Brief introduction

For this project, we have set out to explore the effectiveness of segmentation filters in cleaning up uniformly noised images with varying noise strengths of 0.0, 0.1, 0.5, and 0.8. Our aim is to apply these filters to three different images and examine the results in detail.

To accomplish this, we will be using three different segmentation filters and EPF filters with filter sizes of None, 5x5, and 15x15. It is important to note that when we say None for filter size, we mean that no edge preserving filter will be applied to the image.

The end result of this project will be a total of 108 segmented images, which is the product of <img_count> * <noise_strengths_count> * <segmentation_methods_count> * <preserving_filter_sizes_count>, or 3 * 4 * 3 * 3.

Selected methods

To effectively analyze our EPF filtered and uniformly noised images, we will be implementing three different segmentation methods: **clustering, split_merge, and Otsu (auto-thresholding)**. These methods will allow us to group pixels together based on their similarities, making it easier to identify and analyze specific areas of the image.

To preserve the integrity of the edges in our images, we will be using the **median filter as our edge preserving filter**. This filter is known for its ability to effectively reduce noise while maintaining the sharpness of the image edges.

Report (Conclusion)

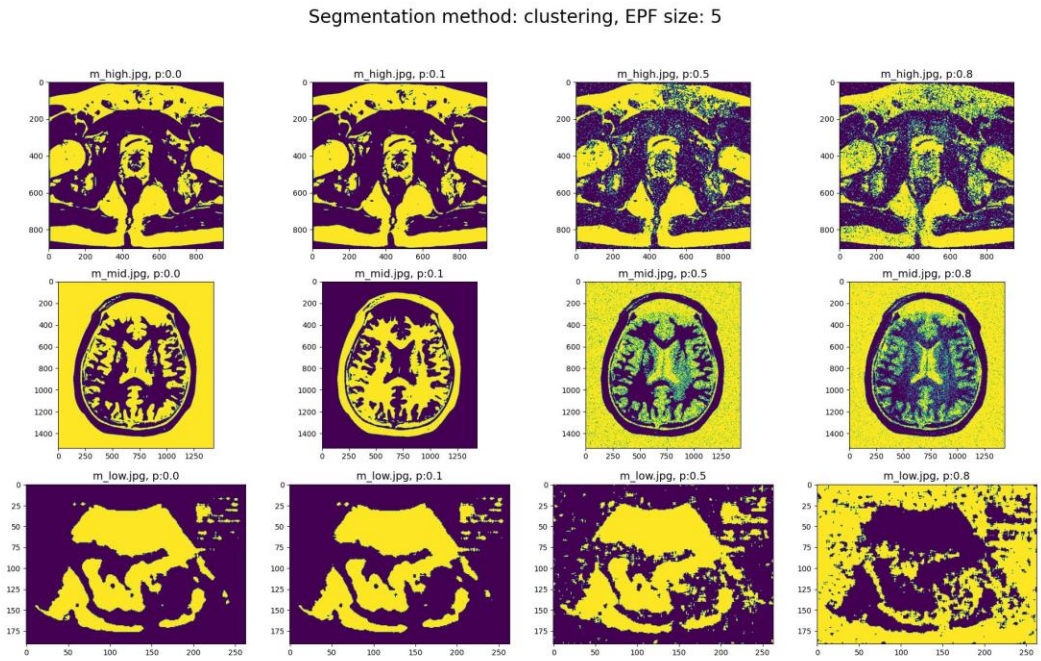
Segmented images will be displayed throughout the remainder of the report. Based on the results, it is evident that applying an edge-preserving filter to an image significantly improves its segmentation. Without EPF filters, selected segmentation methods struggle to properly segment the given image.

When different filter sizes are applied to the image, the resulting segmentation varies. Therefore, selecting the appropriate filter size is crucial in this case. Based on the results, filter size 15 outperformed filter size 5 for all images with high, mediocre, and low levels of detail.

