SEGMENTATION OF OVERLAPPED CELLS OF PAP SMEAR IMAGES

Dissertation submitted in fulfilment of the requirements for the Degree of

MASTER OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

By

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TOPIC APPROVAL PERFORMA

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SPECIALIZATION AREA : Intelligent Systems **Supervisor Signature:** _____

PROPOSED TOPIC : Segmentation of overlapping cells of pap-smear images.

Qualitative Assessment of Proposed Topic by PAC		
Sr.No.	**Parameter**	**Rating (out of 10)**
1	Project Novelty: Potential of the project to create new knowledge	7.75
2	Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students.	7.50
3	Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program.	7.75
4	Project Supervision: Project supervisor's is technically competent to guide students, resolve any issues, and impart necessary skills.	8.50
5	Social Applicability: Project work intends to solve a practical problem.	8.25
6	Future Scope: Project has potential to become basis of future research work, publication or patent.	7.75

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Final Topic Approved by PAC: **Segmentation of overlapping cells of pap-smear images.**

Overall Remarks: Approved

PAC CHAIRPERSON Name: 11024::Amandeep Nagpal **Approval Date:** 05 Mar 2017

ABSTRACT

Cancer is the most dangerous disease in the world because the symptoms of the cancer takes a very long time in the appearing till that the disease is already spread in the whole body so then it makes very difficult for the treatment and the saving the life of the patent so the proposed research work will help in the diagnose of the cancer or non-cancerous cell in the pap smear screening tests images so that the treatment can be start by doctors in the early stage and the life of the patent can be saved .

DECLARATION

I hereby declare that the research work reported in the dissertation/dissertation proposal entitled " Segmentation of Overlapped Cells of Pap Smear Images" in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University, Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Mr./Mrs. Research Guide's Name. I have not submitted this work elsewhere for any degree or diploma.

I understand that the work presented herewith is in direct compliance with Lovely Professional University's Policy on plagiarism, intellectual property rights, and highest standards of moral and ethical conduct. Therefore, to the best of my knowledge, the content of this dissertation represents authentic and honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

Signature of Candidate

Rohit Singh

11300151

SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the M.Tech Dissertation/dissertation proposal entitled "SEGMENTATION OF OVERLAPPED CELLS OF PAP SMEAR IMAGES", submitted by **Rohit Singh** at **Lovely Professional University, Phagwara, India** is a bonafide record of his / her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

Signature of Supervisor

(Name of Supervisor)

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1) **Concerned HOD:**
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   External Examiner

   Signature: _____

   Name: _____

   Affiliation: _____

   Date: _____

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   Date: _____

ACKNOWLEDGEMENT

Gratitude cannot be seen or expressed. It can only be felt in heart and is beyond description.

Often, words are inadequate to serve as a model of expression of one's feeling, specially the sense of indebtedness and gratitude to all those who help us in our research work. It is of pleasure to express our gratitude and indebtedness along with sincere thanks to my mentor **Mr Sanjay Kumar Singh** for providing us the guidance to work for the dissertation research work on "**Segmentation of Overlapping Cells of Pap-Smear Images**".

We want to formally acknowledge our sincere gratitude to all those who assisted and guided us in completing this research work.

Rohit Singh (11300151)

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Name: _____ UID: _____ Domain: _____
Registration No: _____Name of student:_____

Title of Dissertation:
_____

- ☐ Front pages are as per the format.
- ☐ Topic on the PAC form and title page are same.
- ☐ Front page numbers are in roman and for report, it is like 1, 2, 3…….
- ☐ TOC, List of Figures, etc. are matching with the actual page numbers in the report.
- ☐ Font, Font Size, Margins, line Spacing, Alignment, etc. are as per the guidelines.
- ☐ Color prints are used for images and implementation snapshots.
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- ☐ Minimum references in report are 30.

Here by, I declare that I had verified the above mentioned points in the final dissertation report.

Signature of Supervisor with UID

CHAPTER 1

INTRODUCTION

1.1 CANCER

The cancer is a an abnormal growth of the cell which have the power to different organs of the body. All cancer begins from the single cell or some small group of the cell.[1]

Normally all human body has over a hundred million million cells in the body, which is controlled by the different type of signals produced by the different cells, if any one of the signals are damage or corrupt then it will cause the abnormal or uncontrolled cell division of the a part of the body which produces the faulty signal forms a lump called tumor, when the cancer starts it is called the primary tumour.

There are some special type of cancers which do not form the lump, they starts from the blood cells and forms the cancer cell in the blood streams or there are few chances in which the cancer forms in the bone marrow.

The start of the cancer is a process in which several changes are needed to happen in the cell or a small groups of the cells

1.2 GENES AND CELL DIVISION

There are different types of the cells in the human body which have different type of takes to perform. Instead of this there are many similarities in all the cells like the dense part which is the nucleus, the nucleus have the chromosomes which are made up of DNA (Deoxyribonucleic Acid). The DNA is the combination of the gens which are mainly ATGC in the form of the string. The gens are in the form of codons which are the pair of the three gene at a time, each codon have different type of the message which tells accordingly to the codon how the cell work, react or to do a function. Each codon is the encrypted instruction to the cell how to work or which is the molecule is needed by the cell, the different molecule and the DNA control the whole cell.

1.3 CHANGES OF THE GENES INSIDE OF THE CELL

Mostly the Gens take a look that all the cells grow, get all the needed nutrition and multiply in the defined manner.

In a single day over hundreds of cells dies and multiply to form a new cell.in the multiplication process the some to the genes got replaces, does not have copied well or there are the chances that the gene is copied twice, although there is most likely the chances are that 99% of the chances if there is a change in the gene the specimen will not able to survive in the nature, but there are 1% chances that the cell or the specimen will be survived then then the wrong Gene sequence of the gene will produce signal to produce different type of the molecule instead of the required one or that the cell sends the signal to multiply continuously and the molecule which is required to stop the cell division is not formed by the cell which leads to the abnormal or uncontrolled development or the multiplication of the cells, usually a single gene change may leads to the normal cell into mutated cell but it also takes years to the mutated cell to grow enough to form a tumour which will able to show the symptoms or able to detect in the can.

1.4 MUTATIONS

Mutation can happen at the process of the mitosis or meiosis when the parents share their DNA to their offspring's, or there are chances that it can happen when the cell is multiplying, or by the operation which are inside of the cell or by the chemicals which are outside the cell like tobacco etc.

Some genes gets damaged in day to day life routine but the human body is also having the capability to repair the damage, but there are few chances that the cell is not able to detect the damage in the gene and just copy the damaged gene to further cells which leads to the mutation [3]

1.5 DNA AND GENES

Inside of the all Eukaryotic cell have a structure known as the nucleus. The nucleus is the control centre of the cell because it has all the data needed to the cell to control its mechanisms and the behaviours needed for the survival of the cell.

All the information is present in the chromosomes; every human has 23 pairs of the chromosomes in every cell. The chromosomes are formed by the combinations of the

four genes which are ATGC. The structure of the DNA is in the form of the double helix which is formed by the two strings of the genes. There is a also the rules in the combination of the genes that are A only pairs with the T and G only pairs with the C.

In the process of the mitosis and meiosis the 50%of the gene is taken from the Mother and the rest 50% of the genes are taken from the father which is the reason that we shows some characteristics of our mother and some characteristics of our father, examples of characteristics like colour or the eye, colour of the hair, colour of the skin, blood group, height etc.

