Chapter 17
A Fusion-Based Approach to Generate and Classify Synthetic Cancer Cell Image Using DCGAN and CNN Architecture

Ahan Chatterjee
https://orcid.org/0000-0001-5217-4457
The Neotia University, India

Swagatam Roy
https://orcid.org/0000-0002-8012-5529
The Neotia University, India

ABSTRACT

The most talked about disease of our era, cancer, has taken many lives, and most of them are due to late prognosis. Statistical data shows around 10 million people lose their lives per year due to cancer globally. With every passing year, the malignant cancer cells are evolving at a rapid pace. The cancer cells are mutating with time, and it's becoming much more dangerous than before. In the chapter, the authors propose a DCGAN-based neural net architecture that will generate synthetic blood cancer cell images from fed data. The images, which will be generated, don't exist but can be formed in the near future due to constant mutation of the virus. Afterwards, the synthetic image is passes through a CNN net architecture which will predict the output class of the synthetic image. The novelty in this chapter is that it will generate some cancer cell images that can be generated after mutation, and it will predict the class of the image, whether it's malignant or benign through the proposed CNN architecture.

DOI: 10.4018/978-1-6684-7544-7.ch017

INTRODUCTION

One of the most discussed diseases of the 21st Century is none other than Cancer. As per statistics per year around 10 million people pass away globally due to cancer. (Chatterjee et al. 2020) Detection of cancer cell in the early stage is plays as one of the key factor in increased survival rate.(Yang et al.,2017) Application of Deep Learning is brining paradigm shift in medical image prognosis. (Rubin et al., 2019) There is a shortage of labeled data in the field of bio-medical, thus the importance data augmentation increases. (Perez at al. 2017) Along with the generated image data, the classification of those data correctly is another important task as with the early detection of malignant cell we can act quickly and better in the prognosis to save one's life. The arrival of Deep Neural Network (DNN) has brought dynamic changes in the field by improving algorithms by leaps and bounds. (Xie et al., 2015)

One of the most promising approaches of image synthesis is Generative Adversarial Networks (GAN). Data Augmentation becomes easier with the applicability of GAN as it's capable of creating high quality realistic image from the training dataset. Along, with the data generation we need to classify those generated images into malignant and benign class for prognosis, and for this we use Convolutional Neural Network (CNN). CNN is highly capable to classify image based on the patterns and features present in an image. (Kitrungrotsakul et al., 2019) In this paper, our study focuses on generating new cancer cell using GAN, which doesn't exist currently but it may appear in human body as a malignant cell due to constant mutation of cancer cells. (Chen et al. 2014) As the cancer cell is constantly mutating it's becoming more dangerous than before, thus detection at early stage becomes more important. (Zhang et al. 2016). Then the generated image is being tested through a CNN Architecture, to classify those cells into malignant and benign. In this way we create a data library for new cancer cells and classify them into classes for future prognosis.

The paper is structured as; Sect II. contains literature review, Sect III. contains our proposed methodology and model architecture, Sect IV. contains results, and analysis on that backdrop, and Sect V. as concluding remark with future scope of study.

1. Literature Review

Shin et al. used Image to Image Condition in GAN to generate the synthesized data to classify T1 brain tumor class on ADNI dataset. They showed it can increase accuracy of classifier if trained in GAN images rather than original dataset. Iqbal et al. proposes an innovative method of medical imaging using GAN (MI-GAN) to generate retinal images. The results show the newly formed image contains the structure from original image. Senaras et al. proposed a conditional GAN technique (cGAN) to synthesize. Another work by Mahapatra et al. shows to generate a high resolution image from a low resolution image through proposed model of P-GAN. Another work suggested implementing GAN for hyper spectral images, authored by Zhu et al. Fosto Kamga guy et al. proposed to use transfer learning algorithms such as VGG16, Alexnet, InceptionV3 to create a fusion-schema model to generate images. Shang et al. computed the missing data problem in a dataset using Cyclic-GAN technique. Gurumurthy et al. proposed a DeLiGAN method to solve problems arise due to limited dataset for training. Premchand and Dutt proposed a methodology through which GAN can be implemented for speech denoising. One of the major challenges in implementing CNN model is the requirement of cleaned required data, thus to solve synthetic images are taken.