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Project Proposal – Rip current detector

Rip currents are deadly sea currents mostly appearing on sandy coasts such as Israel's Mediterranean shore. These very strong currents reach up to $2.5\frac{m}{s}$, faster than an Olympic swimmer and responsible for most of the deaths by drowning in Israel's coasts. Almost all cases of drowning due to rip current are during lifeguards' off-hours or unsupervised coasts, this is because the rip current is easy to detect by professional lifeguards. Our project goal is to mitigate the lifeguard work by using Deep Learning methods for detecting those deadly currents.

For the last few years the main approach to detect rip current was by using classical methods such as optical flow [1] and aggregating video frames and detecting Haar like features [2]. In February 2021 a paper published by de Silva et al. presented a Deep Learning approach to detect the rip current from an image database using R-CNN with regional aggregation [3]. In addition, a website contains thousands of ground truth images including rip currents and their area edges labeled by NOAA's[1] experts were published for free use.

We first aim to restore the paper's results to accurately detect the rip current region based on the image database mentioned above. At this stage the correct example will be defined by the Intersection over Union (IoU) above threshold value of 0.3 and our benchmark would be to beat the averaged accuracy achieved by F-RCNN (0.983). In addition, we plan to correctly classify not only the location of the rip currents in the images, but also the severity of them. We can estimate it by using the ratio between height and width of each rectangle marking the rip currents in the images, as the ratio is higher so does the severity of the rip current, as can be concluded from fluid mechanics laws. The latter would be measured using multi class accuracy.

References:

[1] Philip, S., Pang, A., 2016. Detecting and Visualizing Rip Current Using Optical Flow, in: Bertini, E., Elmqvist, N., Wischgoll, T. (Eds.), EuroVis 2016 - Short Papers, The Eurographics Association. p. 115. doi:10.2312/eurovisshort.20161155.

[2] Maryan, C., Hoque, M.T., Michael, C., Ioup, E., Abdelguerfi, M., 2019. Machine learning applications in detecting rip channels from images. Applied Soft Computing 78, 84–93.

[3] Akila de Silva, Issei Mori, Gregory Dusek, James Davis, Alex Pang, Automated rip current detection with region based convolutional neural networks, Coastal Engineering, Volume 166, 2021, 103859, ISSN 0378-3839, https://doi.org/10.1016/j.coastaleng.2021.103859.

[1] National Oceanic and Atmospheric Association