Figure 1.1 DNA

1.6 HOW FAULTY GENE LEAD TO CANCER

The gens gets faulty when the cells multiply or in the process of the DNA replication for the new cell. This is the mutation when the genes gets changed which undergoes throughout our life's, these are factor which cause mutation inside the cells, there are some other factors which leads to the mutation by outside of the cell(external factors):-

- Tobacco smoke
- Radiation
- Ultraviolet radiation from the sun
- Some substances in the food

- Chemicals in our environment

Sometimes the people inherit faulty genes in the process of the reproduction from the mother or the father which increases the chances of the having the cancer.

Usually the cells can repairs the faults in the genes. But when the fault is very high and it is unable to repair that fault then the immune system usually detects the cell which gets the faulty sequence of the genes the directs to destroy that cell from the body so that it cannot effect the out cells of the body this process helps us from in protecting the cancer. But sometimes due to the mutation the substance produce to detect and direct the cell to perform an action does not gets understand by the cell or the instead of that substance some other substance is produced so this leads to the abnormal functionality of the cells, it can be the substance required for the multiply gets excess or the substance needed for the stopping the multiplication process of the cells does not produced , all of these leads to the multiplication of the cells in uncontrolled manner, and it does not responds to the substance which leads to the destroyment of the cells. This leads to the cancer.

The genes which are required for telling the cells to reproduces or the multiplication of the cells is the Oncogenes , it is found very often in the infants and found very less in the adults.

The genes that are required for the telling the cells to stop the process of the multiplication is the p53, the mutation of the p53 gene leads to the abnormal growth of the cells which leads to the cancer.

P53 is also known as the tumour suppressor gene because it tells the cells to stop multiply. P53 is the missing gene found in most of the common cancers.

In the cells there are some proteins found which are used to repair the faulty genes. But mutation in the genes which leads to the formation of the proteins which repairs the faulty DNA leads to increase the chances of the cancer due to the Zero probability of the chances of the repairing of the DNA.

The Gene which tells the cell to die or the self-destruct when it gets too old or carrying heavy damage which is not possible to repair is called the apoptosis or programmed cell to death, it’s the very complex and very necessary process for a cell,

due to this the cell is normally destroyed when there is anything wrong which prevents the cancer formation.[4]

1.7 TUMOURS

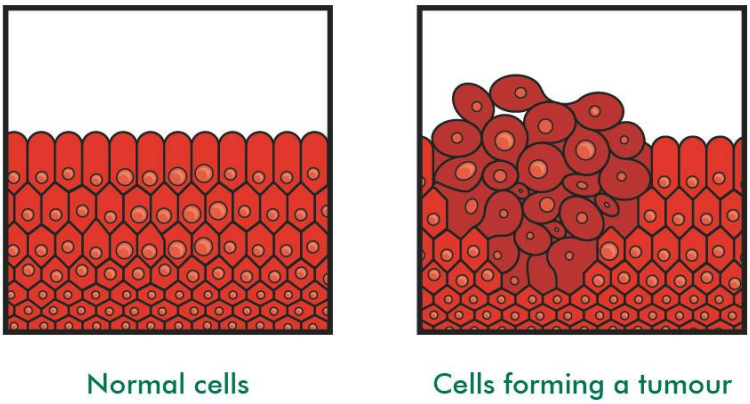

Figure 1.2 Normal cell and Tumour

1.7.1 BENIGN TUMOURS

Benign means it is not cancer

Usually grow slowly

Does not spreads to the different organs

Has covering of normal cells

Benign tumors are cells which are similar to the normal cells, they cause different problems to the body when they

- Grow very large
- Becomes uncomfortable or unsightly
- Accidently pressed by other body parts.
- Task the place in the skull (brain tumour)
- Releases the different hormones that govern the how the body works.

1.7.2 MALIGNANT TUMOURS

Malignant tumours are formed from the cancer cells.

- Usually grow faster than benign tumours
- It spreads to other parts and damage the nearby cells or organs
- It can spreads to the different organs by the bloodstreams or by the lymph system to convert into the secondary tumours

Spreading to nearby cells and or other organs is known as metastasis.[5]

1.8 HOW CANCER GROWS

The cancer cells are in the tissue where the cancer cells are developed examples like lining of the organs or the bladder or the breast ducts, in scientific terms it is known as superficial cancer growth or carcinoma in situ.

The cancer cells usually multiply and grows very rapidly to form a tumour, usually a tumour has more than milllions of cells. Human body has usually a layer of membrane inside the tissue called the basement membrane if the cancer cells are able to penetrate the basement membrane of the tissue then it is known as invasive cancer.

The cancer can grow nearby cells or the organs directly, this is known as local invasion.

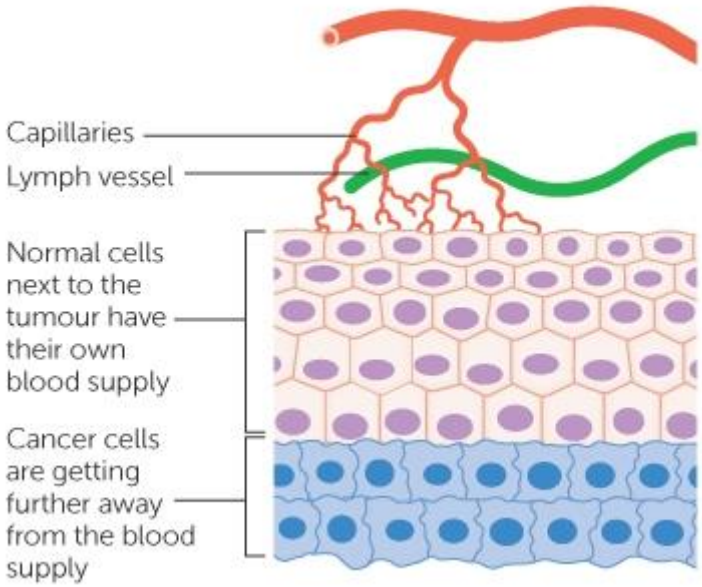

Figure 1.3 Cancer Cells and Capillaries

As the tumour starts growing its centre starts shifting away from the blood capillary, so due to this it gets less and less oxygen and other nutrients which are essential for the survival of the cells without the oxygen and the nurituients the tumour cannot grow more than the size of the pin head, to overcome this problem the centre of the tumour stats sending the signals that are angiogenic factors which are used to growing of the new blood vessels, once the cancer tumour able to generate a blood vessel in the centre of the tumour then the tumour can easily get the oxygen and the

other nutrition's which are necessary for the survival of the cancerous cells it starts growing more rapidly.

The many researchers have found that the angiogenic factors are very high near the cells of the tumour, Drugs that can helps in the stopping of the new blood vessels known as the anti angiogenic drugs can helps in the stopping the growth of the tumour and spreading in the nearby cells or the tissue. These drugs cannot help in the getting rid of the cancer cells but it can help in the stopping and shrinking of the tumour in some cases.

