Semi-Supervised Generative Adversarial Network (SGAN) for Nuclei Detection in Breast Cancer Histopathology Images

**Abstract—In this paper we refine the work of a Semi-Supervised**

**Generative Adversarial Network (SGAN) to work with the H&E**

**breast cancer histopathology images dataset published by the**

**Case Western Reserve University. Our goal was to evaluate if the**

**semi-supervised model could achieve comparable or better**

**performance to state-of-the-art approaches in nuclei detection.**

**Our results showed that our model was able to learn useful high-**

**level features of nuclear structures as well as to generate visually**

**appealing samples. We conclude that more experimentation is**

**necessary in order to formulate a more robust and significant**

**progression.**

***Keywords— Feature representation learning; automated nuclei***

***detection; semi-supervised approach; Generative Adversarial***

***Network; breast cancer histopathology.***

I. INTRODUCTION

Nuclei Detection allows researchers to identify each individual cell in a sample. By measuring how cells react to various treatments, the researcher can understand the

underlying biological processes at work. The analysis of histopathology images is currently the standard for diagnosing breast cancer. This fact is a convincing motivation to

discover, enhance, and automated efficient approaches to distinguish individual cancer nuclei on breast pathology images.

Getting large amounts of unlabeled medical data is generally much easier than labeled data. Unsupervised generative models with stochastic components such as

Generative Adversarial Networks (GAN) and Variational Autoencoder (VAE) can be trained end-to-end to learn representative features in a completely unsupervised way. For that reason, both approaches could optimally leverage this amount of information.

The following is an outline of the rest of this paper. A review of similar architectures and previous related works is presented in Section II, a detailed description of our Semi-Supervised Generative Adversarial Network (SGAN) is presented in Section III, the experimental setup and comparative strategies are discussed in Section IV, the experiment results and discussions are reported in Section V, and conclusions and future work are presented in Section VI.