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ME-CCNN: Multi-encoded images and a cascade convolutional neural network for breast tumor segmentation and recognition

Ramin Ranjbarzadeh[1] · Saeid Jafarzadeh Ghoushchi[2] · Nazanin Tataei Sarshar[3] · Erfan Babaee Tirkolaee[4] · Sadia Samar Ali[5] · Teerath Kumar[6] · Malika Bendechache[7]

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Abstract
Breast tumor segmentation and recognition from mammograms play a key role in healthcare and treatment services. As different tumors in mammography have dissimilar densities, shapes, sizes, and edges, the interpretation of mammograms can be time-consuming and prone to interpretation variability even for a highly trained radiologist or expert. In this study, several encoding approaches are first proposed to achieve an effective breast cancer recognition system as well as create new images from the input image. Each encoded image represents some unique features that are crucial for detecting the target texture properly. Subsequently, pectoral muscle is eliminated using obtained features from these encoded images. Moreover, 11 distinct images are then applied to a shallow and efficient cascade Convolutional Neural Network (CNN) for classifying each pixel inside the image. This network accepts 11 local patches as the input from 11 obtained encoded images. Next, all extracted features are concatenated to a vertical vector to apply to the fully connected layers. Using different representations of the input mammogram images, the suggested model is able to analyze the input texture more effectively without using a deep CNN model. Finally, comprehensive experiments are then conducted on two public datasets which then demonstrate that the proposed framework successfully is able to gain competitive outcomes compared to a number of baselines.

Keywords Breast cancer · Tumor segmentation · Medical image analysis · Deep learning

1 Introduction

Breast cancer represents a heterogeneous group of tumors (lesions) with varied genotype and phenotype features and spreads at different rates that are still one of the major diseases leading to female death and can be recognized from medical images. Breast cancer is prone

✉ Ramin Ranjbarzadeh
ramin.ranjbarzadehkondrood2@mail.dcu.ie

✉ Erfan Babaee Tirkolaee
erfan.babaee@istinye.edu.tr

Extended author information available on the last page of the article