HISTOGRAM-BASED EDGE DETECTION AS A TOOL FOR DETECTING RIVER COASTLINE

Grzegorz Walusiak, Matylda Witek, Tomasz Niedzielski

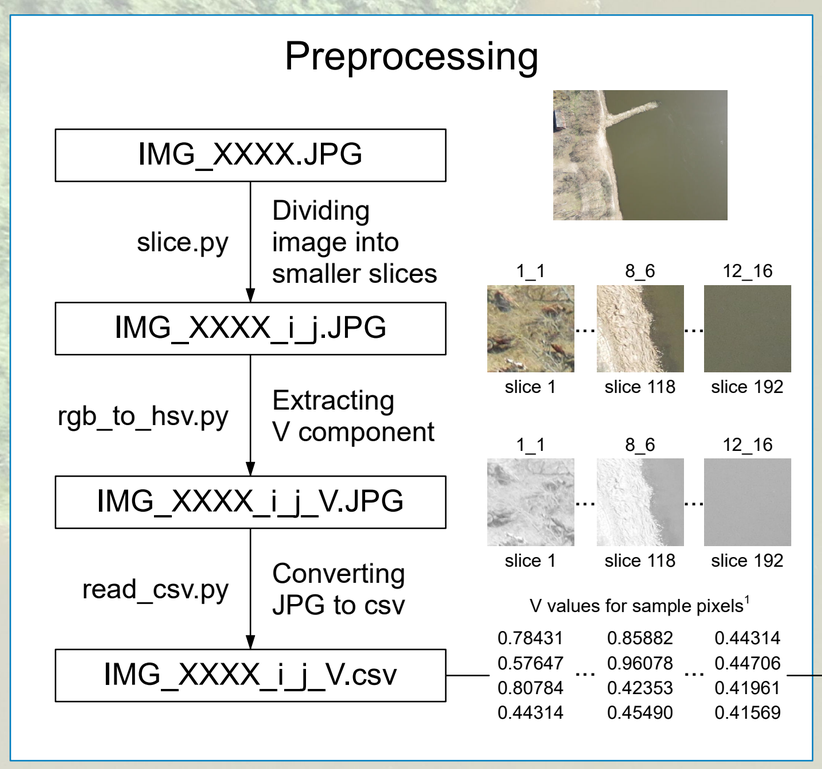
Department of Geoinformatics and Cartography
Institute of Geography and Regional Development
University of Wrocław, Poland

