DOI: 10.37102/1992-4429_2022_39_01_07

NEURAL-NETWORK-BASED CLASSIFICATION OF BIOLOGICAL OBJECT IMAGES TAKEN BY UNDERWATER CAMERAS

D.D. Kaplunenko, S.S. Zotov, A.E. Subote, V.K. Fischenko

This article considers the application of a pre-trained convolutional neural network for classifying marine inhabitants visible with underwater cameras located in the Alekseeva bay, Popov Island, located in the Peter the Great Bay in the Sea of Japan. To test how these methods are applicable, we used the YOLOv5 model, specially trained to detect moving marine species located within underwater cameras' line of sight. We used two types of models with a small (simple) and large (complicated) number of parameters. Before the experiments, we assumed that after the training process, the model could distinguish fishes from shrimps, crabs, jellyfishes and sea stars (a total of six classes of objects). To train the model, we have used a dataset prepared by the University of Aalborg (Denmark), also named Brackish Dataset, which is available free online. Further, the model trained with this dataset has been applied to images obtained from the marine station of Popov Island. These images were obtained during the fall of 2018 (September – October). During the data analysis, the model detected mentioned classes of marine habitats with a different probability. In general, the applied studies have shown that the YOLOv5 trained to detect marine habitats can give adequate results depending on the robustness of the learning process and how deep the learning was. In addition, it showed that it is necessary to pre-train that kind of model on proprietary datasets which can cover peculiar regional properties of Far East marginal seas.

Keywords: underwater video surveillance, Sea of Japan, object detection model YoloV5.

References

1. Fishchenko V.K., Zimin P.S., Zacerkovny A.V., Goncharova A.A., Subote A.E., Golik A.V. Stationary systems of underwater video surveillance: possibilities of application for biota monitoring of the coastal waters of the Petra Bay Great (Sea of Japan). Bulletin of the Far Eastern Branch of the Russian Academy of Sciences. 2018. No. 1. P. 149–160.

2. Fishchenko V.K., Zimin P.S., Zacerkovny A.V., Subote A.E., Golik A.V., Goncharova A.A. Systems of stationary underwater video surveillance of coastal waters. Underwater research and robotics. 2020. No. 1 (31). P. 60–71. DOI: 10.37102/24094609.2020.31.1.008.

3. Bochkovskiy A., Wang Chien-Yao, Liao Hong-Yuan Mark YOLOv4: Optimal Speed and Accuracy of Object Detection. arXiv:2004.10934v1 [cs. CV] 23 Apr 2020.

4. Pedersen, M., Haurum, J. B., Gade, R., Moeslund, T. B., & Madsen, N. (2019). Detection of Marine Animals in a New Underwater Dataset with Varying Visibility. In IEEE Conference on Computer Vision and Pattern Recognition Workshops IEEE. IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW). http://openaccess.thecvf.com/content_CVPRW_2019/html/AAMVEM/Pedersen_Detection_of_Marine_Animals_in_a_New_Underwater_Dataset_with_CVPRW_2019_paper.html

5. Thum G. W., Tang S. H., Ahmad S. A., Alrifaey M. Toward a Highly Accurate Classification of Underwater Cable Images via Deep Convolutional Neural Network. http://dx.doi.org/10.3390/jmse8110924

6. Ricolfe-Viala C., Blanes C. Improving Robot Perception Skills Using a Fast Image-Labelling Method with Minimal Human Intervention. https://doi.org/10.3390/app12031557

7. Jocher Glenn. Train Custom Data for YOLOv5. Electronic resource. https://github.com/ultralytics/yolov5#pretrained-checkpoints Date of the application 1.02.2022

8. Brackish Underwater Dataset. Electronic resource. https://public.roboflow.com/object-detection/brackish-underwater Date of the application 1.02.2022

About the authors

KAPLUNENKO Dmitry Dmitrievich, PhD, senior research scientist
V.I. Il'ichev Pacific Oceanological Institute of the Far Eastern Branch of the Russian Academy of Sciences
Address: 43, Baltiyskaya Street, Vladivostok, 690041, Russia
Research interests: geophysical fluid dynamics, global circulation modelling, Russian Far East seas
Phone: +7 (423) 231-3087, fax: +7 (423) 231-2573
E-mail: dimkap@poi.dvo.ru

ZOTOV Sergey Sergeevich, senior lecturer, head of the educational program TDZZ of the Academy of Digital Transformation
Far Eastern Federal University
Address: 690922, Primorsky Territory, Russian Island, Ajax settlement, 10
E-mail: zotov.ss@dvfu.ru
Phone: +7 (423) 2362424 (доб. 2281), **Fax** +7 (423) 243-2315

SUBOTE Aleksey Evgenyevich, Head of the Department for Operation, Development and Protection of Information and Telecommunication Resources
V.I. Il'ichev Pacific Oceanological Institute of the Far Eastern Branch of the Russian Academy of Sciences
Address: 43, Baltiyskaya Street, Vladivostok, 690041, Russia
E-mail: subote.ae@poi.dvo.ru
Phone: +7 (423) 231-2851, **Fax** +7 (423) 231-2573

FISHCHENKO Vitaliy Konstantinovich, Ph.D., Head of the Laboratory for the Analysis of Oceanological Information
V.I. Il'ichev Pacific Oceanological Institute of the Far Eastern Branch of the Russian Academy of Sciences
Address: 43, Baltiyskaya Street, Vladivostok, 690041, Russia
E-mail: fischenko@poi.dvo.ru
Phone: +7 (423) 231-1631, **fax** (423) 2312573