Using KNN and Image Processing Techinques to Predict land and water in a Map

Muhammad Kumail
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***Abstract*—In this electronic document I used KNN and image Processing techniques to accurately predict where land or water will be using the original image. I used Manhattan distance and Euclidean distance for distance calculations and k was varied in range (1,3,5,7,9)**

Introduction :

This article presents a comprehensive exploration into the fusion of KNN and image processing methodologies for land-water segmentation, The ability to accurately delineate land and water regions is crucial for numerous applications, such as hydrology, urban planning, and environmental conservation.[1]

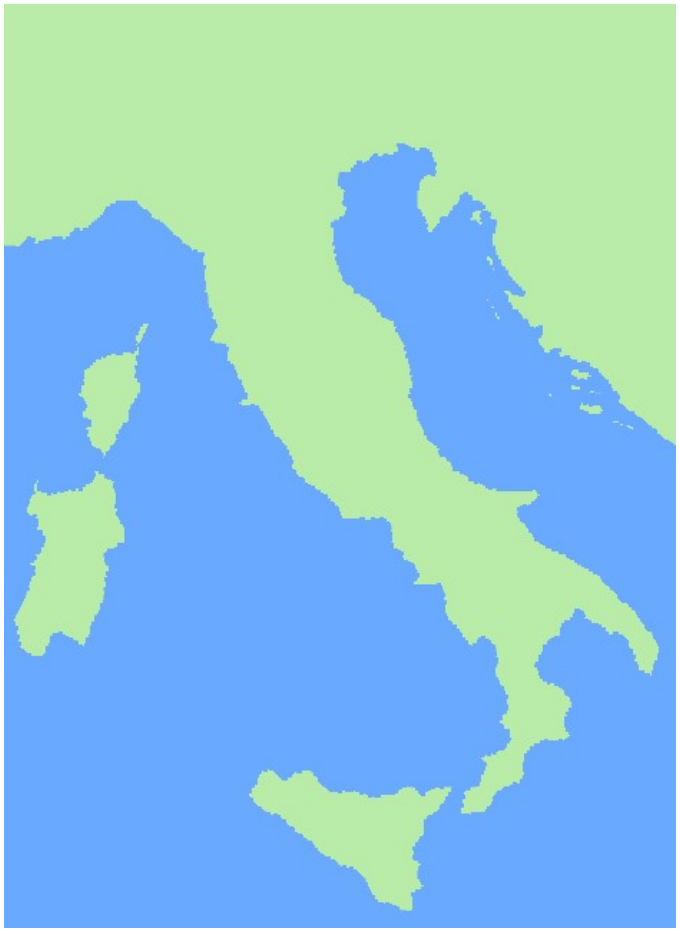
Dataset Description:

We were provided with a map of Italy which looks like a boot and also variations of it being 10% filled, 20% filled up to 50% filled, we were also provided with a 100% filled image which was to be used as reference for accuracy.

Methadology and Implementation details

I used skimage for image processing techniques, first I extracted all the channels from the 3d image applied knn on all of them. I used Manhattan distance and Euclidean distance for all the distance calculations and used different k's which varied from 1,3,5,7 and 9. I used filter for 21x21 and applied stretch padding to use the k-NN effectively and efficiently. I also generated confusion matrix for each case and using the confusion matrix I calculated accuracy, specificity and sensitivity for every case. Finally, for displaying plots, I used matplotlib and also saved the plots using matplotlib.

Original Image:



Results:

10% filled and 1 k:

