Application of soft computing | Published: 13 May 2022

Deep convolution neural networks learned image classification for early cancer detection using lightweight

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Soft Computing **26**, 5937–5943 (2022)

Abstract

Essentially, cancer refers to the formation of abnormal cells in any section or area of the body. The goal of early cancer detection is to identify patients who are showing signs early on in order to maximise their chances of a successful therapy. Early detection and treatment of cancer reduce the disease mortality. A wide range of image processing and machine learning techniques have been presented for the identification of cancer. There was no improvement in detection accuracy or efficiency with existing systems. To overcome these problems, we present the

Least Mean Square Filterative Ricker Wavelet Transform-based Deep Convolutional Neural Learning Classifier Model (L-DCNLC). By using a fully connected max pooling deep convolutional network with higher accuracy and reduced time consumption, the L-DCNLC Model aims to identify cancer early. There are three hidden layers and one output layer in the fully linked max pooling deep convolutional network. The number of patient photographs in the database is used as input in the L-DCNLC Model's input layer. Following that, preprocessing is performed in hidden layer 1 to perform denoising in order to improve image quality. This is accomplished by employing the Least Mean Square Weiner Filtering process, which has a higher peak signal-to-noise ratio. The Continuous Ricker Wavelet Transform is then used to extract the image features from the preprocessed image in hidden layer 2. Finally, the classification process is performed in hidden layer 3 using the Kulczynksi Similarity Coefficient to detect the cancerous image by comparing the testing and extracted features. Thus, the cancerous image is detected and displayed with a low error rate in the output layer. The brain cancer and lung cancer datasets are analysed to determine peak signal to noise ratios (PSNR), cancer detection accuracy, and cancer detection time. The evaluation results indicate that the L-DCNLC Model improves accuracy and PSNR while requiring less computational time than previous works.

Data availability

Data sharing not applicable.

References

Abd-Ellah MK, Awad AI, Khalaf AAM, Hamed HFA (2018) Two-phase multi-model automatic brain tumour diagnosis system from magnetic resonance

images using convolutional neural network. EURASIP J Image Video Proc 97:1–10

Ali M, Riyaee KSA (2020) Skin cancer detection: Applying a deep learning based model driven architecture in the cloud for classifying dermal cell images, Informatics in Medicine Unlocked. Elsevier, Amsterdam, Netherlands

BhaskarraoBahadure N, Ray AK, Thethi HP (2017) Image Analysis for MRI based brain tumor detection and feature extraction using biologically inspired BWT and SVM. Int J Biomed Imag Hindawi. https://doi.org/10.1155/2017/9749108

Cinar A, Yildirim M (2020) Detection of tumors on brain MRI images using the hybrid convolutional neural network architecture. Medical Hypotheses, Elsevier 139:1–8

Feng Y, Yang F, Zhou X, Guo Y, Tang F, Ren F, Guo J, Ji S (2019) A deep learning approach for targeted contrast-enhanced ultrasound based prostate cancer detection. IEEE/ACM Trans Comput Biol Bioinf 16(6):1–8

Ge Ting, Ning Mu, Zhan Tianming, Chen Zhi, Gao Wanrong, Shanxiang Mu (2019) Brain lesion segmentation based on joint constraints of low-rank representation and sparse representation. Comp Intell Neurosci Hindawi 2019:1–11

Gumaei A, Hassan MM, Hassan MR, Alelaiwi A, Fortino G (2019) A hybrid feature extraction method with regularized extreme learning machine for brain tumor classification. IEEE Access 7:36266–36273

Karthiga B, Rekha M (2020) Feature extraction and I-NB classification of CT images for early lung cancer detection. Materias today. Elsevier, Amsterdam

Gongfa Li D, Jiang YZ, Jiang G, Kong J, Manogaran G (2019) Human lesion detection method based on image information and brain signal. IEEE Access 7:11533–11542

Kumar S, DattatreyaP Mankamem (2020) Optimization driven deep convolution neural network for brain tumor classification. Biocybernetics Biomed Eng 40(3):1190–1204

Mallick PK, Ryu SH, Satapathy SK, Mishra S, Nguyen GN, Tiwari P (2019) Brain MRI image classification for cancer detection using deep wavelet autoencoder-based deep neural network. IEEE Access 7:46278–46287

Mishra S, Majhi B, Sa PK (2019) Texture feature based classification on microscopic blood smear for acute lymphoblastic leukemia detection. Biomed Signal Proc Control 47:303–311

Mohamed Shakeel P, Burhanuddin MA, Desa MI (2019) Lung cancer detection from CT image using improved profuse clustering and deep learning instantaneously trained neural networks. Measurement 145:702–712

Natarajan VA, Sunil Kumar M, Patan R, Kallam S, Noor Mohamed MY (2020) Segmentation of nuclei in histopathology images using fully convolutional deep neural architecture, 2020 International conference on computing and information technology (ICCIT-1441), pp 1–7, doi: https://doi.org/10.1109/ICCIT-144147971.2020.9213817.

Özyurt F, Sert E, Avcı D (2020) An expert system for brain tumor detection: Fuzzy C-means with

superresolution and convolutional neural network with extreme learning machine. Med Hypotheses 134:1–8

Rajan PG, Sundar C (2019) Brain tumor detection and segmentation by intensity adjustment. J Med Syst 43(282):1–13

Soltaninejad M, Yang G, Lambrou T, Allinson N, Jones TL, Barrick TR, Howe FA, Ye X (2017) Automated brain tumour detection and segmentation using superpixel-based extremely randomized trees in FLAIR MRI. Int J Comp Assisted Radiol Surg 12:183–203

Togacar M, Ergen B, Comert Z (2020) Detection of lung cancer on chest CT images using minimum redundancy maximum relevance feature selection method with convolutional neural networks. Biocybernetics Biomed Eng 40(1):23–39

Varuna Shree N, Kumar TNR (2018) Identification and classification of brain tumor MRI images with feature extraction using DWT and probabilistic neural network. Brain Inform 5(1):23–30. https://doi.org/10.1007/s40708-017-0075-5

Wang X, Guo Yi, Wang Y, Jinhua Yu (2019) Automatic breast tumor detection in ABVS images based on convolutional neural network and superpixel patterns. Neural Comp Appl 31:1069–1081

Zhao J, Li D, Kassam Z, Howey J, Chong J, Chen Bo, Li S (2020) Tripartite-GAN: synthesizing liver contrast-enhanced MRI to improve tumor detection. Med Image Anal 63:1–16

Funding

This research has no funding by any organization or individual.

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Contributions

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Ethics declarations

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Cite this article

Seshadri Ramana, K., Bala Chowdappa, K., Obulesu, O. *et al.* Deep convolution neural networks learned image classification for early cancer detection using lightweight. *Soft Comput* **26**, 5937–5943 (2022). https://doi.org/10.1007/s00500-022-07166-w

Accepted	Published	Issue Date
03 December 2021	13 May 2022	June 2022

DOI

https://doi.org/10.1007/s00500-022-07166-w

Keywords

Machine learning **Classification**

Image processing **Cancer detection**

Continuous ricker wavelet transform