Brain Tumor Growth Predictor

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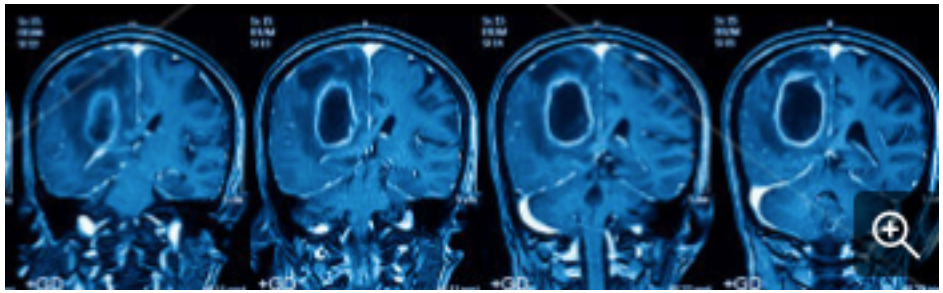
Abstract:
This code will process images of brain tumors in MRI's to allow a patient to see percent growth or shrinkage of their tumor in any amount of time. The patient can upload images of his or her tumor and the areas of the tumors at different dates will be predicted. This will be completed by isolating the tumor in the image and calculating the area by finding the edges of the tumor (the most bright points), then in a separate function calculating the percent change of the area. This work makes it possible to read MRI's with more precision than simply looking at them.

Tufts

Background

- My code helps a patient quantify the effectiveness of their cancer treatment and tumor growth
- Simply eyeballing the growth or shrinkage of a tumor may not always be accurate
- The code can help someone predict the ROC of their tumor size



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Technical Approach – Photo Editing

- The photo was edited to make image processing more simple
  - 'imcrop' prompts user to isolate the tumor to avoid bugs in the code caused by bright spots elsewhere in the brain
  - 'rgb2gray' converts the photo to black and white and 'imadjust' contrasts it. The pixels in the photo are now more easily manipulated

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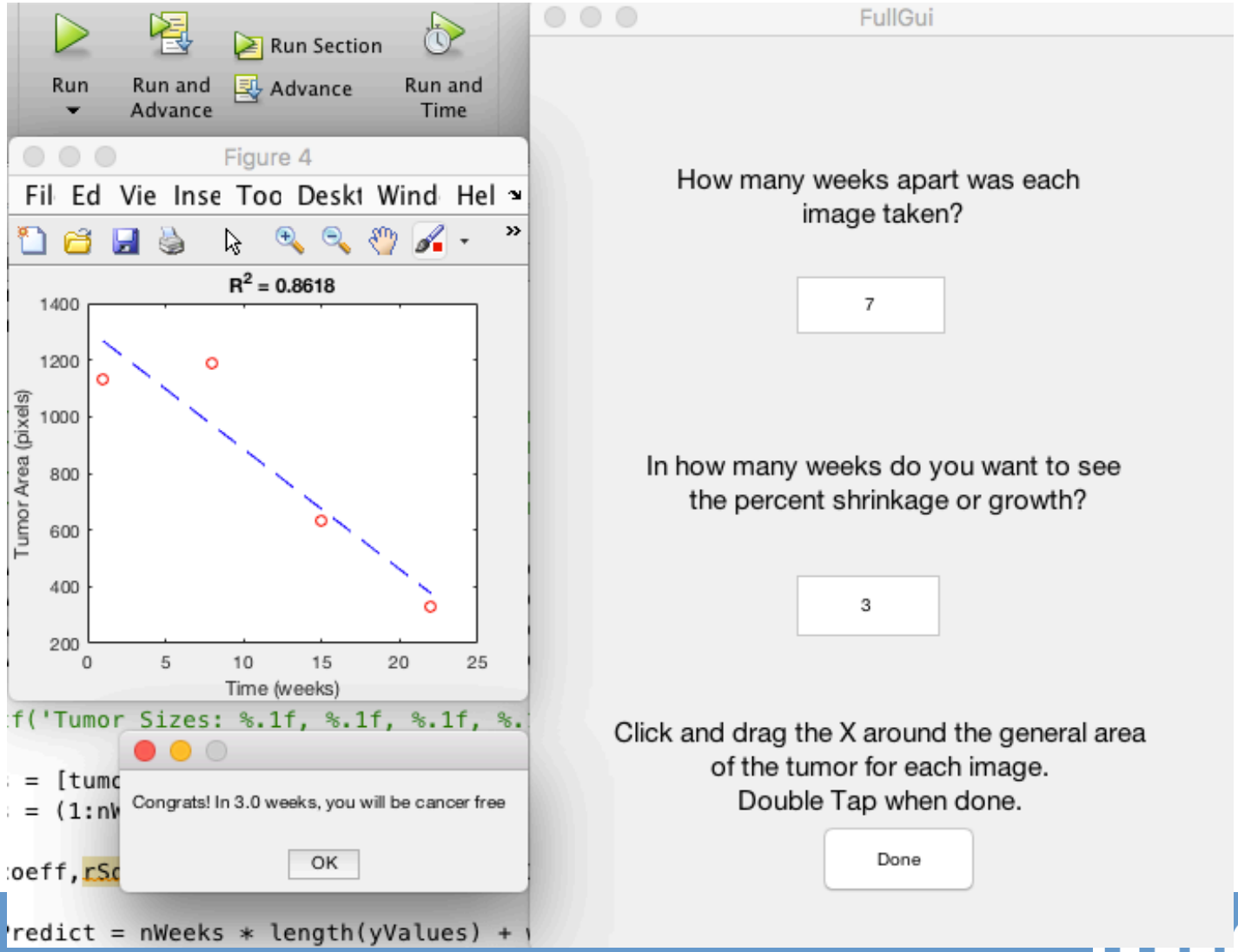
Technical Approach – Finding Area