The cancer may use the 3 ways by which it can spread or grow

- Making pressure on the nearby cells

  In this way the cancer tumour starts making the pressure on the nearby surrounded cells and blocks the flow of the blood vessels by which the nearby cells starts to die itself which help the tumor to grow and get the nutrients.
- By using the Enzymes

  A normal cell produces the substances which are known as the enzymes. These enzymes are used to attack on the bacteria and viruses in the body, they are also used to the remove the dead or destroyed cells from the body so the new cells can grow in that area. Some cancer have very large amount of these enzymes or the white blood cells which in the part of the immune system, this makes easy for the tumour to grow and takes over the healthy tissue. When cancer cells takes the normal cells it may cause bleeding due to damage to nearby vessels.
- Moving through tissue

  The cancer cells can move from one place to another more easily, the scientists have found that there is a special type of the substance which is secreted by the cancer cells which helps the cancer cells to move , it looks like it helps in the local spreading of the cancer, the researchers are working to know about that substance, if we are able to stop the substance from working then there will also a way to stop the separation of that substance, it will makes easier to cure.[5]

1.9 PRIMARY AND SECONDARY CANCER

The place at which the cancer start is known as the primary site, and if the cancer cells stats spreading another part of the body then it is known as secondary cancer or metastasis.

Some cancer may have more than one secondary's.

Cancer cells can be spread to another place in the body by the bloodstream or lymphatic system, where they start to from new tumours.

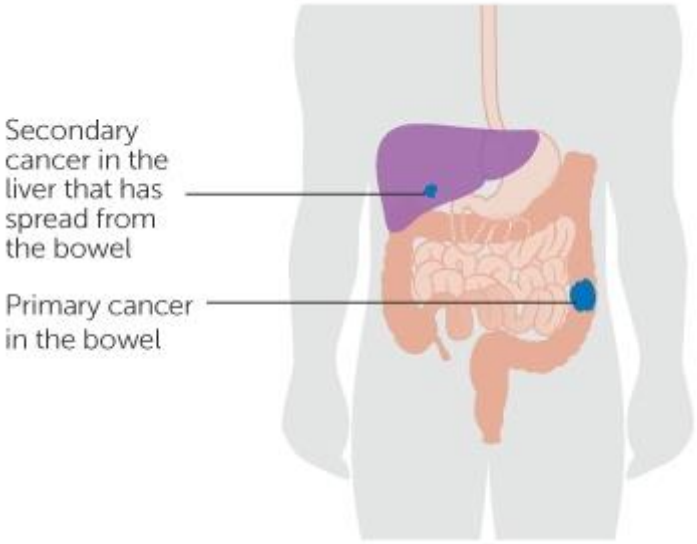

Figure 1.4 Primary Site and Secondary Site

To move from primary site to secondary site the cancer cell have to travel from primary site to the secondary, for this the cancer cells have to break and leave the tumour and travel from one part to another from this process the substance which is responsible is the substance which enables the movement of the cancer cells. The cancer cells which are able to break in uses the blood capillary or the lymph .

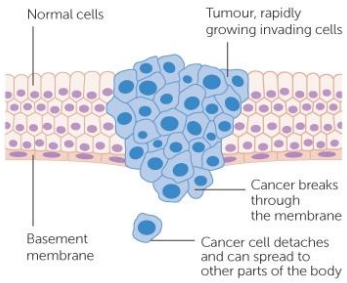

Figure 1.5 Detached Cancer cell From Tumour

If the cancer cells are able to enter in the bllod capillaries then they are able to move any part of the body these cells are known as the circulating tumour cells. The researchers are working on the tests by which we can able to detect the circulating tumour cells in the blood streams so that it can be diagnose easily they are also looking for to predict treatment which will work best for the patient.

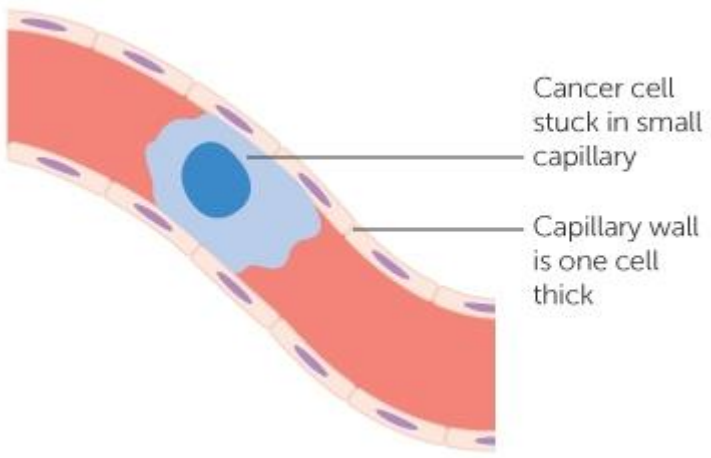

Figure 1.6 Cancer cell in capillary

The circulation blood takes along the cancer cells in the body until it get stuck in the veins, then the cancer cell starts to make may to the nearby cells or the organ, there it starts to multiply and grow it all the requirements are available there.

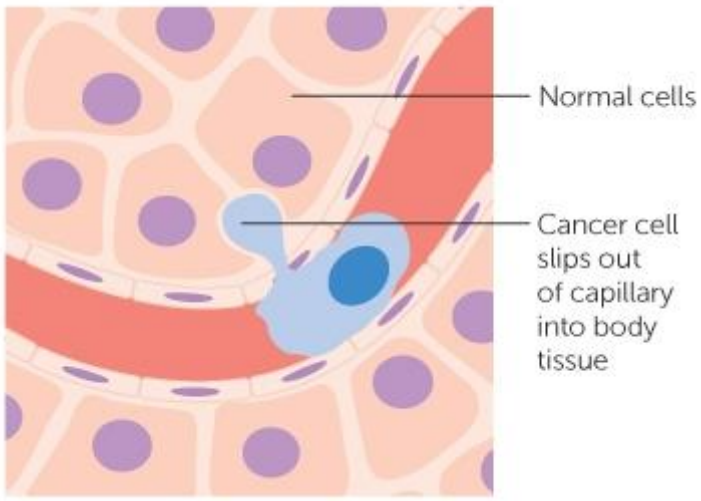

Figure 1.7 Cancer cell at Secondary site

It is very complicated because most of the cancer cells don't get survival nutrients , or most of them are killed by the white blood cells

Lymphatic system

The Lymphatic system is the network of the tube and glands that are used for the filtering of the body fluids and infection, the cancer cell may able to get into the small lymph vessel from primary site then it goes to the lymph glands and starts growing at that position which is known as the lymph node spread.[6]

1.10 PLACES CANCER CAN SPREAD

When the cancer cells are in the blood or the lymph vessels it can able to move any part of the body, But cancer cells need some conditions which are necessary for the survival, for that there are some places is the body where are cancer cells can easily able to make the secondary sites.[7]

- Lungs
- Liver
- Lymph Nodes
- Bones
- Brain
- Skin

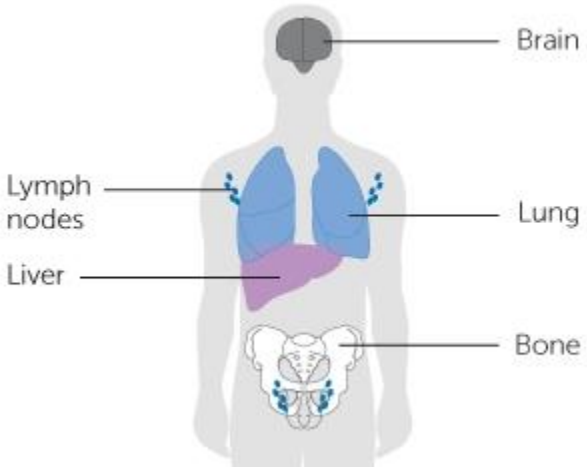

Figure 1.8 Target Places for cancer cell

1.11 CATEGORIES OF THE CANCER

Billions of cells grouped together and work in a controlled way to from a human body, which cannot be seen by the naked eyes, It can only be seen under the microscope. The cells grouped to form a tissue and a group to tissue forms a organ, an group of organs forms an organ system and a group of organ systems forms a body.