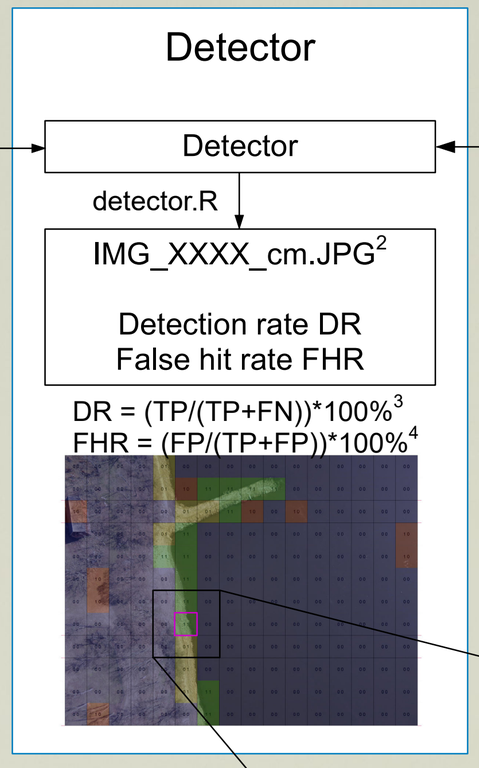
Objectives

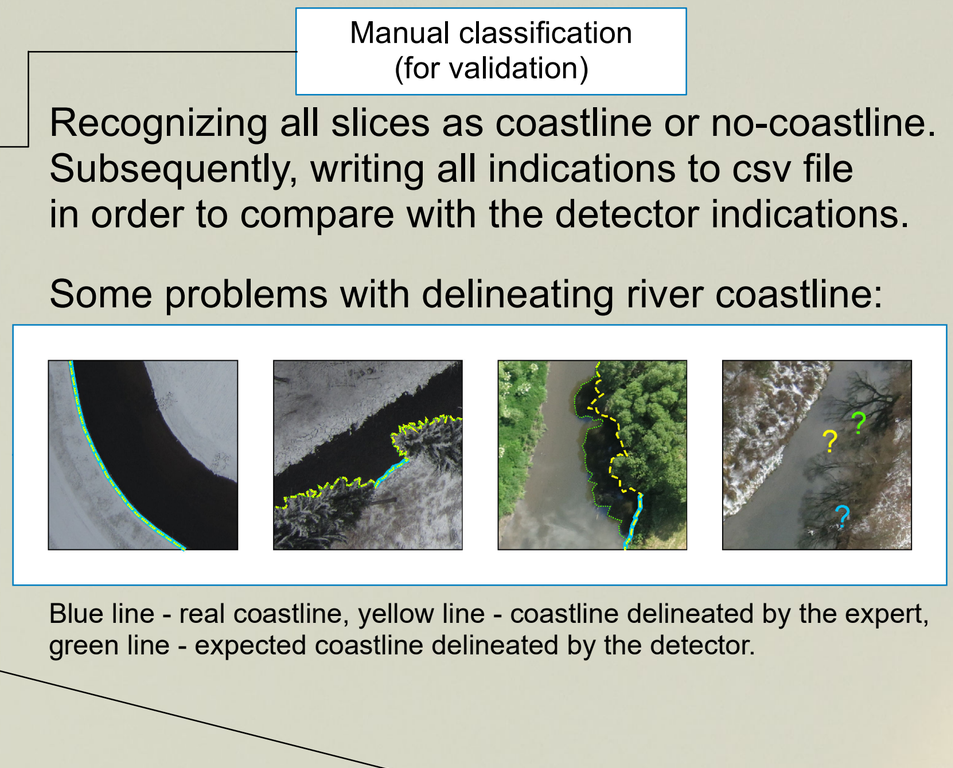
To elaborate a new method for delineating river coastline based only on close-range RGB nadir images acquired by means of UAV (unmanned aerial vehicle), converted to HSV (hue, saturation, value) color space. We used spectral characteristics of water surface which has uniform V component, while other land cover types have heterogeneous V. Areas, where character of V changes considerably, are suspected to be river coastline. We focused on identifying multi-modal or leptokurtic histograms.

Main statistical conditions for river coastline detection were as follows:
- for one mode distribution the kurtosis should be greater than the established threshold and simultanously the concentration around mode should be greater than the established threshold,
- for more mode distribution the concentration around mode should be greater than the established threshold.

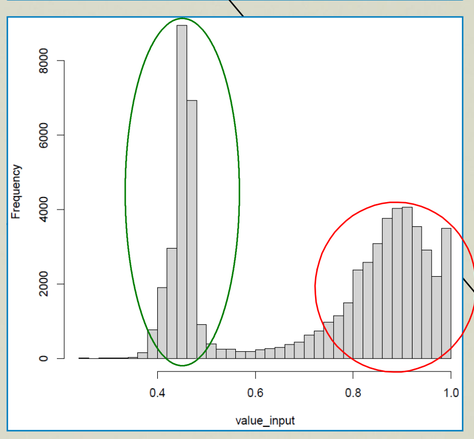
Methods







Blue line - real coastline, yellow line - coastline delineated by the expert, green line - expected coastline delineated by the detector.

