in the U.S. will receive a primary brain tumor diagnosis in 2023. The resources below will help you throughout your experience.
Signs and Symptoms
Some of the most common signs and symptoms cause by brain tumors include but are not limited to the following:
Headache
Seizures
Difficulty thinking, speaking, or finding words
Changes in personality or behavior
Weakness, numbness, or loss of movement in one part or one side of the body
Difficulty with balance or dizziness
Sensory changes like difficulty hearing, difficulty seeing, or loss of smell
Memory loss
Confusion in everyday matters or disorientation
Unexplained nausea or vomiting
Fatigue or muscle weakness
If you are diagnosed with a brain tumor, ask your provider where it is located in the brain to better prepare for possible symptoms and safety concerns.
BRAIN STRUCTURES AND THEIR FUNCTIONS
FRONTAL LOBE
12:41 PM
3/13/2024

Lessons Learned and Future Work

- Obtain better dataset (have domain knowledge to label the data ourselves or ask for data from relevant work) in order to have a better prediction model
- Write code with pylint standards and documents as we go instead of at the end
- Write tests early on or as we go throughout the project (or use test driven development)

Next steps …

- Create more of a true “chatbot” for interactivity on the website to provide more information and resources.
- Train better models with a variety of scan data