

Survey of Brain Abnormality using Gabor Wavelets

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Abstract: Nowadays, MR images are very important for automatic defects detection in many diagnostic and therapeutic applications. This available work categorized the brain tissues as normal or abnormal automatically, using computer vision. This paper introduces novel approach of strong automatic diagnostic system using Gabor Wavelets and to find accuracy of tumor diagnosis in brain. Here we are tried to give clear justification from brain tissues using Gabor wavelets, entropy, contrast, energy and statistic features (such as mean, median etc.).

Keywords: Brain, Cancer, Brain Tumor, Type of Brain Tumor, Tumor Grade, MRI

1. Introduction

Brain Cancer is a one of the disease that reasons abnormal cell division and spreads over dissimilar elements of body through blood and lymphatic system. Tumors are separated into two classes as benign and malignant tumor. In the medical field, the main difficulty is the early diagnosis of the disease. This may be due to a lot of causes such as the be short of specialization and infrastructural feature [1].

A brain tumor is an abnormal growth of tissue in the brain. Unlike other tumors, brain tumors spread by local extension and rarely metastasize (spread) outside the brain. A benign brain tumor is composed of non-cancerous cells and does not metastasize beyond the part of the brain where it originates. A brain tumor is considered malignant if it contains cancer cells, or if it is composed of harmless cells located in an area where it suppresses one or more vital functions.

Regarding MRI brain tumor characterization, 2D textural features have been previously employed in pattern recognition systems for the analysis of brain lesions. More specifically, in a recent study [10], utilizing hierarchical ascending classification with correspondence factorial analysis discrimination accuracies between different tumor types, ranging between 49% (tumors vs oedemas) and 63% (benign vs malignant tumors) were achieved. In another study [9], discriminant analysis and the k-nearest neighbor classifier was used for distinguishing between human brain tumors and oedematous tissues, achieving maximum overall accuracy of 95%. Finally, in a previous study by the authors [11], a two level hierarchical decision tree was employed to discriminate between metastatic brain tumors from gliomas and meningiomas (primary brain tumors) using solely 2D textural features. By using a modified probabilistic neural network classifier discrimination accuracies of 71% (metastatic vs primary tumors) and 81% (gliomas vs meningiomas) were achieved. On the other hand, there has been little work done in the area of characterization and analysis of brain tumor employing features derived from 3D MRI texture. A recent study [12], using a set of six 3D co-occurrence features and linear discriminant analysis, showed improved discrimination accuracies utilizing volumetric features as compared with those obtained by employing the respecting six 2D features between necrosis and solid tumor (100% over 68%) as well as between edema and solid tumor (81% over 57%)

Brain tumor detection is done using various methods and techniques which involves detection using segmentation, pattern matching and Texture Analysis. So many usually used imaging techniques are Computer Tomography (CT) scan, Sonography and Magnetic Resonance Imaging (MRI) technique. When we use MRI technique, it is very clear that soft tissues is different, has high resolution and manufactures good contrast.

The existing organization is obtained the MR images, it collect MR images of the patient with the complaint, these MR images are converted to grey scale images. In this phase preprocessing process is apply for noise elimination and enhancing the image quality for better contrast. By using this process Artificial neural network is trained in such a way to classify the tumor as malignant or benign

2. Brain

The brain is the main organ and collection of mass of tissue which is situated in the head. In the brain there are thin membranes and these membranes are called meninges. Watery fluid spreads in the brain and this fluid are called cerebrospinal fluid. There are spaces in the meninges and this fluid flows between them.

Large numbers of network of nerves which carries the messages back and forth in the brain. The eyes, ears and other part of the body directly connected to the brain. Some other nerves connected to the spinal cord to connect the brain. The glial cells surrounded by the nerves cells.

The another work of brain is charge our senses like hearing, sight, touch, taste, memory, smell, emotions, and personality [1].

