

DETECTION OF SURFACE WATER QUALITY BIOMARKERS USING COMPUTER VISION MODELS BASED ON DATASETS OF IMAGES AT DIFFERENT SCALES

M. Walo, D. Majerek, T. Kuzmina, G. Łagód

Lublin University of Technology, Lublin, PL

Abstract: Biomarkers are used to study surface water quality, the presence of which can indicate the level of anthropogenic pressure, or the presence of specific groups of pollutants. Detection and determination of microbial abundance is a non-invasive and low-cost way to provide data linked to the quality of the aquatic environment. The tests can be based on analyzing the composition of a previously prepared sample of biological material, such as periphyton, taken from a water body under a microscope at the appropriate magnification. The purpose of this work was to analyze the possibility of automating this task by using deep learning methods and to test the influence of the scale of objects (optical magnification) present in digital images of a microscopic sample, on the prediction of a computer vision model. For this purpose, two YOLO v8 neural networks trained on digital images taken at x10 and x40 magnification (of a transmitted-light optical microscope operating in a bright field of view) were used for detection of the *Cyclotella* biomarker. After training and hyperparameter tuning, the models were tested on images at different magnifications than those on which they were taught. Then, on a set consisting of images at different magnifications, the model that was created was tested for more accurate detection of the *Cyclotella* object.

Keywords: water quality biomarkers, surface water, detection task, computer vision, digital images