The cancer can be grouped by the cells in which it starts. There are mainly five groups

- Carcinoma

  Carcinomas are type which found in the epithelial tissues, these are the cells which cover the outside of the body in the form of the skin, they are also cover in the organs of the body from inside or as cavity examples like chest cavity, abdominal cavity.

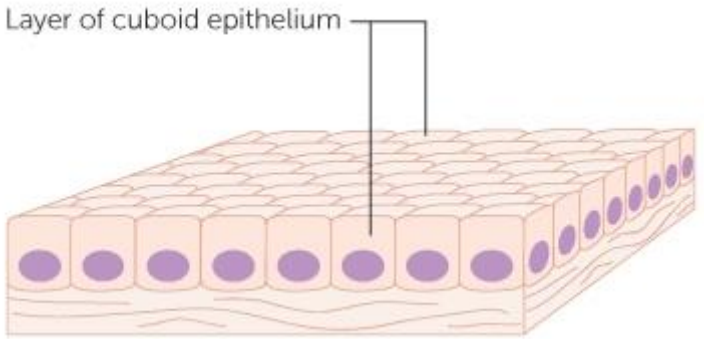

Figure 1.9 Epithelial Tissue

Different types of the epithelial cells

1. Squamous Cell carcinoma

   These are starts in the squamous cells, these are flat covering cells which are usually found in places like skin or the lining of the throat or oesophagus.

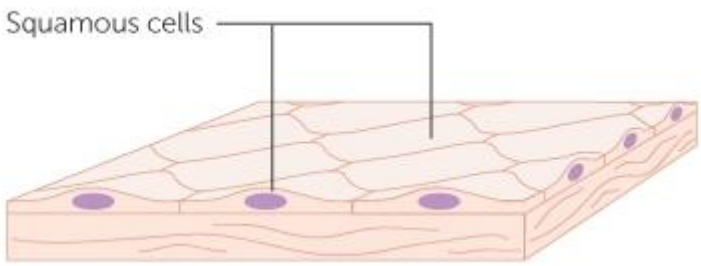

Figure 1.10 Squamous Cell

2. Adenocarcinoma

Adenocarcinoma start in the glandular cells which are known as the adenomatous cells that produces fluids which are used for the keeping the tissues moist.

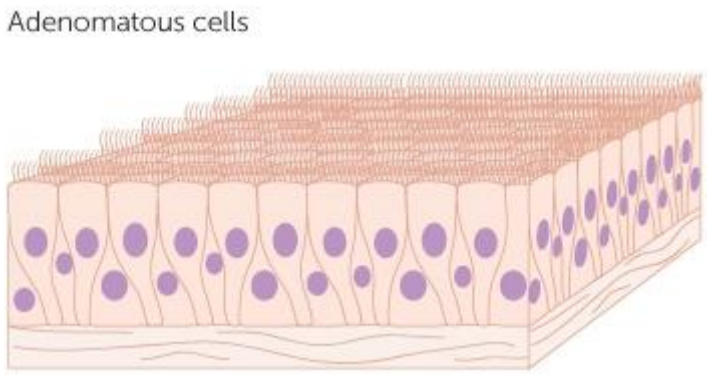

Figure 1.11 Adenocarcinoma

3. Transitional cell carcinoma

   Transitional cells are those kind of the cells which can stretch as an organ expands or the stretches , these are made up of the tissues called transitional epithelium. Examples like lining of the bladder. Cancers which starts in the kind of the cells are called transitional cell carcinoma.

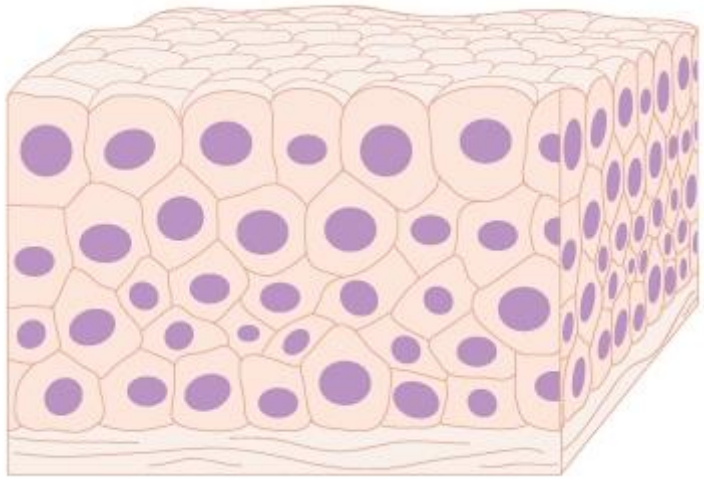

Figure 1.12 Transitional cell carcinoma

4. Basal cell carcinoma

   Basal cells are found in the deepest layer of skin cells, Cancer starts in these kinds of the cells are called basal cell carcinomas.

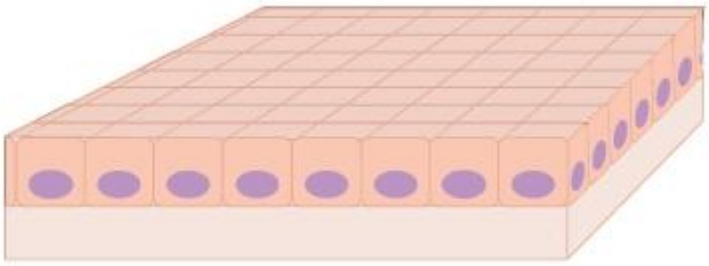

Figure 1.13 Basal cell carcinoma

- Sarcoma

  Sarcoma starts in the connective tissues, which are the supporting tissues of the organs in the body. Connective tissues are like Bones, cartilage, tendons and fibrous tissue. It is of two types

  1. Bone Sarcomas

     Bone Sarcomas starts from the Bone cells.

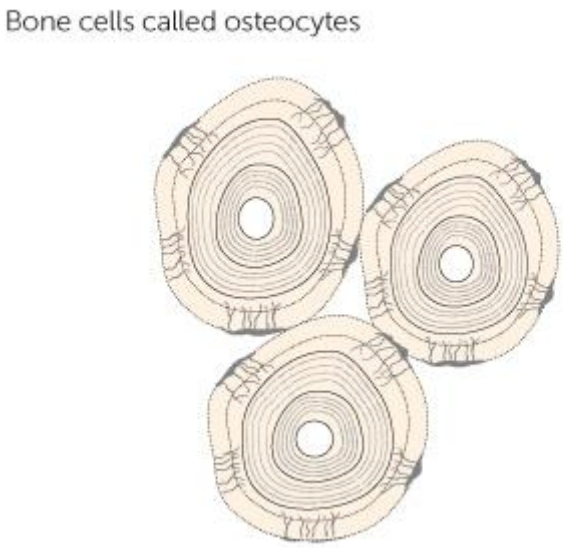

Figure 1.14 Bone Cell Sarcoma

  2. Soft Tissue Sarcomas

     Soft tissue sarcomas are very rare. Most common types are

     - Muscle

       Cancer in the muscle is known as rhabdomyosarcoma.