There are three major parts of the brain are as follows:

- **Cerebrum** - The top portion of the brain is called cerebrum. It is the largest part of the brain. It consisting of two hemispheres, left hemisphere and right hemisphere. The right hemisphere is responsible for the left side of the body. The left hemisphere is responsible for the right side of the body. It collect the information from our senses and sends the order to our body. The brain controls other thing like reading, thinking, learning, speech, and emotions.
- **Cerebellum** - The cerebellum is also known as little brain. The cerebrum are situated back of the brain. The cerebellum controls balance and complex actions.
- **Brain Stem** - Its far the bottom a part of the brain. It acts as a sensory data device. It also liable for cardiac gadget. It downwords the base and connect to the spinal twine. It controls complex activities. Body temperature and blood strain with the aid of brain stem. It controls the vital body functions.

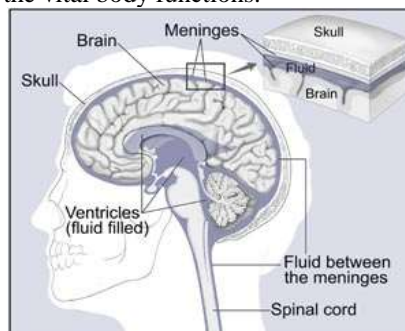


Fig. 1.1: The brain and nearby structures

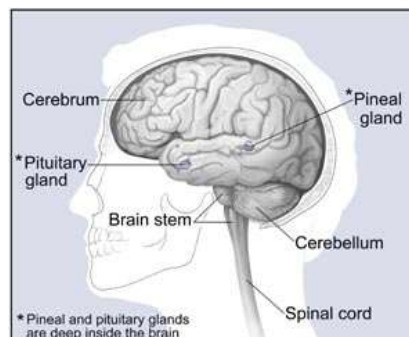


Fig. 1.2: Major parts of the brain

3. Cancer

Cancer starts off evolved in cells, the constructing blocks that make up tissues. Tissues make up the organ of the frame. Commonly, cells grow and divide to form new cells as the frame needs them. While cell grow vintage, they die, and new cells take their area. Sometimes this orderly technique is going wrong. New cells form when the frame does not need them, and old cells do no longer die once they should. Those more cells can shape a mass of tissue called a boom or tumor.

4. Brain Tumor

A brain tumor is an atypical boom of tissue inside the mind. not like different tumors, mind tumors spread through neighborhood extension and seldom metastasize (unfold) outside the brain. A benign mind tumor consists of non-cancerous cells and does now not metastasize beyond the a part of the brain wherein it originates. A mind tumor is considered malignant if it carries cancer cells, or if it's miles composed of harmless cells positioned in a place where it suppresses one or greater vital functions.

4.1 Types of Brain Tumor

4.1.1 Benign brain tumors do not comprise cancer cells [7]:

1. commonly, benign tumors can be eliminated, and they seldom develop back.

2. The border or edge of a benign mind tumor can be simply visible. Cells from benign tumors do not invade tissues round them or unfold to other components of the body. however, benign tumors can press on sensitive areas of the mind and motive serious health problems.
3. in contrast to benign tumors in maximum different elements of the body, benign mind tumors are once in a while lifestyles threatening.
4. Very rarely, a benign brain tumor may emerge as malignant.

4.1.2 Malignant mind tumors comprise cancer cells:

1. Malignant mind tumors are generally extra serious and regularly is life threatening.
2. they may be possibly to grow unexpectedly and crowd or invade the surrounding healthful brain tissue.
3. Very not often, most cancers cells may additionally spoil far from a malignant mind tumor and unfold to other parts of the brain, to the spinal wire, or maybe to other components of the frame. The unfold of cancer is called metastasis.

