Detection of cervical lesions based on deep learning

**Abstract：**TOO ADD

**Key words:** medical image;Target detection;Regional identification of cervical cancer;Deep learning

1.Introduction

According to data from World Health Organization, cervical cancer is the fourth most frequent cancer in women with an estimated 570,000 new case in 2018 representing 6.6% of all female cancers. Low-and middle-income countries have significantly higher mortality risk of cervical cancer, where reported approximately 90% of global death cases. China, in particular, reported 131,500 new cases and 53,000 deaths from cervical cancer every year, presenting 18.4 % of all deaths from malignant tumors in women [3]. Hence, cervical cancer is commonly accepted as one of biggest threatens in women’ health.

Early detection, early diagnosis and early treatment is current consensus for reducing the mortality risk of cervical cancer. As the high-risk human papillomavirus (HR-HPV) infection has been shown to be a necessary factor in the development of cervical cancer, the virological etiology of cervical cancer is clear. Cervical intraepithelial lesion, as an early sign of cervical cancer, is an abnormal hyperplasia and precancerous lesion of the cervical surface squamous epithelium, which may develop to cervical cancer eventually. Effectively detecting the cervical intraepithelial lesion in early combined screening of cervical cancer is the fundamental step. However, a successful diagnosis based on mainstays of cervical cancer screening program including thin layer based cytology (TCT), human papillomavirus (HPV) test, colposcopy requires comprehensive infrastructures and extensively trained personnel. Especially, colposcopy biopsy 【add reference for this】, as the gold standard for diagnosing cervical intraepithelial lesion and cervical cancer, is visually evaluated by physicians / health workers, whose skills and experience could significantly affect the accuracy of diagnosis.

Colposcopy biopsy is thescreening of the cervix by visual inspection after application (VIA) of acetic acid to highlight precancerous or cancerous abnormalities. However, recent studies and researches reveals some limitations under current colposcopy biopsy process. Firstly, it has been shown in *[4,5,6]* that overtreatment and undertreatment could be a severe consequence of VIA due to failure of distinguishing precancer from much more common minor abnormalities accurately. More importantly, visual identification of precancer by experienced health workers had been proven to be challenging *[7,8]*, let alone in areas with less-developed medical services. Therefore, searching for a more reliable diagnosis approach without increasing burdens on programmatic simplicity and sustainable costs remains a hot area in both clinical and academical research of cervical cancer.

Researchers had put tremendous efforts on extending recent innovation results from computer science to clinical research and application. For instance, a set of deep learning algorithms had been developed and validated in [9] for analyzing CT imaging of patients with head trauma or stroke; In the discussion of [10], deep learning algorithms shows high sensitivity and specificity for detecting diabetic retinopathy and macular edema in retinal fundus photographs. Focusing on cervical cancer, [11,12,13] explored applications of deep learning to colposcopy image analysis and suggested promising results. HOWEVER (we need discuss what is our true selling points here)

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