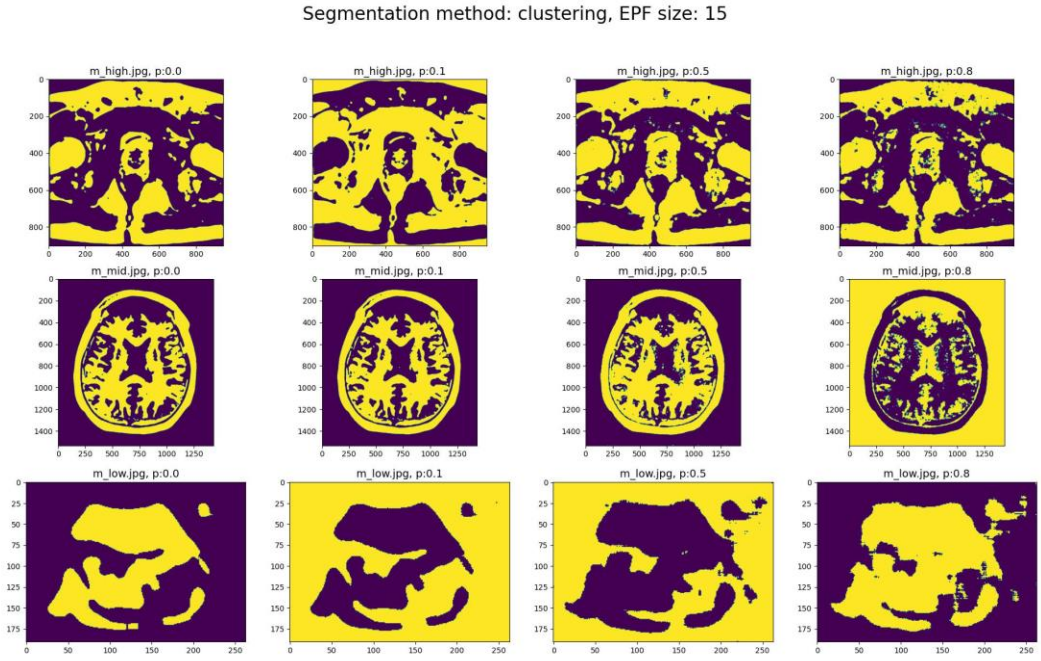
In addition to EPF filters, adding uniform noise to the images aids in the segmentation task, particularly for low-detailed images. However, for highly detailed images, adding uniform noise can also introduce noise to the segmentation task, which can be detrimental.

RESULTS

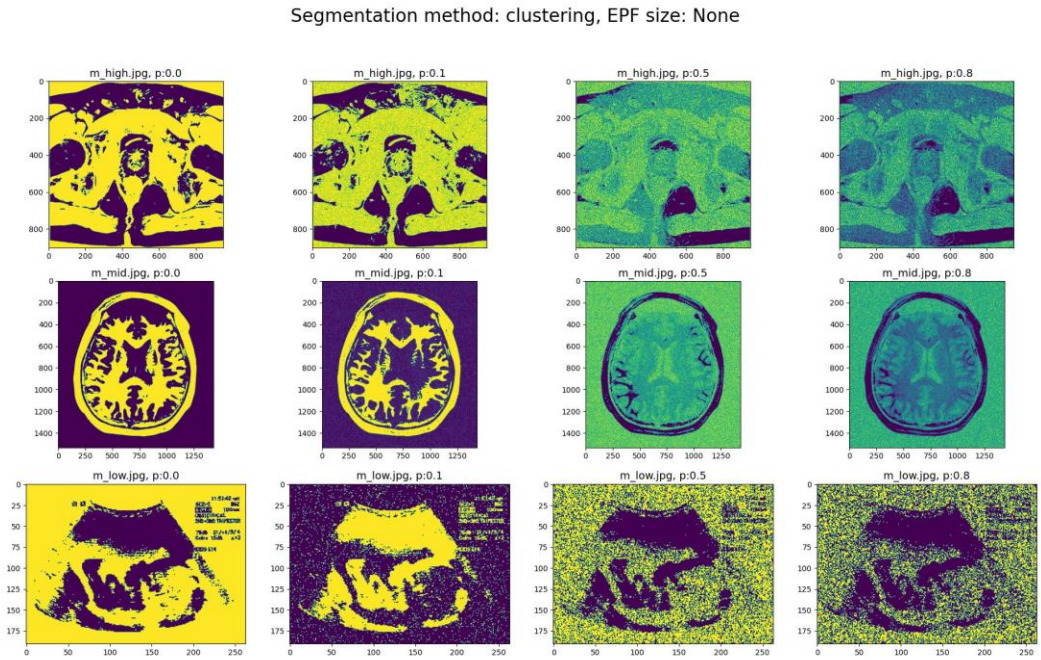
Clustering Segmentation – EPF Filter Size: 5x5