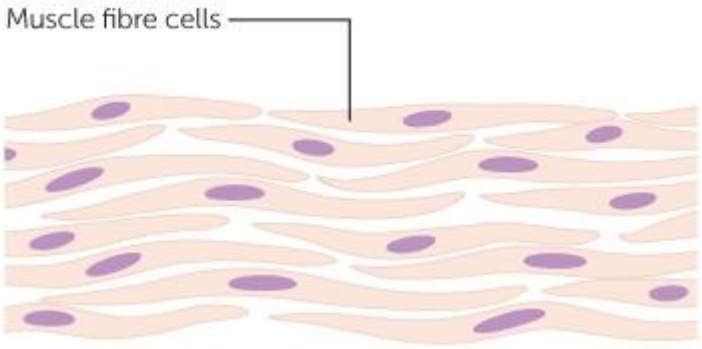

Figure 1.15 Muscle cell

- Cartilage

  Cancer in the cartilage is called chondrosarcoma.

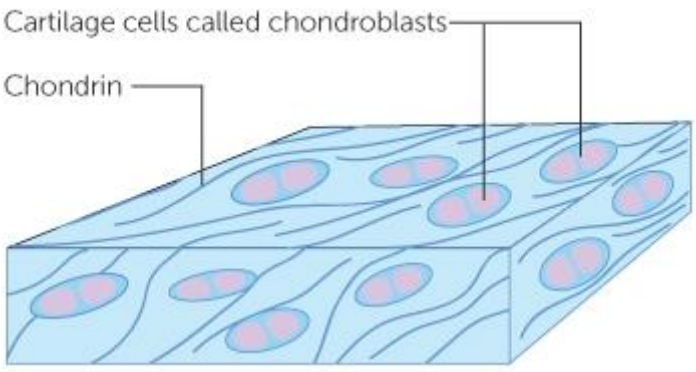

Figure 1.16 Cartilage Cells

- Leukaemia

  The Luekaemia is the type of the cancer in which the bone marrow starts making the white blood cells which are not fully developed so they are not able to fight against the white blood cells. Leukaemia is the most common in the children.

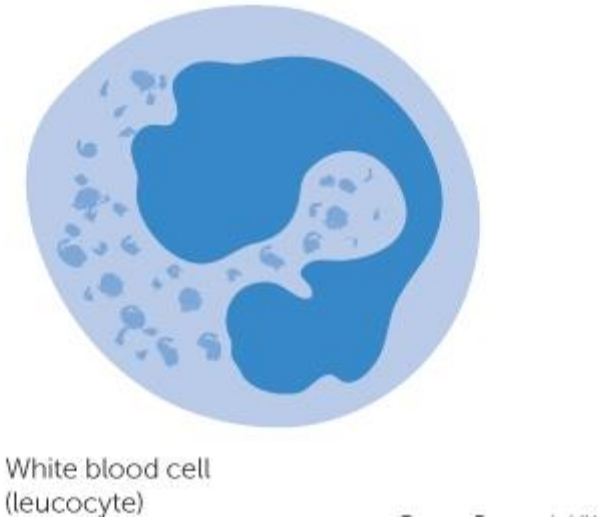

Figure 1.17 White Blood Cell

- Lymphoma and myeloma

  Lymphomas

  It is the cancer which starts in the lymphatic system, the lymphoma can start anywhere in the because it runs in the whole body, some lymphocites(white blood cells) multiply abnormally and don't dies as usual, these cells starts multiplying when they are not fully developed so they are not able to fight against the infection. The abnormal lymphosites starts collecting in the nodes or the bone marrow or spleen and start to from tumours.

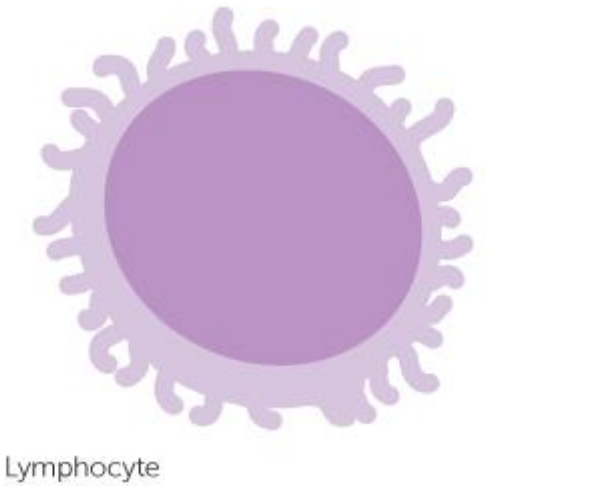

Figure 1.18 Abnormal Lymphocyte

Myeloma

The myeloma is the type to cancer in which the plasma also known as immunoglobulins which are made in the bone marrow, which produces the

antibodies to fight against the infections. In this the plasma cells starts to multiply uncontrolled manner and starts to making of the antibodies which do not work in proper way.

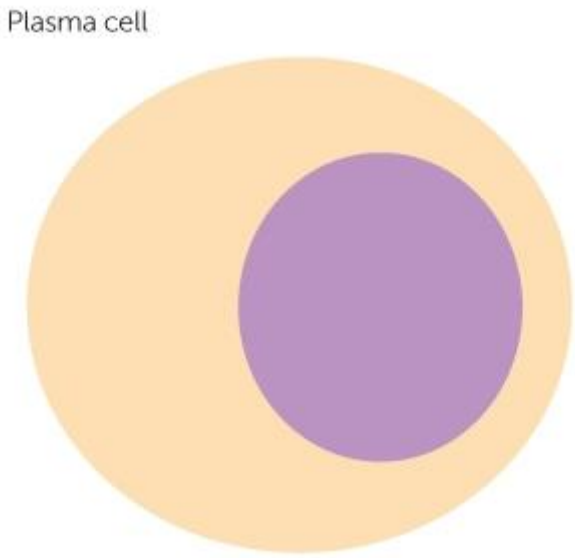

Figure 1.19 Plasma Cell

- Brain and spinal cord cancer

  The Brain and spinal cord makes a very complex network of neurons or nerve cells which help the brain to gets or send the electrical signals to the different parts or the body, the neurons have glial cells that supports the nerve cells. The most common cancer is formed in the glial cells which is known as glinoma, some of the tumours are non-cancerous (benign) which grow very slowly.[11]

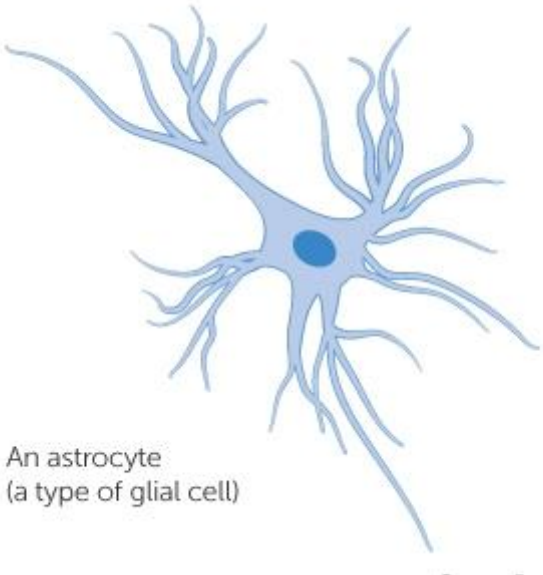

Figure 1.20 Glial Cell

1.12 STAGING

The staging of the cancer is the process in which the caner is described in the size and the how far the growth of the cancer in the body or sometimes it is also done to know that whether the cancer is spread in its surrounding tissue of another part of the body, this is described by the various tests.