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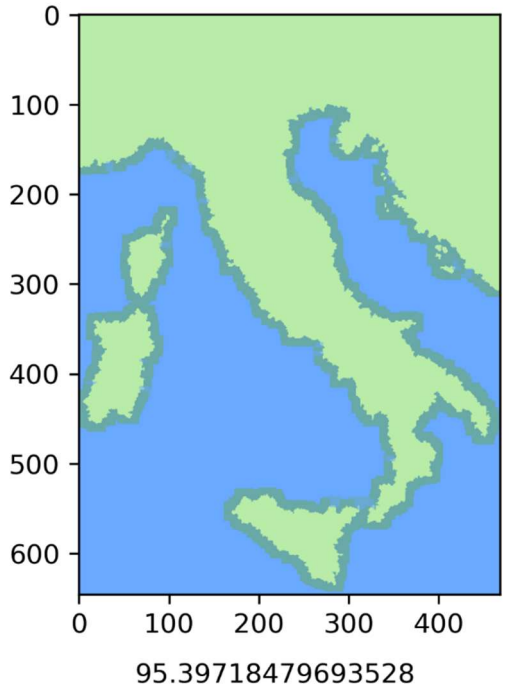
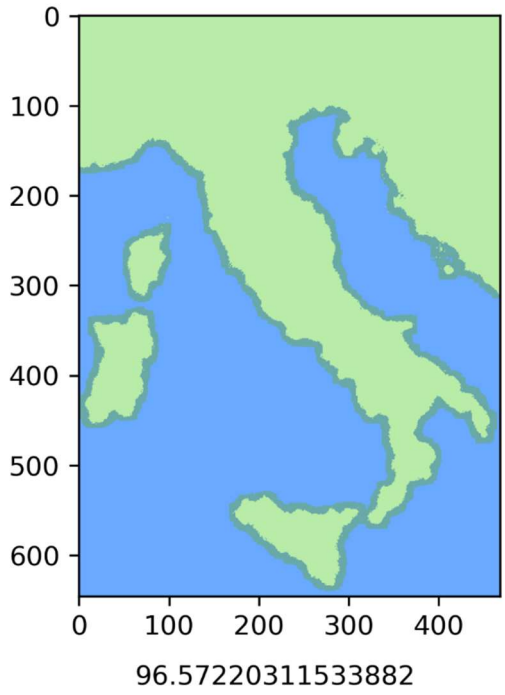
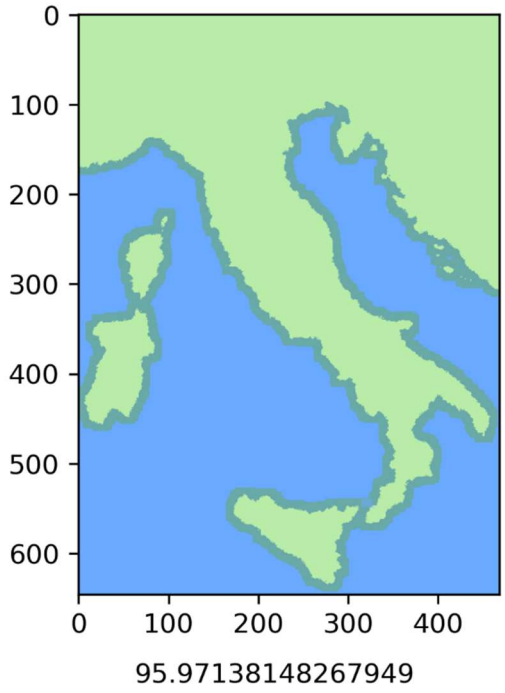
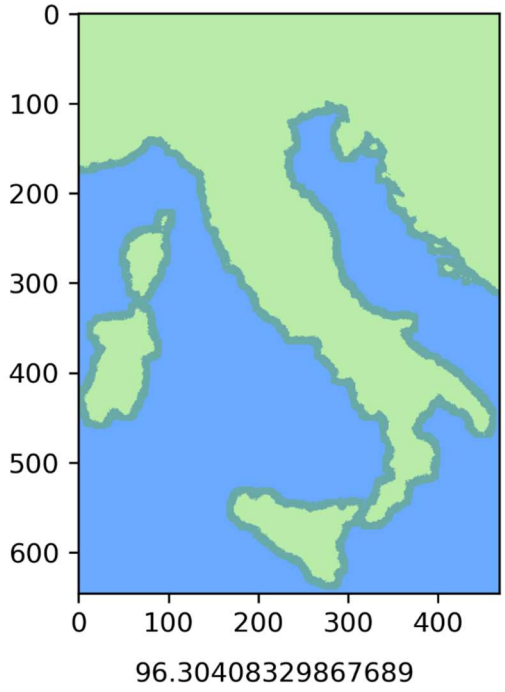


10 % filled and 9k:



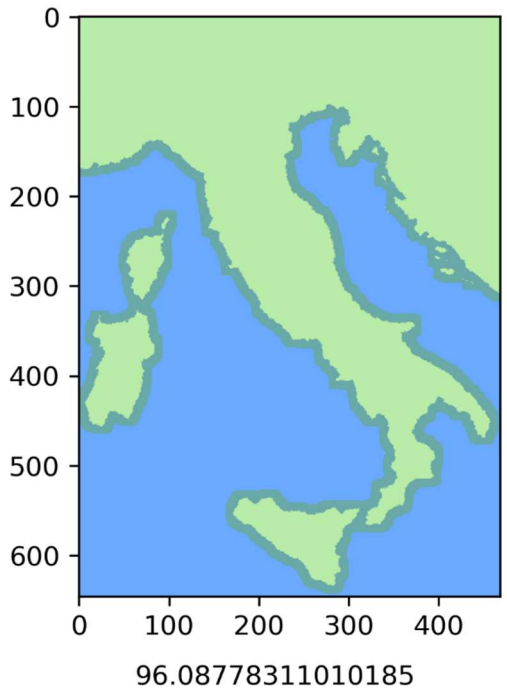


20% filled and 9k:

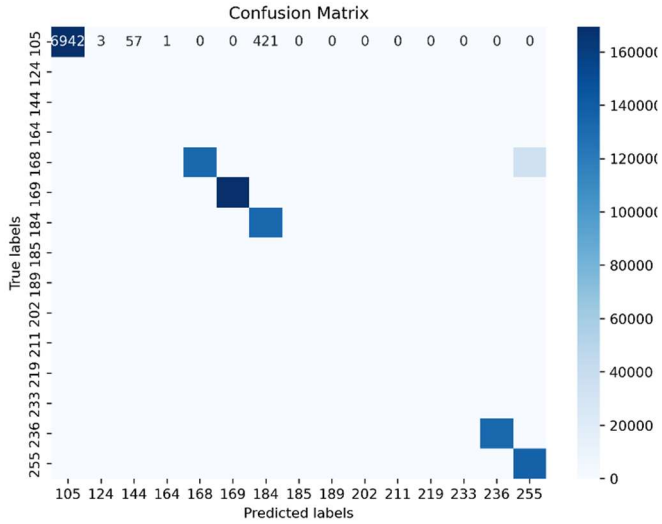


50% filled and 9K:

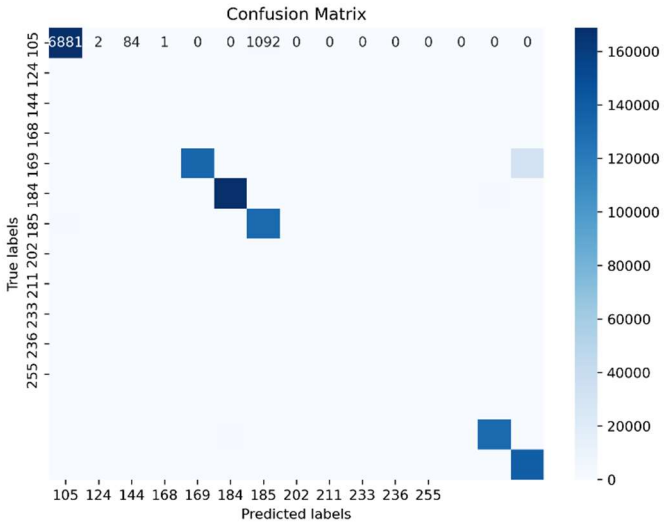
20% filled and 5k:



Confusion Matrix 50% filled 9k:



Confusion Matrix 20% filled 5k:



Discussion:

This assignment really tested image processing skills and programming ability and it also tested my cpu as the processing time was long even with filter size. I found out that the predictions were much accurate with k as 3,5 and 7 and using Euclidean distance was much fruitful as the predictions were More accurate than Manhattan distance.

Conclusion:

In conclusion, the integration of KNN and image processing techniques presents a good foundation for image prediction tasks. Using Skimage and matplot lib really proved helpful by using different modules provided by skimage [2].I was able to accurately predict land or water at each pixel.

References

[1] Joshi R, Sharma G, Tripathi V and Nainwal A. (2024). Classification of Weeds Using Neural Network Algorithms and Image Classifiers. Intelligent Human Computer Interaction. 10.1007/978-3-031-53830-8_4. (26-36).J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[2] Wu X.Y, Wang S.H. and Zhang L.D. 2017 'The theory and application of k-nearest neighbor algorithm'[J] *Computer engineering and Application* **53**K. Elissa, “Title of paper if known,” unpublished.