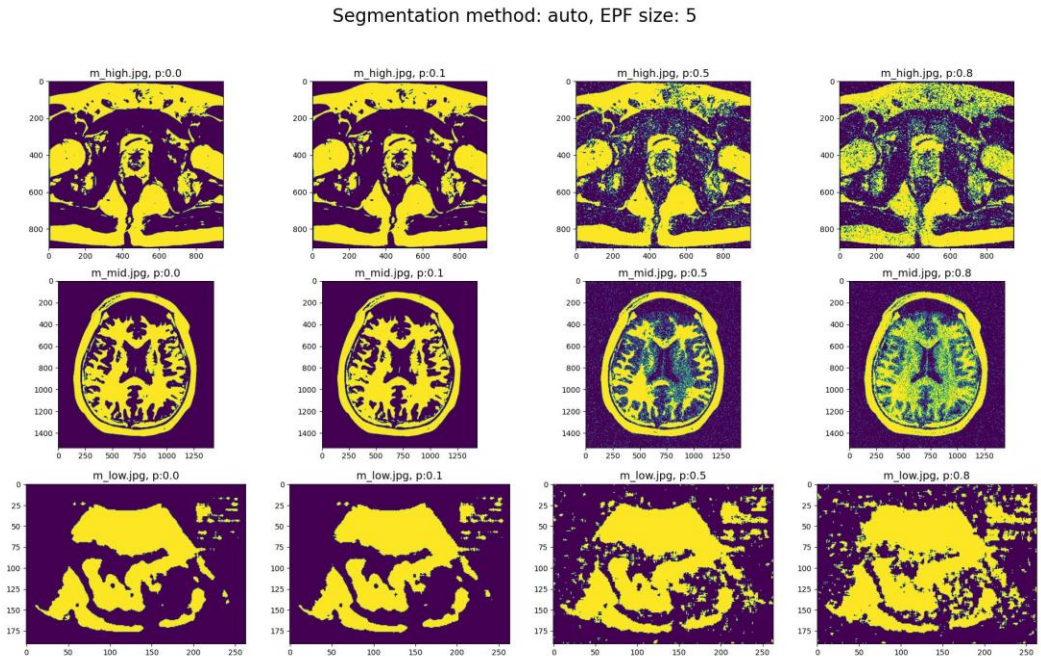
Clustering Segmentation – EPF Filter Size: 15x15



