

Title: Fast and Efficient Lung Abnormality Identification With Explainable AI: A Comprehensive Framework for Chest CT Scan and X-Ray Images

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Abstract: Vector quantization (VQ) is a block coding method that is famous for its high compression ratio and simple encoder and decoder implementation. Linde–Buzo–Gray (LBG) is a renowned technique for VQ that uses a clustering-based approach for finding the optimum codebook. Numerous algorithms, such as Particle Swarm Optimization (PSO), the Cuckoo search algorithm (CS), bat algorithm, and firefly algorithm (FA), are used for codebook design. These algorithms are primarily focused on improving the image quality in terms of the PSNR and SSIM but use exhaustive searching to find the optimum codebook, which causes the computational time to be very high. In our study, our algorithm enhances LBG by minimizing the computational complexity by reducing the total number of comparisons among the codebook and training vectors using a match function. The input image is taken as a training vector at the encoder side, which is initialized with the random selection of the vectors from the input image. Rescaling using bilinear interpolation through the nearest neighborhood method is performed to reduce the comparison of the codebook with the training vector. The compressed image is first downsized by the encoder, which is then upscaled at the decoder side during decompression. Based on the results, it is demonstrated that the proposed method reduces the computational complexity by 50.2% compared to LBG and above 97% compared to the other LBG-based algorithms. Moreover, a 20% reduction in the memory size is also obtained, with no significant loss in the image quality compared to the LBG algorithm.

Keywords: Computational time, Codebook, Firefly algorithm, Bat algorithm, Image compression, Linde–Buzo–Gray, Peak signal to noise ratio, Vector quantization

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