Chapter 5
An Approach of SIFT With Fed-VGG16 and Fed-CNN for Identification and Classification of Brain Tumors

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ABSTRACT

Brain tumors develop when cells in the brain multiply rapidly and unchecked. It can be fatal if not addressed in its early stages. Getting segmentation and classification right is still a challenge, despite a lot of work and good results in this field. Radiologists may now more easily locate tumor regions with the use of experimental medical imaging techniques like magnetic resonance imaging (MRI). Image processing techniques such as pre-processing, segmentation, contour detection, feature extraction using SIFT (scale invariant feature transformation), classification using VGG16, CNN, Fed-VGG16, Fed-CNN classifiers, and evaluation using confusion matrices are presented in this study. The models reach up to 97%, 98.51%, 99.28%, and 100% classification accuracy for the used classifiers, correspondingly, according to the experimental data. In order to facilitate early detection for subsequent research and activity, it seeks to mitigate some of the problems that have already been addressed.

1. INTRODUCTION

The CNS relays sensory data and the responses to it to every part of the body. Both the brain and the spinal cord play a role in this transmission. According to anatomical descriptions, the brain consists of the cerebrum, the cerebellum, and the brain stem (Watson et al., 2010). Human brains, whether male or female, have a volume of 1260 cm3 and a weight of about 1.2-1.4 K. Making decisions, controlling motor

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skills, and solving problems all rely on the frontal lobe of the brain. In terms of posture, the parietal lobe is in charge. When it comes to visual processing, the occipital lobe is in charge, whereas the temporal lobe is in charge of memory and hearing. A group of greyish-colored neurons called cortical neurons make up the outside of the brain, which is called the cerebral cortex. The cerebellum is smaller in size compared to the cerebrum. It is responsible for motor control, or the systematic regulation of voluntary movements, in sentient creatures with a neurological system. The ALI, lesionGnb, and LINDA algorithms are unable to identify the little lesion area because of its size variability and stroke territory. In comparison to other animals, humans have a highly developed and organized cerebellum (Koziol et al., 2012). Anterior, posterior, and flocculonodular lobes make up the cerebellum. The vermis is a spherical structure that joins the two lobes. A region of white matter makes up the cere bellum, while a thinner, greyish-colored cortex covers the outside. When it comes to coordinating intricate motor activities, the front and back lobes are there to help. The flocculonodular lobe is responsible for regulating the body's buoyancy. An anatomical structure resembling a stem, the brain stem measures 7 to 10 centimetres in length. Assisting with breathing, maintaining balance, and controlling eye movement are all functions of the central nervous system, which comprises bundles of nerves from the brain to the rest of the body. Upon leaving the thalamus of the cerebrum, nerve fibers go via the brain stem to the spinal cord. Their dissemination over the body began at that point. In the brain stem, the midbrain, pons, and medulla are the most important structures. Functions including motor control, visual processing, auditory processing, and eye movement rely on the midbrain. While the medullaoblongata aids with blood control, swallowing, sneezing, etc., the pons withholds feelings, intra-brain communication, and respiration (Amin et al., 2022).

1.1. Brain Tumor

One of the most lethal diseases, brain tumors develop when brain tissue grows rapidly and uncontrollably within the skull. There are two possible types: benign and malignant. In contrast to benign tumors, which typically develop slowly, malignant ones can spread rapidly across the brain and other tissues nearby. On the other hand, benign tumors pose a threat to the brain tissues around them if they continue to grow. While 30% of tumors are cancerous, 70% are benigns. So far, about 120 different types of brain tumors have been identified and recognized. The most prevalent ones are pituitary, meningioma, and glioma. Meningiomas are the most common type of primary brain tumors that involve the meninges and can spread to other parts of the brain and spinal cord. However, astrocytes, which are glial cells, are the origin of glioma tumors. Astrocytomas are the most common type of glioma tumors; they are low-risk and typically develop slowly. Nonetheless, among brain tumors, high-risk glioma is among the most dangerous. When cells in the pituitary gland in the brain grow uncontrollably, a tumor known as a pituitary arises. Consequently, because brain tumors may be fatal, early detection is key (Saikat et al., 2022).

1.2. Magnetic Resonance Imaging (MRI)

Pneumoencephalography and cerebral angiography are two older, more invasive imaging techniques that have been replaced by a new series of high-resolution, non-invasive techniques like CT scans and MRI. But MRI is usually the gold standard when it comes to clinical imaging. Various lumps of different colors can be seen in the results of CT or MRI scans that are caused by neoplasms.

Improvements in MRI have expanded its usefulness in revealing physiological information that could aid in diagnosis and prognosis. Radiation oncologists, surgeons, and oncology patients benefit from these