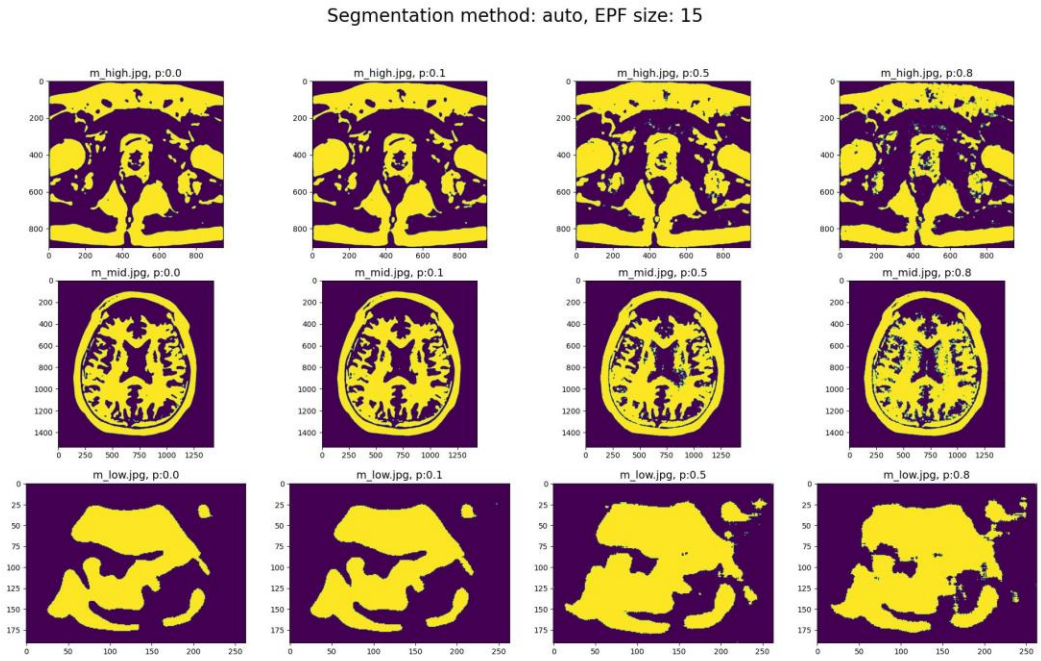
Clustering Segmentation – EPF Filter Size: None (No EPF)



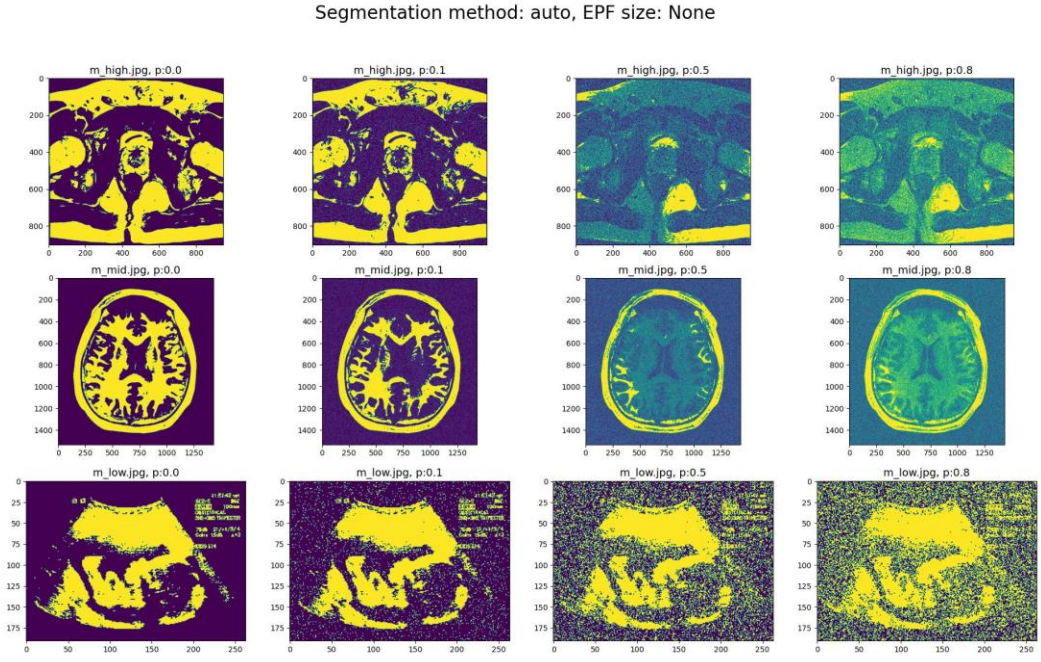
Auto-Thresholding (Otsu) Segmentation – EPF Filter Size: 5x5



