DETECTION OF GASTRIC CANCER THROUGH ADVANCED ENDOSCOPIC IMAGING TECHNOLOGY USING CNN

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College ***:*** *Canara Engineering College, Mangaluru*
Branch ***:*** *Department of Information Science and Engineering*
Guide(s) ***:*** *Prof. Shilpa B.*
STUDENT (S) *: Ms. Ashwini K. Hegde*
Ms. Chaithanya G. Puthran
Ms. Jayaswi
Ms. Rachana

Keywords

Deep Learning, Convolution Neural Networks, Confusion Matrix, Endoscopic image diagnosis, Dataset, Keras.

Introduction

Stomach cancer, with one of the highest mortality rates among cancers, often goes undetected in its early stages due to subtle symptoms. These symptoms, which intensify as the disease progresses, can be mistaken for less serious conditions like inflammation or ulcers. This diagnostic challenge underscores the necessity of endoscopic imaging for early detection. The World Health Organization recognizes stomach cancer as a top-five killer, responsible for 9% of cancer deaths and 7% of cases globally. It's a particularly aggressive cancer type, with a 90% mortality rate within the first five years post-diagnosis. Approximately 800,000 deaths annually attest to its prevalence, making early detection critical for improving survival rates. Gastric cancer (GC) is invasive and notoriously difficult to diagnose early due to its complex nature involving genomic and epigenetic variations. Despite extensive research, GC remains largely incurable, with no clear early signs, leading to poor prognoses and high recurrence rates. Histopathological examination is a key diagnostic tool, providing definitive results that guide patient management and treatment decisions. Overall, the importance of early and accurate diagnosis cannot be overstated, as it significantly impacts treatment efficacy and patient survival.

Objectives

The Specific objectives of the Project are as follows.

1. To develop a system that process endoscopic images and classifies them.
2. To design a system that identifies the presence of Gastric cancer from user's endoscopic images.
3. To apply the concept of deep learning in determining the Gastric cancer.
4. To design a system with well-defined user interfaces for the end users.

Methodology

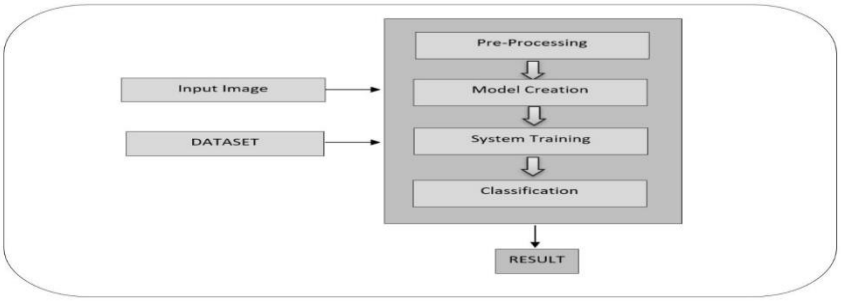

Figure 1: Flow chart of project methodology

The suggested technique's design is depicted in the above figure. The four primary parts of the framework are classification, model generation, pre-processing, and system training. The collection of photos are pre-processed by scaling them to the necessary dimensions using the prior processing component. A machine language model with the necessary quantity of levels may be constructed via the model's Building modules. The algorithm is trained using dataset pictures during its learning period, which also stores the algorithm's value. To ascertain the possibility that a person has cancer of the stomach, the data provided in the test picture is classified using the categorization algorithm.

Algorithm: CNN

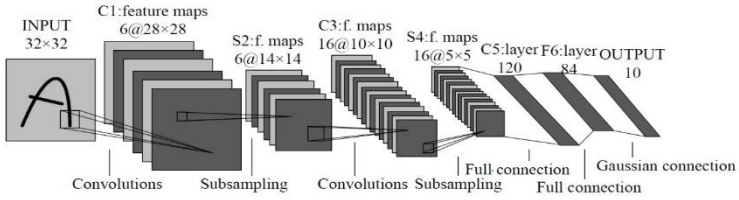

Figure 2: Working of CNN Algorithm

Using a series of convolutions and collecting, it identifies the properties of the information at various sizes. The CNN network is distinct in the way that it uses values that are shared and neighborhood links. It lowers the likelihood of overfitting while also simplifying the network's optimization process by reducing the amount of weights. Convolutional, pooling, fully linked, and Softmax layers are the three mutually supporting layers that make up a CNN**.**

Results and Conclusions

The proposed project objectives result the following outcomes.

1. Data Utilization: Employed a dataset of annotated endoscopic images for training the Convolutional Neural Networks (CNN).

2. CNN Performance: The CNN demonstrated high accuracy in recognizing patterns indicative of gastric cancer.

3. Clinical Trial Readiness: The system's performance was validated using an independent dataset, suggesting readiness for clinical trials.

4. Real-time Diagnosis Support: The CNN model showed potential to assist endoscopists in real-time diagnosis, reducing individual error.

5. Future Enhancements: Further studies are needed to improve the accuracy and efficiency of CNN algorithms for stomach cancer detection.

The project successfully integrated machine learning with endoscopic imaging to enhance the detection of gastric cancer, indicating a promising direction for future healthcare technology advancements.

Scope for Future Work

The following shows the Scope for Future Work

1. Enhancement of CNN Algorithms: Further research and development to improve the accuracy and efficiency of CNN algorithms for stomach cancer identification.

2. Clinical Trials: Conducting clinical trials with new endoscopic images to explore the potential of CNNs in supporting real-time diagnosis by endoscopists.

3. Error Reduction: Utilizing CNNs to minimize individual errors during endoscopic examinations and provide a reliable second opinion.

4. Expansion of Dataset: Increasing the dataset size and diversity to enhance the model's learning and predictive capabilities.

5. Integration with Medical Practice: Developing a user-friendly interface for the system to be easily adopted in medical practice for early detection and diagnosis of gastric cancer.

Innovation

The innovation lies in the development of a system that processes endoscopic images to classify them for the presence of gastric cancer. Utilizing deep learning techniques, particularly CNN, the project aims to propose a model for accurate diagnosis using endoscopic images, thereby achieving high accuracy. The system is designed with a user-friendly interface, allowing end users to determine the likelihood of gastric cancer from their endoscopic images. This approach represents a significant advancement in medical diagnostics, potentially increasing early detection rates and improving patient outcomes for one of the most prevalent and deadly forms of cancer.