UNIVERSITÉ DE TOULON

LIS
LABORATOIRE D'INFORMATIQUE & SYSTÈMES

Master internship : Enhancement of underwater images based on deep learning

1 Internship topic

Perception in an underwater environment is a dual issue, both civil and military. The exploration of the underwater environment is a crucial task for various actors such as a navy, oceanography, oil groups, etc. For example, knowledge of the seabed plays an important role in deploying submarines and ships. As for input data, underwater vision mainly relies on the following two types of input data. The first are visual images/videos. This type of imagery often has a limited field of vision because light or electromagnetic waves propagate with difficulty in an aquatic environment. The second type which are side-viewing active sonar images are often used in underwater imaging due to the large propagation of acoustic waves. However, this type of image can lead to difficulties in the detection and classification of objects because it provides much less visual information than visual images/videos.

Studying visual data taken by underwater cameras is a difficult task. This challenge comes from the following issues. First, the underwater images are noisy and dark due to the lack of light in the acquisition phase. Moreover, this condition also leads to low contrast, as well as light scattering effects in these images. On the other hand, the absorption of light in water is different depending on the wavelength, therefore the variation in illumination and color is strong in this type of images. This is because visible light with longer wavelengths is strongly absorbed by water. This causes the colors of the fish to vary depending on the distance and depth from the camera. In addition, due to the lens/air/water interface, image distortion is also a problem in underwater images compared to conventional images. This is why the detection and recognition of objects in underwater images is more difficult than that of popular images, since these factors make the classical detection and classification algorithms ineffective because they are not designed for deal with such difficulties.

The objective of this internship is to study deep learning methods [1, 2, 3, 4, 5, 6] to propose a method for improving underwater images before using classical methods computer vision.

2 Profile and requirements

Students in Master or engineering school with a major in image processing, machine learning or artificial intelligence. Good python programming skills are required. Knowledge of deep learning frameworks is a desirable plus. The candidate must have good writing and oral communication skills.

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3 Realization et Supervision

The student will work in the SIIM team of the LIS laboratory, UMR 7020 for 6 months. The internship can start as soon as possible. The internship will be supervised by Thanh Phuong NGUYEN, University of Toulon. To apply for this internship, please send your CV and the latest transcript to Thanh Phuong NGUYEN at : tpnguyen@univ-tln.fr

Références

[1] Sharma, P.K., Bisht, I., Sur, A. : Wavelength-based attributed deep neural network for underwater image restoration (2021)

[2] Islam, M.J., Xia, Y., Sattar, J. : Fast underwater image enhancement for improved visual perception. IEEE Robotics and Automation Letters (RA-L) **5**(2) (2020) 3227–3234

[3] Li, C., Guo, C., Ren, W., Cong, R., Hou, J., Kwong, S., Tao, D. : An underwater image enhancement benchmark dataset and beyond. IEEE Transactions on Image Processing **29** (2020) 4376–4389

[4] Riba, E., Mishkin, D., andE. Rublee, D.P., Bradski, G. : Kornia : an open source differentiable computer vision library for pytorch. In : Winter Conference on Applications of Computer Vision. (2020)

[5] Islam, M.J., Edge, C., Xiao, Y., Luo, P., Mehtaz, M., Morse, C., Enan, S.S., Sattar, J. : Semantic Segmentation of Underwater Imagery : Dataset and Benchmark. In : IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE/RSJ (2020)

[6] Cao, Z., Hidalgo Martinez, G., Simon, T., Wei, S., Sheikh, Y.A. : Openpose : Realtime multi-person 2d pose estimation using part affinity fields. IEEE Transactions on Pattern Analysis and Machine Intelligence (2019)