ABSTRACT

Compressive Sensing (CS) is a method wherein the acquisition and compression of signals are concurrently executed, and performed by a server that processes input data to be forwarded to the recipient. This approach enables the accurate reconstruction of signals from a significantly lower number of samples than traditional methods require. It proves invaluable in scenarios where reducing the volume of data to be acquired, stored, or transmitted is desired, which can lead to savings in time, storage space, or bandwidth. The server processes input data for detection and classification without undertaking a reconstruction process. The method of non-reconstruction classification is referred to as Compressive Learning (CL). However, CL has the drawback of reduced accuracy under conditions of aggressive compression rates. Here, reconstruction is necessary to maintain high levels of accuracy.

.

In certain situations, signal reconstruction is necessary while high-level inference remains the primary goal of compressed sensing (CS) systems. A joint reconstruction and inference pipeline was proposed by [24], optimizing a deep learning (DL) pipeline. After learning the sensing matrix, the pipeline diverges into two separate branches: image reconstruction and image labeling. This configuration, in essence, is more efficient than solutions that rely on separate pipelines for reconstruction and labeling. The work by[15] also integrates these two stages into a single phase, classifying compressed EEG and EKG signals at the sensor node.

.

In a dataset comprising a limited number of 92 images, the joint process of labeling and reconstruction must remain efficient and accurate. The research proposes a joint pipeline following the image processing sensing matrix A in a compressive sensing framework with two pipelines: DCT CL and Multi Neural Networks, and the SVD method within the GoogleNet framework. Method SVD with GoogleNet framework provides a solution for object recognition, achieving accuracy values ranging from 0.8947 to 0.6315 for compression ratios of 3.97 to 31.75. This performance shows a linear tendency concerning the PSNR level, an index of the quality of signal reconstruction, and demonstrates an efficient process in the S matrix. The CL pipeline obtained accuracy values from 0.6522 to 0.3403 for the same compression ratios. Furthermore, the stand-alone real-time object detection system YOLOv7 (You Only Look Once) was added to this research as a benchmark for comparing accuracy results using reconstructed objects, achieving accuracy values between 0.74 and 0.405 for the same compression ratios. .

Keywords: Compressive Sensing, Compressive Learning, Discrete Cosine Transform, Singular Value Decomposition, Deep Learning, Accuracy.