- Nested for loop: Runs through every row and column to find largest distances between brightest points on the tumor (the borders)
- IMPORTANT: when the user crops the image, the area of what they cropped is not taken, the code actually calculates the approximate area of the elliptical tumor using the different brightness's on the tumor within the image matrix

Technical Approach – finding percent change in a given number of weeks

- Using a function that calculates the line fit for a set of data points, a line of best fit was created for each tumor area at the respective weeks the images were taken.
- By having the user input (in a GUI) when they want to have the predicted percent change take place, a new area is generated using the percent change function. Because the area is in terms of pixels and not a real unit, it is converted into a percent change

Results- If tumor is shrinking



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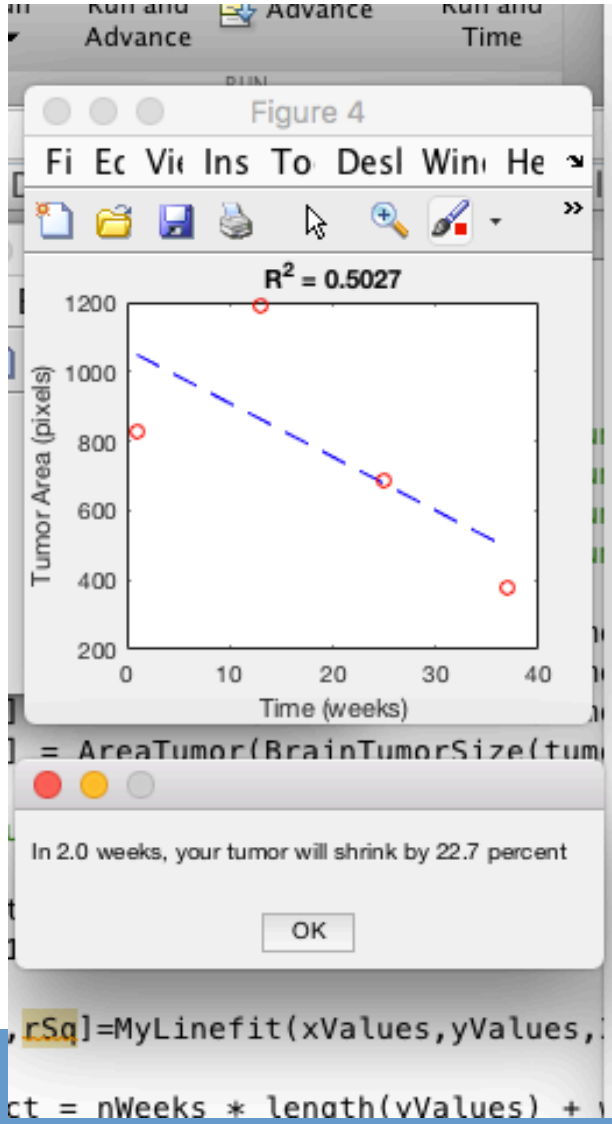
Results- If tumor is shrinking



