**Introduction**

For this project, 52 images taken by confocal microscope of samples of the mouse hippocampus were used. Specifically, the imaged samples were taken from either 5xFAD mice -- transgenic mice used in Alzheimer’s disease research that form amyloid beta (Aβ) plaques -- or C57 strain mice which were used as a control. In some of the images from the dataset, cloudy, grey areas are visible as distinct against the background noise; these are areas where Aβ is present in the given sample. To determine whether categorization of each image as containing Aβ or not is feasible without the use of dyes or staining, image classification was attempted on this data set.

**Image Processing Approach**

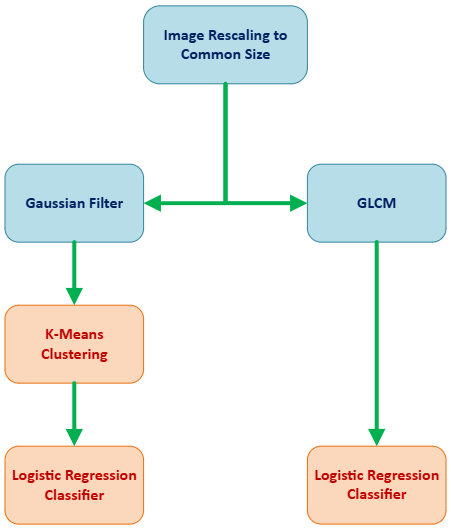
To determine whether an image contained Aβ plaques, two image processing approaches were attempted:

1. The use of K-means clustering (K = 2) to generate two-color images of each image roughly distinguishing areas of plaque from areas of background noise. These generated images were then fed into a logistic regression model to categorize the images.
2. The generation of Gray-Level Co-occurrence Matrices (GLCMs) for each image to distinguish each image by the texture of the plaque areas as compared to the background noise. Statistical parameters calculated from these matrices were then fed into a logistic regression model to categorize the images.

In the first case, an initial filtering step was performed on all images. This step consisted of a simple Gaussian filter [with a constant σ of …] in an attempt at reducing the influence of background noise on either classification approach. A Median filter was applied on one image arbitrarily selected from the image set – this filter increased the influence of background noise on the

For the GLCM generation, the algorithm being a form of texture analysis meant that any blurring of the images to reduce noise would obscure the differences in pixel intensity changes between areas with Aβ and background areas. For this reason, Gaussian filtering was not performed on these images after resizing.

Figure 1 illustrates the overall steps in the process.



**Figure 1: Two Classification Approaches Applied to the Image Set**

Other image processing techniques were also attempted. Applying a Fast-Fourier Transform algorithm on one image arbitrarily selected from the image set revealed no significant patterns in the frequency spectrum, so no frequency filtering was applied as a pre-processing step. The use of histogram equalization, in a similar manner to the Median filter, emphasized the noise in the images to such a degree that subsequent K-Means clustering resulted in qualitatively less differentiation between areas with and without plaque.

[Canny edge detection]

[hysteresis thresholding]

**Limitations**

The most notable limitation of both image classification approaches was in the relative paucity of image data.

[intrinsic noise from fluoresced proteins]