Staging of the cancer is very important task for the doctors because it helps the team of the doctors to know which type of the treatment is necessary for the cancer.

Like if the cancer is in the just one place then only surgery or radiotherapy will be enough for the treatment of the cancer.

If the cancer is already spread in the body then then treatments like surgery or radiotherapy is not enough, you need treatment which will circulates in the whole body so that the cancer cells which are there in the body will gets the treatment, examples like chemotherapy, hormone therapy or biological therapies are effective because these circulates along the blood in the whole body, these type of the treatments are known as systemic treatments.

1.13 TYPES OF STAGING SYSTEMS

Doctors use a common language for the category of the cancer in the body which helps in the decision making of the writing the prescription for the cancer

There are mainly two types of the cancer staging techniques.

1.13.1 THE TNM STAGING SYSTEM

The TNM stands for the Tumour Node Metastasis. The system tells that what is the size of the cancer, whether it is spread into the lymph nodes and whether it has spread into the different parts of the body.

T refers to the size of the tumour, how much it is spread in the surrounding tissue. It can be 1,2,3 or 4, 1 for the small size and 4 for the large size.

N refers to whether the cancer is spread in the lymph nodes, it can be between 0 to 3.

M refers to whether it is able to spread in the other part of the body, it can be 0 or 1.

Example: a small cancer that has spread in the lymph nodes but unable to spread in the other parts or the body may be noted as T2 N1 M0.

1.13.2 NUMBER STAGING SYSTEM

The number Staging System uses the TNM system to classify the stage of the cancer. It is basically written in the roman numbers from I to IV.

Stage I

It means that the cancer is very small and contain only in the primary site in which it is started.

Stage II

It means that the size of the tumour is large and cancer is not yet started to spread in the surrounding cells, few time it also means that the cancer cells are able to spread in the lymph nodes near the tumour.

Stage III

It means that the cancer is large in the size and the tumour is started in the spreading into the surrounding tissues and the lymph nodes contains cancer cells.

Stage IV

It means that the cancer is able to spread into the another parts of the body from its primary sites which is also known as the secondary or the metastatic cancer.

Sometimes doctors use A, B, C to further divide the category, example like Stage 3B cervical cancer.

CHAPTER 2

REVIEW OF LITERATURE

"Segmentation Techniques Comparison in Image Processing", R. Yogamangalam, B. Karthikeyan 2013, The author is comparing the different types of the segmentation techniques of the iamges and for the noise cancilaton like threshoulding,region based, edge based,feature based clustering and model based.

"**An Improved Image Processing Analysis for the Detection of Lung Cancer Using Gabor Filter and Watershed Segmentation**", Avinash. S, Dr. K. Manjunath, Dr. S. Senthil Kumar , the author proposed an method to the detection of the lung cancer from the images of the computer tomography, Also explains the types of Lung cancer.It uses gabor filter for enhancing the images and after that it uses Marker Controled Watershed Segmentation Technique to detecting the lung cancer.

"**Sparse Segmentation Algorithm of Liver in CT Images**", Bin Sun,Cun-Hui Ma, Xin-Yu Jin, Ye Luo in 2016 segmentation of the boundary and the shape of the liver or images fromshape dictionary and the best match id selected.It segments the liver images with relative area error og 1.7+-0.7% and overlap error rate of 3.4+-1.5%.

"**Using Statistical Parametric Contour and Threshold Segmentation Technology Applied in X-ray Bone Images**", Kuang-Yi Chou, Chien-Sheng Lin, Chin-Hsiang Chien, Jen-Shiun Chiang, Chih-Hsien Hsia, In x-ray Images due to unequal X-ray Strengths the image id unable to separate soft tissues,for detecting these tissues it uses technique of statistical parameteriic contour with threshould x-ray segmentaion to separate bone and soft tissue.

"**Medical Image Segmentation By More Sensitive Adaptive Thresholding**" Cheolhwan Kim,Jiyoung Yoon, Yun-Jung Lee, author proposed a method for segmentation of the images where adaptive threshoulding un able to segment due to the strong objet nearby the weak object beacause adaptive threshoulding gives high threshould for strong solit objects

"**Image Segmentation By Multi-Level Threshoulding Using Genetic Algorithm with Fuzzy Entropy Cost Functions**", Mohan Muppidi, Paul Rad, Sos S. Agaian, Mo Jamshidi, describes three soft computing methods for gray and colour images using the fuzzy entropy based cost function which find the optimized parameters for the cost function which gives the better and more reliable segmentation results then Multi Level threshoulding.

"Medical Image Segmentation By Improved 3D Adaptive Threshoulding", Cheol-Hwan Kim,Yun-Jung Lee, the adaptive threshoulding detect boundary by image luminance, checks the bimodality at the histogram distribution.

"Fast Segmentation of Bone in CT images using 3d adaptive threshoulding", J. Zhang, C. H. Yan, C.K. Chui, S.H. Ong, the author proposes a method of automatic adaptive threshoulding method in which the initial segmentation is performed on the image and after that the iterative co-relation is done to update the bone and non bone classes.

"Automatic Lung Segmentation in Chest Radiographs using Shadow filter and Local Threshoulding", Preeyanan Pattrapisetwong, werapon Chiracharit, author proposes method for lung segmentation by shadow and local threshoulding in the contrast is enhanced and edges of the lungs are detected by the shadow filter after that the outer body regions are removed and morphological techniques are used to remove the noise on the data set of 247 chest radiographs having accuracy of 90% by this unsupervised learning method.

"MR Brain image Segmentation based on Unsupervised and semi-supervised Fuzzy Clustering Methods", Hayat Al-Dmour, Ahmed Al-Ani, the author segments the brain image by using the median filter for noise removal and after that global threshoulding technique for other nun needed parts from the images after that the author uses the subtractive clustering method for generating the parameters for the FCM Clustering an semi supervised method is used to classify the images based on the FCM parameters.

"An Image segmentation Method By Combining Fuzzy C-means Clustering and Graph cuts optimization for Multiphase level set algorithm", Mantun Gao,Sanmin

Wang,Shuxia Wang, the author uses the fuzzy c-means clustering method for the level set function and after that applying the graph cut method for segmentation.

"A Modified Rough-Fuzzy Clustering Algorithm with Spatial Information for Hep-2 Cell Image Segmentation", Shaswati Roy, Pradipta Maji,the author uses a rough-fuzzy clustering method for the classification of the images of cells for some autoimmune diseases in the Indirect Immunofluroresence analysis by the spatial distance of the neighbouring pixels.