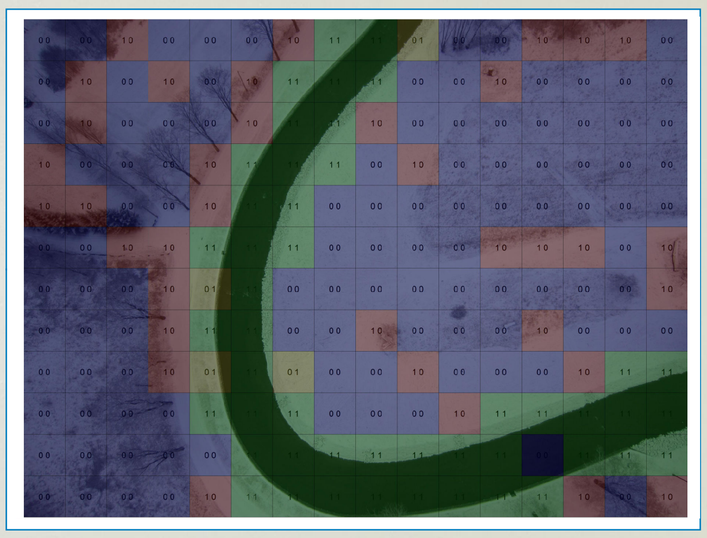


Histogram of V values for 8_6

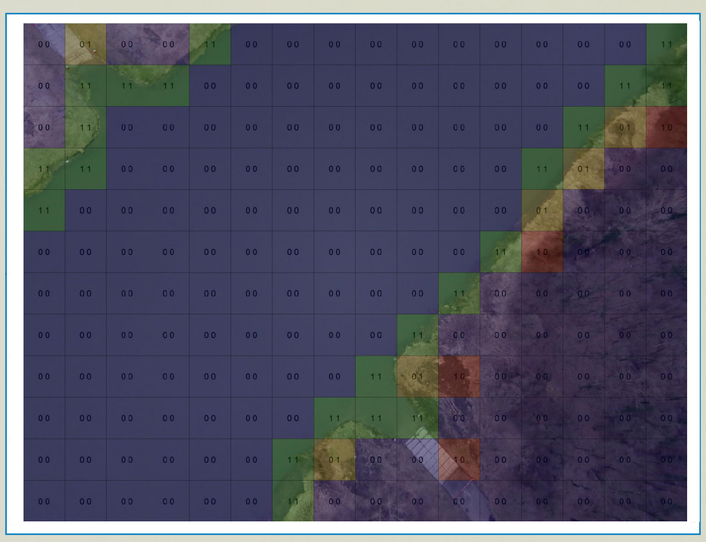
[1] Assumptions for river coastline detection:
- water surface has uniform color and V values (slice 12_16),
- river neighborhood has heterogeneous color and V values (slice 1_1),
- slices with similar and differential V values are suspected to be a river coastline (slice 8_6).

[2] cm - confusion matrix
[3] TP - true positive
FN - false negative
[4] FP - false positive

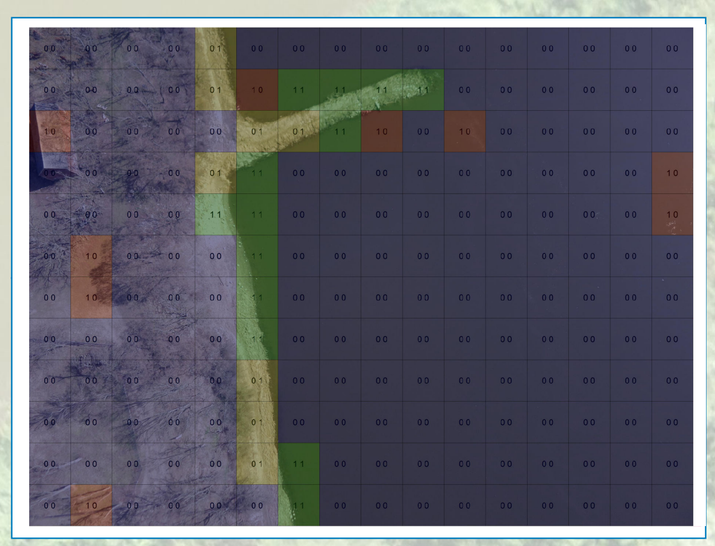
Results



DR 92%, FHR 44.58%



DR 78.57%, FHR 15.38%



DR 61.90%, FHR 38.10%

We analyzed 30 images, presenting both narrow (10 m) and wide (more than 100 m) rivers.
Detection rate ranges from 22.22% to 92.00%, while the false hit rate ranges from 5.00% to 82.76%.
For 70% of all analyzed images the detection rate was above 50%. For 47% of all analyzed images the false hit rate was below 40%.
Considering the subset of photos presenting only wide rivers, detection rate above 50% occurred for 80% of these images.

Conclusions

1. The method is cheap and universal as it uses only RGB images.
2. This approach provides quick indication of river coastline.
3. It is possible to obtain roughly delineated river coastline course.
4. The method works better for wide rivers
5. Obtained results are good input for futher research - spatial transfer from slices to line.

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