

Project-Part 1

The goal of this project is to help further clarify and apply theoretical concepts in Statistical Bayesian Inference as well as in Linear classification by investigating imagery data. The set of images provided are to be used partly for training and partly for testing. These are Flickr images depicting geographical areas with flooded regions.

Given the provided set of images, denote the training/learning images $I_L = \{I_1, I_2, \dots, I_n\}$, with regions which may be classified as floods versus non-floods --i.e., two classes of water images and non-water images (I_W, I_{NW}). Water images contain regions recognized as water, versus non-water images do not include such regions.

In a first stage we would like to statistically characterize these distinct regions—learning stage, also referred to as pre-processing

1. Pre-processing

Extract regions corresponding to “water” from the set I_L whose size is chosen—i.e. 1/3 of entire set-(e.g. crop it manually) as well as those corresponding to “non-water”, and learn the statistical models of water vs non-water. Choose your method and explain both theoretically as well as qualitatively the rationale for such a choice. Detail your work to allow a technically capable individual (but not necessarily area-savvy) to understand your work.

2. Flood Detection

Using the results in (1), and the labels of water and non-water images/regions, build a classifier that can be used for detecting water regions in manually cropped sub-images. Use a Bayesian approach with a properly chosen prior to design a classifier to detect the present/absence of a flood in the test image set I_S that you defined above. Can you design a linear classifier to do the same? **If so do it, and if not give a very clear and well founded statement for that.**

Evaluate the performance of the proposed techniques.

3. Segmentation

Attached is a related paper published in the late 90's which proposes a hierarchical technique for segmenting an image. It delineates regions by way of their pixel memberships to a given class. a. Can use this as an inspiration to propose an equivalent segmentation technique by using the statistical characterization discovered above?

b. Test it and evaluate it.

c. Can you further propose a technique to distinguish a river bed from a regular large flooded area? Test it and evaluate it.