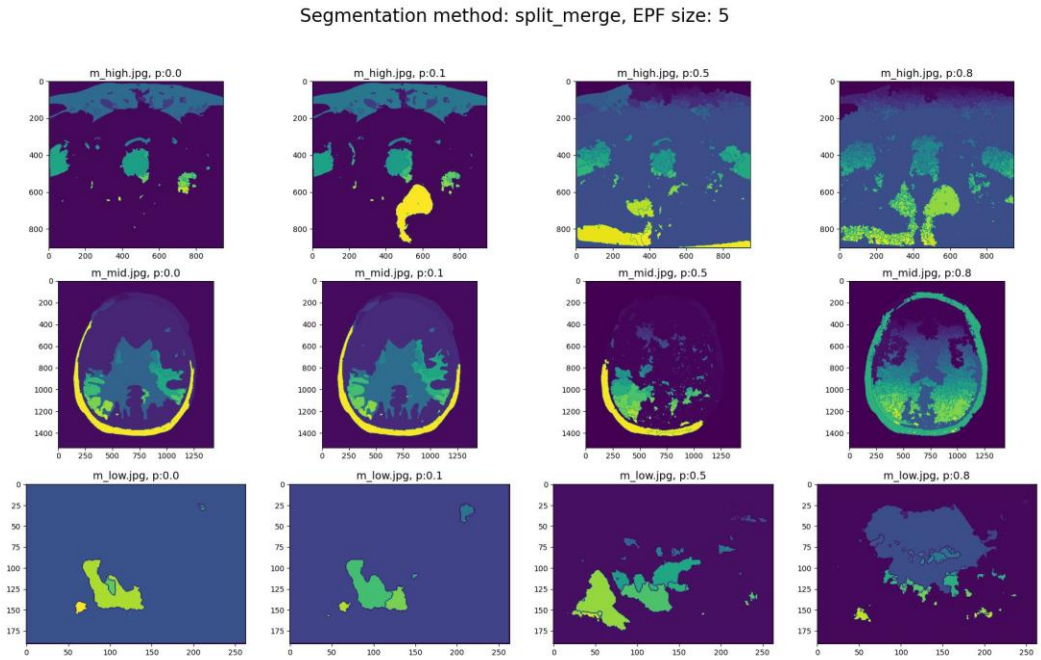
Auto-Thresholding (Otsu) Segmentation – EPF Filter Size: 15x15