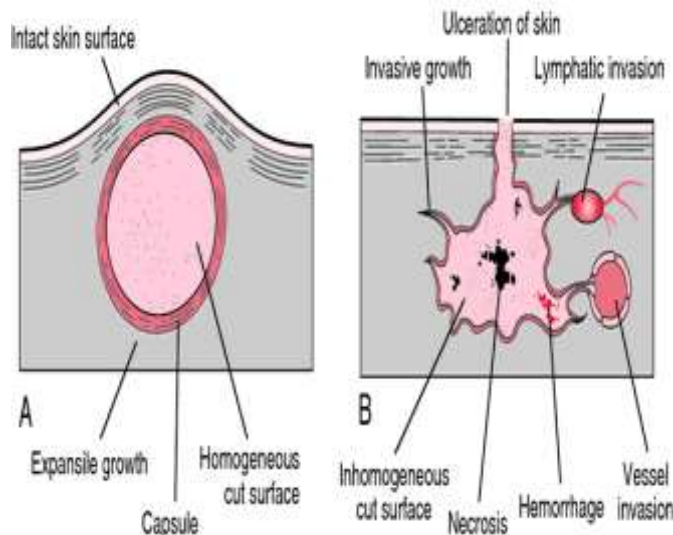


Fig. 1.3: Gross appearance of benign (A) and malignant (B) tumors

5. Tumor Grade

Doctors every so often institution mind tumors through grade - from low grade (grade I) to high grade (grade IV). The grade of a tumor refers back to the manner the cells look underneath a microscope. Cells from excessive-grade tumors appearance more peculiar and normally grow quicker than cells from low-grade tumors [6].

6. Reason of Brain Tumor

Nobody knows the exact causes of mind tumors. docs can seldom explain why one individual develops a mind tumor and any other does not. however, it's miles clean that brain tumors are not contagious. no one can "catch" the disorder from some other character. research has proven that human beings with positive threat elements are more likely than others to broaden a brain tumor. A chance thing is whatever that will increase someone's danger of growing a disease [4].

The subsequent chance elements are related to an multiplied threat of developing a primary brain tumor:

- Being male - In preferred, mind tumors are extra not unusual in adult males than women. however, meningiomas are greater not unusual in women.
- Race - mind tumors arise extra frequently among white human beings than amongst people of other races.
- Age - most brain tumors are detected in individuals who are 70 years antique or older. however, mind tumors are the second most commonplace most cancers in kids. (Leukemia is the maximum not unusual adolescence cancer.) brain tumors are greater not unusual in children more youthful than 8 years vintage than in older youngsters.
- family records - people with own family participants who've gliomas can be more likely to expand this ailment.
- Radiation - people within the nuclear industry have an expanded hazard of growing a mind tumor.
- Formaldehyde - Pathologists and embalmers who work with formaldehyde have an expanded chance of growing mind cancer. Scientists have now not located an improved danger of brain most cancers among different kinds of employees exposed to formaldehyde.
- Vinyl chloride - employees who make plastics may be exposed to vinyl chloride. This chemical may growth the threat of brain tumors.

Scientists are investigating whether cell phones may cause brain tumors. Studies thus far have not found an increased risk of brain tumors among people who use cell phones.

Scientists also retain to observe whether head injuries are a hazard factor for brain tumors. to this point, those research have not determined an increased chance among humans who've had head injuries.

The general public who have recognized chance elements do no longer get mind cancer. alternatively, many that do get the ailment have none of those threat factors. individuals who think they may be at chance have to speak this situation with their physician.

7. Review Work

In this paper, we review the different work focuses on MR images for automatic diagnostic system using Gabor Wavelets. So, the different existing techniques and research work in the direction of automatic diagnosis is evaluated to identify the problem and the relevant optimum solutions.

