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Diagnosis algorithm for early detection of Cervical Uterine Cancer: A Review

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Abstract— *Since there is a lack of programming for the usual manual/visual screening to detect this cancer, it is most often proving insufficient because it is detected in advanced stages, which will need the construction of effective and reliable early detection solutions. Uterine cancer comes in second place after breast cancer, affecting a large majority of women, particularly in developing countries. In this perspective, the aim of the study is to develop a tool which will aid in the early detection and diagnosis of cervical cancer based on the interpretation of MRI images of the cervix. The system we propose consists of three steps: K-means was used in the first step of pretreatment to eliminate noise from the image generally. In the second step, growing segments was utilized to segment the data. Third step is classification which is important to draw the decision about the stage of the cancer [1]*

Keywords— Cervical Cancer, MRI, Region Growing, FIGO Classification.

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I. INTRODUCTION

With 5,000 new cases and 2,500 deaths in a year globally, cervical uterine cancer (CUC) is the women's pathology with the highest levels of morbidity and mortality.

The initial screening method is known as the Papanicolaou test (PAP), which examines a sample of cervical cells by the cervix. The Bethesda System has set guidelines for its interpretation. The PAP is the most economical and effective approach to identifying the CUC early, and it is 100% curable when treats appropriately. Despite its qualities, the PAP continues to produce more than 7% false positives and more than 10% false negatives, with false negative rates as high as 20% to 25% in some locations. The early identification by PAP, the morbidity, and the mortality of the CUC should all be significantly impacted by a computational system that reduces false positives and negatives. A progress in remote diagnosis resolves the lack of cytologists and pathologists in remote places is a population health management tool for scanning samples. A digital image of a sample can be used to differentiate between healthy and sick nuclei. It compares and calculate indicators quickly by the forms and sizes. [6] The cervix is divided into two regions: the ectocervix canal, which projects into the vagina, and is lined by stratified squamous nonkeratinized epithelium. The external os, an opening in the ectocervix, is the point at which it changes into the endocervical canal. The endocervical canal, which is the closer and more "inner" portion of the cervix, is lined with a simple columnar epithelium that secretes mucus. At a slit known as the internal os, the endocervical canal narrows and the uterine cavity opens.[1]

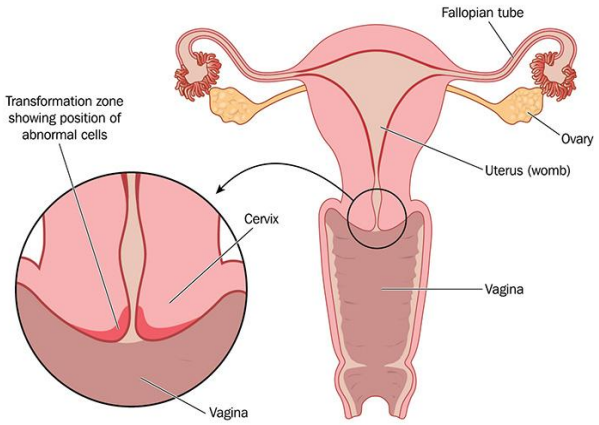

Fig. 1 Female Reproductive system

II. RESEARCH BACKGROUND

In order to perform the PAP test, cervix cell material need to be collected and smeared onto a 25x50mm glass slide. Cell samples are examined by cytotechnologists using an optical microscope to seek for malignant indicators, invasive cancer evidence, or potential cancer precursors. Any suspicion of cancer is reported by the cytopathologist, who also assumes responsibility for the diagnosis. When a cell develops into a malignant cell, it undergoes morphological changes that include the nucleus becoming larger and irregular, the cytoplasm changing the nucleus/cytoplasm size ratio, and the chromatin distribution in the nucleus becoming thicker and irregular.[6].

The development of aberrant cells that can invade and damage healthy tissue results in cervical cancer[3]. The cells lining the cervix are where the majority of cervical malignancies begin; these cells do not abruptly develop into cancer. Instead, the normal cervix cells eventually develop precancerous alterations that could develop into cancer; these alterations can be found by a PAP Smear test and can be treated to stop cancer from occurring. On average, cancer patients are around 45 and 55 years old. After age 55, the incidence of cervical cancer is at high peaks and increases with age. Due to contamination by specific types of human papillomavirus (HPV) (16, 18, 30, 33, 35, and 54), this malignancy is almost always sexually transmitted [5]. That explains the evident connection between sexual activity and cancer, as well as the rapid onset of new relationships and the multiplicity of partners. However, only a small percentage of women with HPV infection will develop tumor. In fact, a number of field-related cofactors with an impact on the formation of cervical cancer, such as immune deficiencies, tobacco addiction, other sexually transmitted diseases, and so on.

