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An Efficient Image Compression Technique using Long Short-Term Memory Networks (LSTM)

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Abstract*: The emergence of big data has imposed significant challenges on data storage and transmission. One pressing issue is leveraging deep learning techniques to achieve superior compression ratios and enhance image quality. Recurrent Neural Networks (RNNs) offer a promising avenue for controlling image bit rates iteratively, thereby enhancing compression performance. However, integrating Long Short-Term Memory (LSTM) into RNNs to address long-term dependencies increases model complexity. To expedite training and enhance image reconstruction quality, this study proposes several innovations.Initially, we enhance the activation function within LSTM to more effectively manage information retention and omission, thereby reducing parameter count and expediting training. Additionally, we introduce an image recovery block within the decoder to reconstruct high-resolution images. Finally, to expedite loss convergence, we replace L1 loss with SmoothL1 loss. Experimental outcomes demonstrate the efficacy of our approach, showcasing higher compression ratios.*

Keywords: image compression; recurrent neural network; long short-term memory

REFERENCES

[1]. B. Oliver, J. Pierce, C. Shannon. The philosophy of PCM. Proceedings of IRE, vol. 11, pp.1324-1331, 1948.

[2]. G. K. Wallace. The JPEG still picture compression standard. IEEE Transactions on Consumer Electronics,vol. 1, pp.43-59, 1991.

[3]. D. Taubman. High performance scalable image compression with EBCOT. IEEE Transactions on Image Processing, vol. 7, pp. 1158- 1170, 2000.

[4]. G. Toderici, D. Vincent, N. Johnston, et al. Full resolution image compression with recurrent neural networks, IEEE Conference on Computer Vision and Pattern Recognition, pp. 5306-5314, 2017.

[5]. C. Dong, C. C. Loy, K. He, et al., Learning a deep convolutional network for image super-resolution, European Conference on Computer Vision. pp. 184-199, 2014.

[6]. C. Dong, Y. Deng, C. C. Loy, et al., Compression artifacts reduction by a deep convolutional network, IEEE International Conference on Computer Vision. pp. 576-584, 2015.

[7]. J. Ballé, V. Laparra, E. P. Simoncelli. End-to-end optimizedimage compression, 2016.

[8]. F. Jiang, W.Tao, S. Liu, et al., An end-to-end compression framework based on convolutional neural networks. IEEE Transactions on Circuits and Systems for Video Technology, pp. 3007-3018, 2017.

[9]. G. Toderici, S. M. O'Malley, S. J. Hwang, et al., Variable rate image compression with recurrent neural networks, 2015.

[10]. Jiji RS, Pollak AW, Epstein FH, et al. Reproducibility of rest and exercise stress contrast-enhanced calf perfusion magnetic resonance imaging in peripheral arterial disease. J Cardiovasc Magn Reson 2013; 15:14.

[11]. S. Li, M. Li, P. Li and Y. Li, "Image compression algorithm research based on improved LSTM," 2020 International Symposium on Computer Engineering and Intelligent Communications (ISCEIC), Guangzhou, China, 2020

[12]. Versluis B, Backes WH, van Eupen MG, et al. Magnetic resonance imaging in peripheral arterial disease: reproducibility of the assessment of morphological and functional vascular status. Invest Radiol 2017; 46:11-24.

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[13]. Isbell DC, Epstein FH, Zhong X, et al. Calf muscle perfusion at peak exercise in peripheral arterial disease: measurement by first-pass contrast-enhanced magnetic resonance imaging. J Magn Reson Imaging 2019; 25:1013-20.

[14]. M. Hisatomi, J. I. Asaumi, Y. Yanagi et al., "Diagnostic value of dynamic contrast-enhanced MRI in the salivary gland tumors," Oral Oncology, vol. 43, no. 9, pp. 940–947, 2017.