Cancer isn't a brand new sickness. Written descriptions of it may be discovered on Egyptian papyrus dating back to more or less 1600 BC. The Egyptians blamed the ailment at the gods and handled it with a cauterizing device they called "the fire drill" [2]. Reputedly the drill did not work, because the writing on the papyrus says, "there is no remedy." The Greek physician Hippocrates is thought to be the primary individual to apply the word "carcinosis", which describes the crab-like way that each the ulcer-forming and non-ulcer forming tumors spread. through the years, the word shortened to "most cancers". whilst the primary autopsy become performed via Italian anatomist Giovanni Morgagni in 1761, the foundation turned into laid for the medical observe of cancer, also known as oncology.

The 18th century John Hunter become one of the first human beings to indicate running on a tumor. regrettably for his patients, anaesthesia become now not evolved till a century later. no longer pretty, surgery began to flourish as soon as anesthesia changed into introduced.

Whilst the modern-day microscope turned into invented within the 19th century, it allowed scientists to study most cancers with the unaided eye and the contemporary pathologic look at of cancer turned into born. Surgeons ought to now eliminate tissue and pass it to pathologists, who should tell the surgeon whether or not an operation efficaciously eliminated a tumor.

MRI: An MRI uses magnetic fields, no longer x-rays, to provide unique pics of the body. MRIs may also create more targeted pics than CT scans (see underneath) and are the favored technique of diagnosing a brain tumor. The MRI can be of the brain, spinal twine, or each, depending on the form of tumor suspected and the probability that it's going to spread within the CNS. There are special kinds of MRI, and the outcomes of a neuro-exam, completed with the aid of the internist or neurologist, allows determine which kind of MRI to use.

1. Intravenous (IV) gadolinium-enhanced MRI is commonly used to help diagnose a mind tumor. that is while a patient first has a regular MRI, and afterwards is given a evaluation (a unique form of dye referred to as gadolinium) via an IV; a 2nd MRI is then executed to get every other series of snap shots using the dye.

2. A spinal MRI can be used to diagnose a tumor on or close to the spine.

3. A purposeful MRI (fMRI) affords statistics about the region of specific areas of the brain which might be responsible for muscle movement and speech. during the fMRI examination, the affected person is asked to do sure tasks that motive changes in the mind and can be seen on the fMRI picture. This check is frequently used to plan surgical procedure, so the general practitioner can keep away from detrimental the useful parts of the brain while putting off the tumor [5].

4. Magnetic resonance spectroscopy (MRS) is a test using MRI that provides statistics on the chemical composition of the brain. it is able to assist tell the distinction between lifeless (necrotic) tissue resulting from preceding radiation remedies and new tumor cells inside the brain.

CT SCAN: A CT scan creates a three-dimensional picture of the interior of the body with an x-ray machine. A pc then combines those snap shots into a detailed, go-sectional view that shows any abnormalities or tumors. A CT test can assist find bleeding and expansion of the fluid-crammed areas in the brain, called ventricles. modifications to bone in the skull also can be visible on a CT scan. every now and then, a evaluation medium (a special dye) is injected into a affected person's vein to provide higher detail, in particular if the affected person cannot have an MRI (such as if the man or woman has a pacemaker) [8].

PET SCAN: A PET test is a way to create pictures of organs and tissues inside the body. A small quantity of a radioactive substance is injected into a affected person's body. This substance is absorbed mainly by organs and tissues that use the most energy. due to the fact a tumor tends to use strength actively, it absorbs extra of the radioactive substance. A scanner then detects this substance to provide photographs of the internal of the body[3].

The main difference between proposed work and recent work is to provide a generalized framework the early diagnosis of the disease. Gabor wavelets approach is used to obtain accuracy of tumor diagnosis in brain. The main aim of this paper is to determine the best method which can detect the tumor most efficiently

8. Conclusion

This paper provides an overview of recent development in the domain of the early diagnosis of the disease using several technique which involves detection using segmentation, pattern matching and Texture Analysis. In this project we are limited ourselves to study of methods of brain tumor detection using segmentation only. Among the method using segmentation we will be focusing on the most efficient Gabor wavelet method.

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