"SLIC Superpixels Compared to state-of -the-art Superpixel Methods",Radhakrishana Achanta, Appu Shaji,Kevin Smith,Aurelien Lucchi, Pascal Fua,Sabine Susstrank,the author by comparing the Five previous algorithms proposes an method Simple Linear Iterative clustering for the segmentation of the images using the k-means clustering method having more efficient and faster then the previous algorithms

"Interactive Graph Cuts for Optimal Boundary and Region Segmentation of Objects In N-d Images", Yuri Y.Boykov, Marie-Pierre Jolly in 2001, the author proposes an algorithm which is having an user interactive interface which enables the user to select the objects from the image and the algorithm uses the graph cuts method to segment the various objects removing the background from the selected area and gives the various segmented isolated parts in the image

"Active Contours Without Edges", Tony F. Chan, Lumunita A. Vese in 2001, the author proposes an model for detecting the boundary of the objects in the image which are independed and not depends on the gradient ny using the Mumford-Shah Functional for segmentation

“Unsupervised segmentation and Classification of Cervical cell images”, asli Genctav, Selim Aksoy, Sevgen Onder in2012, the author uses an unsupervised approach in the segmentation of the cervical cells by using the automatic threshoulding for separating the cells from the background and partition these using the properties of homogeneity, circularity and binary classifier.

“An Improved Joint Optimization of MultipleLevel set Functions for te segmentation of the Overlapping Cervical Cells”, Zhi Lu, Gustavo Carneiro, Andrew P. Bradley in 2012, the author represents an improved algorithm for the segmentation of cytoplasm and nuclei from the overlapping images by using the joint optimization of multiple level set functions taking a function a cell of unary and pairwaise constraints, unary properties like contour length, edge strength and cell shape and pairwise are is based on the overlapping areas of the cells, successfully classified 645 cells in which only 10% are free lying cells

“A Variational Approach for Overlapping Cell segmentation”, Masound S.Nosrati, Ghassan Hamarneh, the author proposed a variation method for the Segmentation of the overlapping cervical cells in Pap smear images of the uterine cervix based on the features and shape and the area of the cytoplasm and nucleus.

“An Approach for Overlapping Cell segmentation in Multi-Layer Cervical cell Volumes”, Handy Ahmady Phoulady, Dmitry B. Goldgeof, Lawrence O. Hall, Peter R.Mouton in 2015, the author proposed an algorithm for the detecting and segmenting of the cervical cells by first detecting the nuclei by iterative thershoulding method and after that the overlapping cells are segmented based on the nucleolus.

“Cell Reconstruction under Vornoi and Enclosing Ellipses From 3D Microscopy”, Geraldo L. B. Ramalho, Daniel in 2015, the author is proposing an algorithm for the detection of the nuclei and the cytoplasm, his approach divided into three parts, in the first part rough segmentation of the cellular compartments are done

by superpixel combined to Vornoi diagrams, In the second step the refining process of the boundary of the cytoplasm are done and in the final step the morphological reconstruction process is used for the detection and ellipse on the cell boundary.

"Segmentation of subcellular Compartments Combining Superpixel Representation with Vornoi Diagrams", Daniela M. Ushizima, Anderea g. C. Bianchi, Claudia M. Carneiro in 2014, author is proposing an algorithm to detect individual cells from the images by the help of the nuclei and cytoplasm the algorithm is having 3 steps, in step 1 the cellular mass is calculated, In step 2 the nucleolus is detected by the method of the superpixel, in the final step the cytoplasm estimation is done on the basis of the region based graph growing and Vornoi method

"Cytoplasm and Nucleus segmentation in cervical Smear images using Radiating GVF Snake", Kuan Li, Zhi Lu, Wenyin Liu, Jianping Yin in 2011, the author is using k-means clustering algorithm for the partitioning the nuclei and the cytoplasm after that the author is using the radiant Gradient Vector Flow(RGVF) Snake method for the computation and the detection of the cytoplasm in the images of the cells

"Adaptive Segmentation of the cervical Smear Image Based On GUF Snake Model", Jian-Wei Zhang, Shan-Shan Zhang,Guo-Hong Yang, Da-Cheng Huang, Lin Zhu, Dong-Fa in 2013, the author is proposing an algorithm for the detection of the nucleolus from the image of the cervical cells by initial contour method and if the results are not meet then the adjust the parameters and calculate the GVF Field and segmentation is performed.

"Detection and Removal of Artifacts in Cervical Cytology Images Using Support Vector Machine", Rajesh Kumar R., Ajith Kumar V., Sharath Kumar P. N., Sudhamony S., RavindraKumar R.in 2011, the author is proposing an pattern recognition Strategy on detection and removal of the artiacts using Support Vectored Machine (SVM) of the images of the cervical cells and classify and element ranking

strategy in multiple stages for the easily screening of the false positive rates and optimizing the results.

"Cervical Cancer Detection Using SVM Based Feature Screening", Jiayong Zhang, Yanxi Liu in 2004, the author is using the Support Vector machine to detect the cells with the help of the attributes like Information gain and augmented Variance ratio.

"Automatic Cervical cell segmentation and Classification in Pap smears", Thanatip Chankong, Nipon Theera-Umpon,Sansanee Auephanwiriyakul in 2013, the author is segmenting the single cell from the image of the ERUDIT and LCH data sets and uses fuzzy c-means clustering to classify the cells by making them linearly separable by classifying as cancerous or normal cell, author also uses the different methods to get the optimized results by using KNN,LDA,ANN,SVM and Bayesian Classifier

"THREECOND:An automated and Unsupervised three colour Fuzzy-based Algorithm for Detecting Nuclei in Cervical Pap Smear Images", Fabio Vaschetto,Eduard Montseny, Pilar Sobrevilla, Enrique Lerma in 2009, the author is proposing an THREECOND algorithm for detecting the nucleolus in the pap smear images with the help of the cyto-pathologists and colour information by fuzzy systems

"A Spatial Constraint image segmentation algorithm based on block Clustering", Yu Lin-sen, Liu Yong-mei in 2016, the author is presenting an method for the segmentation based on the spatial constraint of the pixel for that the image is divided into overlapping rectangular blocks and iteratively clustering them.

"Cervical Cancer Classification using Gabor Filters", Rahmadwati,G.Naghdy, M.Ros, Catherine Todd, Eviana Norahmawati in 2011, the author is using texture analysis with the help of the gabor filter, he classifies the it detects the nucleus of the cell in the image and after that it checks for the neighbouring nuclei and classify them

into three categories 1- normal, 2-pre cancer and the last one 3-malignant on the images on the cells taken by the Saiful Anwar Hospital in Indonesia.

"Nucleus and Cytoplast contour detector from a cervical smear image", Pei-Yan Pai, Chin-Chen Chang, Yung-Kaun Chan in 2011, the author is proposing an algorithm to detect the nucleus and cytoplast from the cervical smear images using the adaptive threshoulding method for the detection of the nucleolus and maximal gray level gradient difference method for the detection of the cytoplast.

"Debris removal in Pap-smear images", Patrik Malm, Byju M. Balakrishnan,Vilayil k. Sujathan in 2013, the author is proposing an algorithm for the removal of the unwanted objects, debris from the image so that it will be easy to detect and classify the cells in normal and abnormal cells by using Bayesian quadratic classifier and based on the area and size of the images

"Segmentation of cervical Cell nuclei in high-resolution microscopic images: A new algorithm and web-based software framework", Christoph Bergmeir, Miguel Garcia Silvente, Jose Manuel Benitez in 2011, the author is proposing an algorithm to detect the nucleus and the cytoplasm in the images by using the voting scheme and prior knowledge and detects the shape using the elastic segmentation algorithm and uses canny edge detection for the edge detection.

"Nucleus and Cytoplast contour detector of cervical smear image", Meang-Husiun Tsai, Yung-Kaun Chan, Zhe-Zheng Lin, Shys-Fan Yang-Mao, Po-Chi Huang in2008, the author is proposing an algorithm to detect the nucleolus and the cytoplasm form the cervical smear images by using the maximal colour differentiate and draw the apparatus of nucleus and CNC detector to remove all the noises from the image and uses k-means clustering for the extraction of the cytoplasm.