[15]. Partovi S, Schulte AC, Jacobi B, et al. Blood oxygenation leveldependent (BOLD) MRI of human skeletal muscle at 1.5 and 3 T. J Magn Reson Imaging 2022;35:1227-32.

[16]. Partovi S, Schulte AC, Aschwanden M, et al. Impaired skeletal muscle microcirculation in systemic sclerosis. Arthritis Res Ther 2022; 14:R209.

[17]. Shen, S., Sandham, W., Granat, M., Sterr, A., "MRI fuzzy segmentation of brain tissue using neighborhood attraction with neural network optimization" IEEE transaction on Information Technology in Biomedicine, vol. 9, 2015, pp. 459-467. 1238

[18]. Yi-Fei Tan and Wooi-Nee Tan, "Image Compression Technique Utilizing Reference Points Coding with Threshold Values," IEEE, pp. 74-77, 2022.

[19]. K. Rajakumar and T. Arivoli, "Implementation of Multiwavelet Transform coding for lossless image compression," IEEE, pp. 634- 637, 2023.

[20]. S.Srikanth and Sukadev Meher, "Compression Efficiency for Combining Different Embedded Image Compression Techniques with Huffman Encoding," IEEE, pp. 816-820, 2023.

[21]. C. Rengarajaswamy and S. Imaculate Rosaline, "SPIHT Compression of Encrypted Images," IEEE, pp. 336-341, 2023.

[22]. K. N. Bharath, G. Padmajadevi and Kiran, "Hybrid compression using DWT-DCT and Huffman encoding techniques for biomedical image and video applications," International Journal of Computer Science and Mobile Computing (IJCSMC), vol. 2, no. 5, pp. 255 –261, 2023.

[23]. Sujoy Paul and Bitan Bandyopadhyay, "A Novel Approach for Image Compression Based on Multi-level Image Thresholding using Shannon Entropy and Differential Evolution", Proceedings of the IEEE Students Technology Symposium, IIT Kharagpur, West Bengal, India, pp.56-61, Feb 2020

[24]. Mohammad H. Asghari and Bahram Jalali , " Discrete Anamorphic Transform for Image Compression", IEEE Signal Processing Letters, Vol.2l, No.7, July 2020.

[25]. B. Heyne, C. Sun and J. Goetze, "A computationally efficient high quality cordic based DCT ," IEEE 14th European Signal Processing Conference, 2019, pp. 1 – 5.

[26]. Mittal, C. Kundu, R. Bose and R. Shevgaonkar, "Entropy based image segmentation with wavelet compression for energy efficient LTE systems," IEEE 23rd International Conference on Telecommunications (ICT), 2016, pp. 1-6.

[27]. H. R. Vilas, S. N. Kulkarni, H. Chiranth and M. Bhille, "Segmentation and compression of 2D brain MRI images for efficient teleradiological applications," 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), Chennai, 2016, pp. 1426-1431.

[28]. Chuan Qin, Chin-Chen Hiding and Compression Image Inpainting" IEEE IMAGE PROCESSING, 2014

[29]. S. M. Varghese, A. Johny and J. Job, "A survey on joint data-hiding and compression techniques based on SMVQ and image inpainting," 2015 International Conference on Soft-Computing and Networks Security (ICSNS), Coimbatore, 2015, pp. 1-4.

[30]. Ahmed Chefi, Adel Soudani and Gilles Sicard, "Hardware Compression Scheme Based on Low Complexity Arithmetic Encoding for Low Power Image Transmission Over WSNs", international Journal of Electronics and Communications(A EU), pp.193-200, August 2013.

[31]. Raghavendra.M.J, Prasantha.H.S and S.Sandya, "Image Compression Using Hybrid Combinations of DCT SVD and RLE", International Journal of Computer Techniques, Volume 2 Issue 5-2015.

[32]. S. Bouguezel and O. Ahmad, "Binary discrete cosine and Hartley transforms," IEEE Trans. Circuits. Syst, pp. 1 – 14, 2013.