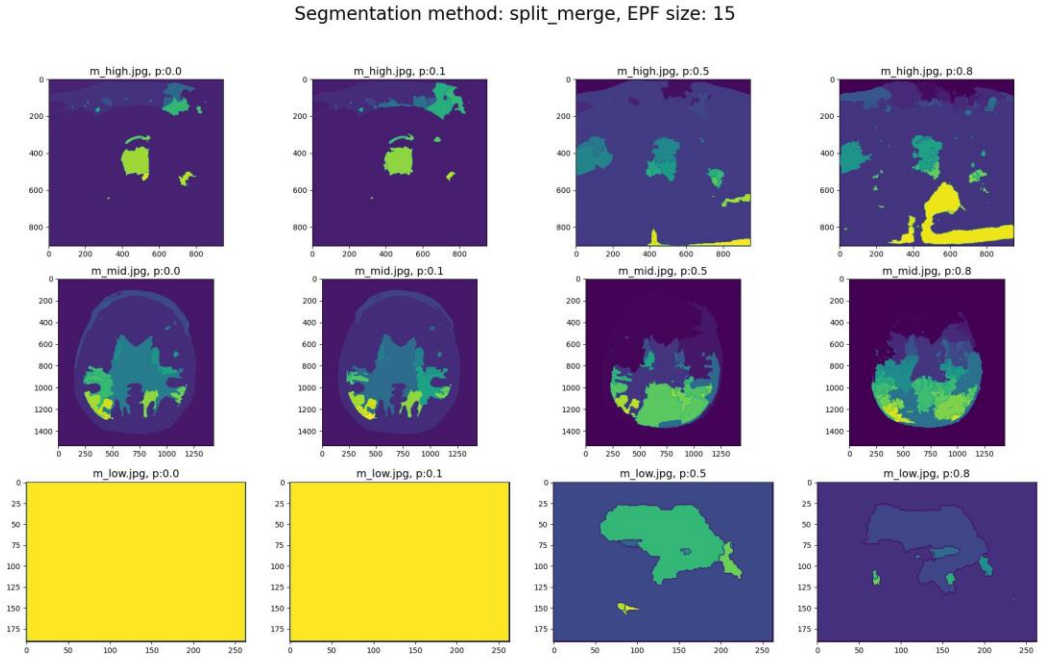
Auto-Thresholding (Otsu) Segmentation – EPF Filter Size: None (No EPF)



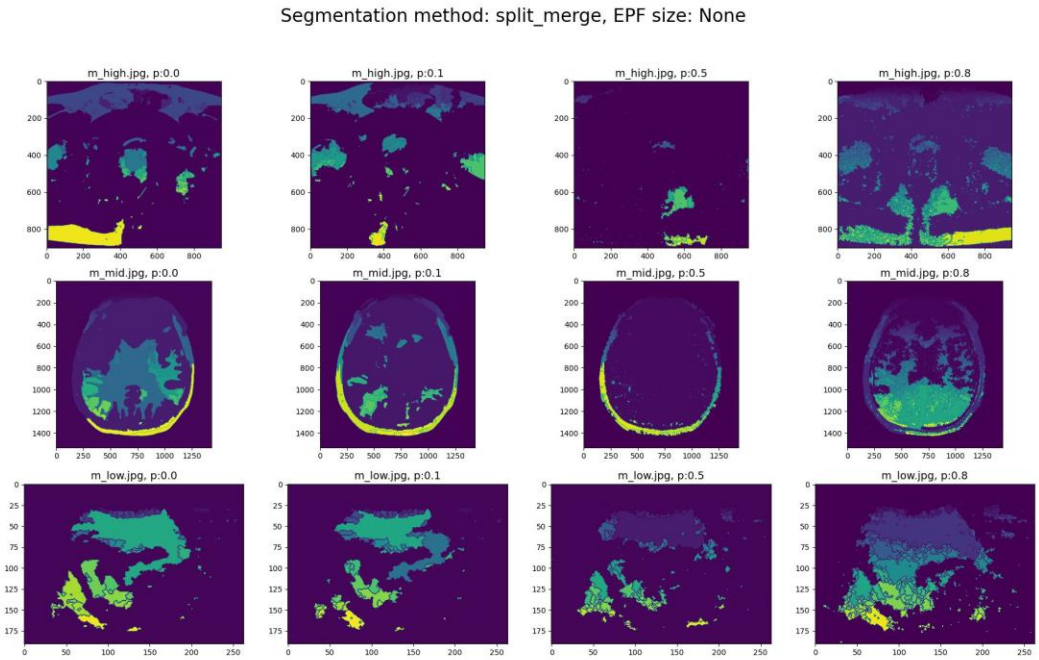
Split Merge Segmentation – EPF Filter Size: 5x5



Split Merge Segmentation – EPF Filter Size: 15x15



Split Merge Segmentation – EPF Filter Size: None (No EPF)



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