CHAPTER 3

SCOPE OF THE STUDY

The future scope of the research work is that the pathologists can easily detect the cells and the cells which are not completely visible in the slices.

The research work can also be used for the detection of the cell and the removal of the other parts in the slice.

The research work can also be used in the early detection of the cancer when the cells are just starting to behave abnormally and destroying the nucleus.

The research work can also be used for the detecting of the cancer and non-cancerous cells in the image

The research work can also be used for the detection of the stage of the cell in the cancer.

CHAPTER 4

OBJECTIVES OF THE STUDY

- The Segmentation of the overlapping cells which are mostly common in the slices made by the humans for the screening tests.

- The Segmentation of the overlapping cells found in the Pap-Smear Screening test images to detect the normal and abnormal cell (cancerous cell) easily and automatically without the help of any doctor.

CHAPTER 5

PROPOSED METHODOLOGY

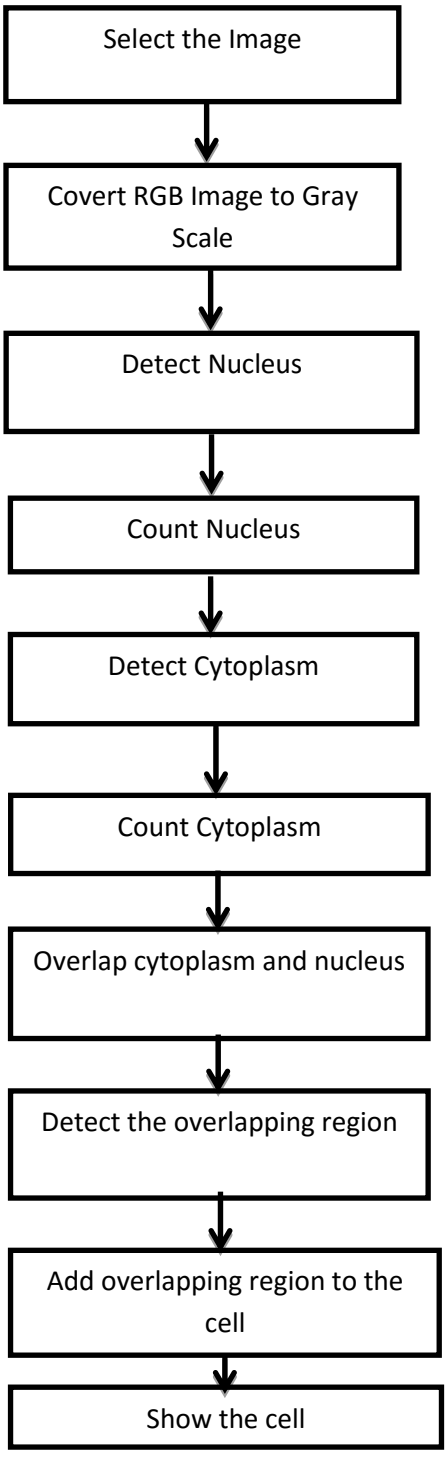

Figure 5.1 Methodology

5.1 SELECT RGB IMAGE

It is the first step in the Segmentation of the cell, In this step the user select or browse the Image of the Pap Smear test from the memory.

5.2 CONVERT RGB IMAGE TO GRAY-SCALE

It is the next step in the segmentation, the RGB Image is converted into the Gray Scale image so that the features and the colour of the image become monochrome. The gray scale image is the images in which the colon of the image is defined in the range between 0 to 255, 0 value represents the dark(black) and the 255 represents the lightest colour which is white

5.3 DETECT NUCLEUS

The detection of the nucleus is the next step after the conversion of the image into Grayscale. The Nucleus is the darkest part in the cell because the nucleus contains the Chromosomes, which are the strings of the DNA, so the most the of the dark colours lies between in the 0 to 90. This can be done by the simple Threshoulding method.

5.4 COUNT NUCLEUS

The Number of the nucleus in the image is the Number of the cells present in the image, because it is the face that no one Eukaryotic cell can found without the Nucleus, so the number of the nucleus is the key that tells that how many cells are in the image.

5.5 DETECT CYTOPLASM

The detection of the Cytoplasm is the little tricky task because the values of the pixel which the cytoplasm lies between the 90 to 170, so for the detection of the cytoplasm can be done by the removing the surrounding portion in the image the surrounding portion in the portion where nothing lies it’s only the empty space whose pixel values lies between the 170 to 255. Making those pixels 255 makes the surroundings clear. And the image left only having the cytoplasm and nucleus.

5.6 COUNT CYTOPLASM

Counting of the cytoplasm tells the number of the visible cells which are in the front facing in the slice, so it also tells the number of the single cells which are separated in

the image from the other cells and the number of the cells which are having the overlapping region in them if the number of cytoplasm is less than the number of the nucleus.

5.7 OVERLAP CYTOPLASM WITH NUCLEUS

After the counting of the cytoplasm we all know the number of the cells which are having the overlapping region and the number of the cells which are not having any overlapping region.

So we overlap the nucleus in the cytoplasm so that we can able to detect the all and separate the cells. By this process the Nucleus and the cytoplasm is highlighted and the surrounding regions will having the pixel value 255.

5.8 DETECT THE OVERLAPPING REGION

The detection of the overlapping region in the two dimensional image is the most difficult task, because the image is always stored in the form of the two dimension that is rows or columns.

The detection of the overlapping portion of the cell is done by using of the some details of the Depth buffer algorithm of the Computer Graphics. The Depth Buffer is the algorithm which is used for the removal of the hidden surface removal when the two of more than two objects are coming in the same single screen at the single time, Each object is having the three values at every edge, which tells the X axis, Y axis and the Depth of the object. The objects are formed in the another screen and after that the all screen objects are formed a stack one over the other and after that the places which only one object is falling the value of the object is taken and the places where the two or more than two objects are falling then the third value of the object is taken which having the value greater in the screens. In the objects which having the smaller value gets replaced by the object pixel having the greatest value, from here we are taking the concept that the regions which are having the overlapping regions will contains the greater value then the other parts of the value, that means in the image are lesser pixel value is the darker the pixel colour is so the darker parts are overlapping regions in the image. So pixel value 90 to 126 or it can depend upon the amount of the portion that is overlapping.

5.9 ADD OVERLAPPING REGION TO THE CELL

After the detecting of the overlapping region the task is left that to add the overlapping region to the cytoplasm so that the compete cell is too formed. This can be done by which that the if the values of the overlapping regions is the same having the value of the cytoplasm's so that tells that the overlapping regions were the just adjacent to the cytoplasm.

5.10 SHOW CELL

The final step is the showing the overlapping region and the cytoplasm with the nucleus image to the user.

CHAPTER 6

EXPECTED OUTCOMES

The expected outcomes of the research work is that the segmentation of the each and every cell can be done so that the easily detection of the cancer can be done and the research work will be boom for the detection of the cancer cells which are not usually done by the pathologists or the doctors so that many patients gets the cancer diagnose at the earlier stages and there cancer can be cure so that the patents life can be saved from the cancer.

The Research work is also helps for the different types of the tests of the cells to segment the objects found in the slice.

CHAPTER 7

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