Early detection and diagnosis of breast cancer lesions using (deep) convolutional neural networks in digital mammographic images.

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Abstract

To write

Chapter 1

Introduction

[1] is the first article to use convolutional networks for breast cancer detection. They used a CNN with two hidden layers to detect microcalcifications. A high sensitivity image processing technique was used to obtain a set of 2104 patches (16 by 16 pixels) of all potential disease areas from 68 digital mammograms; of these, 265 were true microcalcifications and 1821 were "false subtle microcalcifications". Prior to training the CNN, a wavelet high-pass filtering technique was used to remove the background of these images. Each image was flipped over (left-right) and 4 rotations for each the original and flipped images were used for training (0°, 90°, 180°and 270°). The CNN was composed of one input unit (16×16), 12 units in the first hidden layer (12×12), 12 units in the second hidden layer(8×8) and two output nodes(one for YES and one for NOT). The input size (16), number of hidden layers (2) and kernel size (5×5) was obtained via cross validation, altough not many other options were explored: they tried input sizes of 8, 16 or 32, one or two hidden layers and kernel sizes of 2, 3, 5 or 13. The CNN reached 0.87 average AUC when identifying individual microcalcifications and 0.97 AUC for clustered microcalcifications. Only a minimum of three calcifications was considered a detection. Sensitivity and specificity test results were not calculated. This article proved that simple convolutional networks can be efficiently used for medical image pattern recognition.
A refined approach was presented some years later along some non convolutional neural networks [2]. The setting is very similar but .... the specific changes are that ... Plus, they presented some neural networks

Bibliography

[1] Shih-Chung B. Lo, Heang-Ping Chan, Jyh-Shyan Lin, Huai Li, Matthew T. Freedman, and Seong K. Mun. Artificial convolution neural network for medical image pattern recognition. *Neural Networks*, 8(78):1201 – 1214, 1995. Automatic Target Recognition.

[2] Shih-Chung B. Lo, Jyh-Shyan J. Lin, Matthew T. Freedman, and Seong K. Mun. Application of artificial neural networks to medical image pattern recognition: Detection of clustered microcalcifications on mammograms and lung cancer on chest radiographs. *Journal of VLSI signal processing systems for signal, image and video technology*, 18(3):263–274, 1998.