Comparative Research of Image Processing Algorithms for Segmentation of Natural Water Bodies in Satellite Images

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Abrupt climate changes around the world, coupled with the rapid growth of population, are leading to a critical shortage of water, thus creating a need for reliable, up-to-date, and efficient monitoring of global water sources. Such monitoring is possible through satellite imagery. To do so requires the ability to identify bodies of water easily and efficiently in satellite images and map their contours. The research objective is to compare various approaches for solving this problem of identifying bodies of water in satellite images – using classic image processing algorithms, machine learning models and deep neural networks. First, hyperparameters were optimized and fine-tuned and a minor comparison was conducted to find the most accurate machine learning model and neural network. Second, in the major comparison, the found model and network were compared with the classic image processing algorithm to decide which of the three methods is better for solving the problem. The results show that in general neural networks are more accurate than the other methods. Moreover, neural networks with just a single convolution layer performed better than those with multiple or no convolution layers at all. The research and the code that were developed lay the foundation for identifying contour changes in bodies of water over time. This information may be used in predicting droughts and floods and locating new accessible water sources near rural areas.

Awards Won:
Fondazione Bruno Kessler: Award to participate in summer school "Web Valley"