How many weeks apart was each image taken?

12

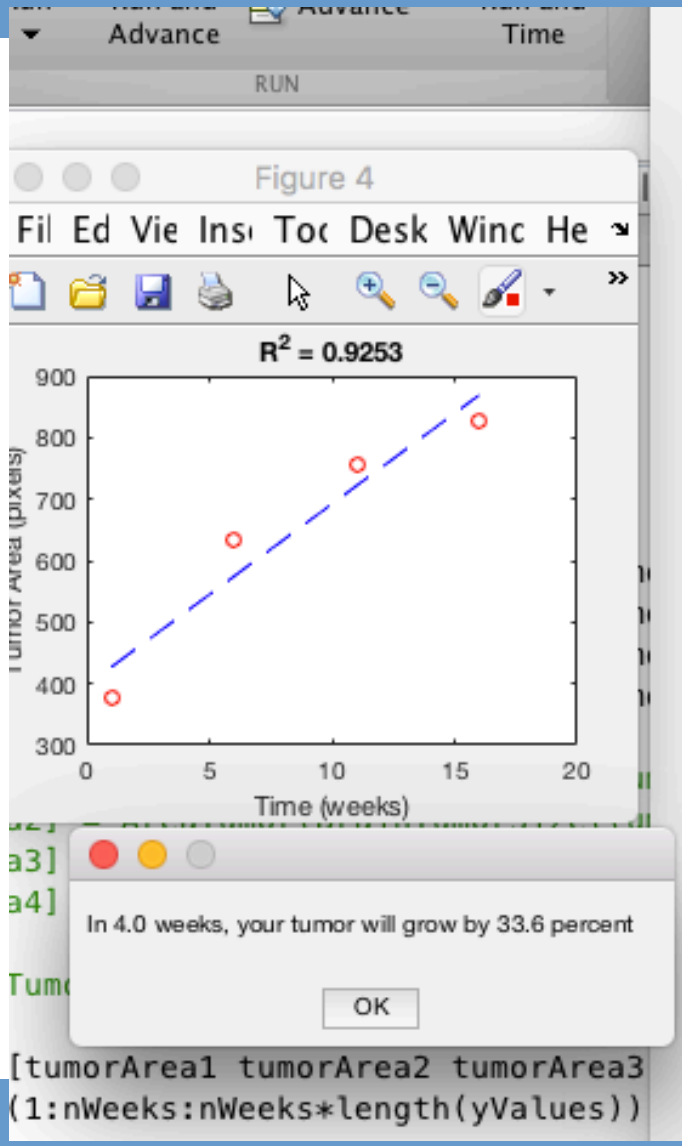
In how many weeks do you want to see the percent shrinkage or growth?

2

Click and drag the X around the general area of the tumor for each image.
Double Tap when done.

Done

Results: If tumor is growing



How many weeks apart was each image taken?

5

In how many weeks do you want to see the percent shrinkage or growth?

4

Click and drag the X around the general area of the tumor for each image.
Double Tap when done.

Done

Tufts

Conclusions and Next Steps

- Given that the growth of a tumor does not grow completely linearly, this code is not perfect
- In the future, I could find the actual growth equation for a tumor and fit the points to that curve.

References

- Images: https://www.shutterstock.com/image-photo/magnetic-resonance-imaging-mri-brain-tumor-373805785