III. METHODOLOGY

DETECTION PROCESS The four stages of the nuclei detection process include scanning, pre-processing, segmentation, feature extraction, and classification. [6]

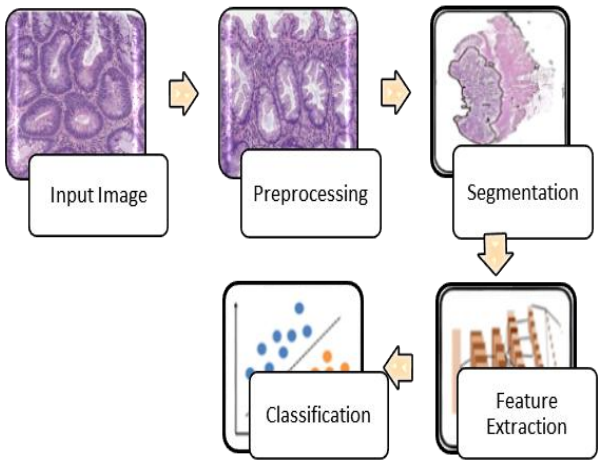

Fig. 2 Detection of Cervical Uterine Cancer system

Many fields of medical image analysis, including computer-aided diagnosis and identification of breast lesions, lung nodules, and histopathological diagnosis, are experiencing an increase in the usage of deep learning techniques. For the quantitative study of cervical cancer, deep learning approaches may enable the identification of new useful imaging features. Deep learning architectures gradually exceed the most advanced classical machine learning algorithms as they get more developed. Segmentation and classification are the two main methods for the automatic detection of cervical cancer. to research the application of deep learning methods to enhance detection rates.

IV. LITERATURE REVIEW

Cervical cancer detection methods have also been discussed in this regard. There are nuclear analysis-based techniques and MRI image analysis and interpretation, depending on the specific dataset and method used.

A. Nuclei Analysis based Techniques

A test set made up of three types of photographs and previously approved by a cytotechnologist was built: Type 1: Optimal conditions for the identification of healthy and abnormal nuclei (evenly distributed) Type 2 consists of normal/ healthy nuclei also abnormalities nuclei, taken from a PAP with positive results Type 3: healthy nuclei which are taken from negative PAP

Author/s	Proposed
Mauricio Solar and Juan Pablo Peña Gonzalez [6]	Nuclei detection and calculation of indicators.

B. MRI images analysis and interpretation

By de - noising and enhancing the borders of structures and tissues, the pre - processing stage improves the quality of the cervical MRI images. The second step is segmentation, which aims to remove the ROI zone and the cancer spread region. In several disciplines, including automatic image segmentation by merging color-edge extraction and seeded region growing [17] and adaptable Region Growing Technique Using Polynomial Functions for Image Approximation [18], the region growth approach is applied. In order to identify the correct stage of cervical cancer, the extracted ROIs are next classified using inference rules derived from FIGO classification.

TABLE I. MRI IMAGES ANALYSIS AND INTERPRETATION

Author/s	Proposed
Ichrak KHOULQI and Najlae Idrissi.[1]	This paper implies strategies for segmenting and categorising pelvic MRI images that have showed high efficacy as demonstrated by the result of the used assessment metrics (SSIM and DICE indices).
Xiran Jiang et al [2]	Without involving too many time-consuming human tasks, including painstaking segmentation, feature development, or selection, deep neural network based radiomics methods are efficient predictive tools for vessel invasion in early-stage cervical cancer prior to surgery.

V. CONCLUSION

Cervical cancer is the third most prevalent cancer in women worldwide, trailing only colorectal and breast cancers in prevalence. It is one of the main cancer death causes for women worldwide. East African and South Asian women had the highest incidence and fatality rates of cervical cancer, respectively. This serious disease occurs frequently, but it is disproportionately distributed, with developing nations bearing the brunt of the impact.

The proposed research will benefit society and contribute to the early identification and treatment of cervical and uterine cancer with a higher degree of precision. Based on the computation of sample cell nucleus properties, such as size and shape, it is possible to automatically partition cancer using computer-aided systems, assisting medical professionals with clinical interpretations and diagnosis. A low-cost automated system like the one that is being proposed is a great tool for expanding and improving coverage and, even better, for minimising false positives and negatives (PAP Tests).

It can be researched using huge data sets in future study or retrained by augmenting the data with picture augmentation techniques. Additionally, machine learning methods are used to increase the detection rate. It will substantially aid in a precise and quick diagnosis. Another benefit is that it saves time, allowing pathologists to concentrate on crucial cases.

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