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Abstract

Subsea inspection data is currently processed and reviewed manually. Shell, Schlumberger research, and OneSubsea are collaborating on a new R&D project to provide automated anomaly detection on real large-scale subsea infield and pipeline inspection data. To achieve the above, the team utilizes state-of-the-art computer vision techniques with machine learning.

Computer vision, through machine learning, has made significant advances in feature identification, tracking, and segmentation. In particular, object detection and semantic segmentation enable the identification and tracking of objects in the presence of occlusion. Such features can be useful for subsea video data, where sensing limitations in terms of resolution, range, and noise can influence the ability to accurately identify and track objects in a complex scene. Further, it can be used both during the operation and for post-processing and labeling of video and sensor data. Online, it can be used to assist an autonomous vehicle during a mission to identify elements of interest within a scene and provide localization. Offline, it can be used to identify anomalies in the subsea infrastructure and pipelines. Object detection is typically approached as a combination classification and regression problem where the algorithm will learn the characteristics of all the structures of interest (classes) using a set of labeled video frames. These characteristics are then subsequently used for labelling the test video frames. Nowadays, deep learning methods based on convolutional neural networks ensure state-of-the-art performance in different areas of computer vision like image classification, activity recognition, and object detection. Obtaining relevant labeled data is critical to evaluating and building the object detection computer algorithms. This labelled data can then be used for training and testing purposes to implement object detection.

The collaboration has produced an efficient workflow for computer vision from ingesting the data, labeling the data, and training for machine learning for automated feature detection. Very promising efficiencies have been gained through the machine learning workflow and through automated anomaly detection. Furthermore, it has shown to remove human error during the acquisition process and show a faster turnaround from data acquisition to insight.