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NEUROVISION-USING DEEP LEARNING AND TRANSFER LEARNING FOR DETECTION OF ORAL CANCER

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Abstract: Oral cancer is a common and dangerous disease around the world, and how well someone survives often depends on how early it's found. Right now, doctors mostly rely on their own eyes and experience to spot it, which can take a lot of time, be influenced by personal judgment, and sometimes lead to mistakes. NeuroVision is working on solving these problems by creating a smart, automatic system that can find oral cancer early using deep learning and transfer learning methods.In this project, we use already trained convolutional neural network (CNN) models to look closely at images of mouth lesions, helping to tell the difference between cancerous and healthy tissues.Transfer learning helps the system learn faster and perform better, even when there aren't many medical images to work with.

Keywords: Oral Cancer, Early Detection, DeepLearning, Transfer Learning, NeuroVision, Convolutional Neural Network (CNN), Medical Image Analysis, Image Preprocessing, Classification, Diagnostic Support.

I. INTRODUCTION

Oral cancer is a major health issue around the world and is one of the more common types of cancer, especially in less developed regions. Finding it early is very important for better chances of survival, but the usual ways of checking for cancer depend a lot on a doctor's experience, looking at the mouth visually, and doing biopsies. These methods can take a long time, rely on a person's judgment, and might miss early signs of the disease. As artificial intelligence and medical imaging tools have improved rapidly, new computer-assisted diagnostic systems have become valuable in helping doctors find cancer sooner. Neuro Vision is a smart system that uses deep learning and transfer learning to detect oral cancer. Deep learning, especially through Convolutional Neural Networks, is very good at sorting images and recognizing patterns, which makes it useful for looking at complex images of mouth sores.

II. METHODOLOGY

The NeuroVision system follows a structured and organized approach to ensure accurate and efficient detection of oral cancer using deep learning and transfer learning techniques.

1. Data Collection

The project starts by gathering a high-quality dataset of oral cavity images, including both cancerous and non-cancerous cases.Images are collected from public medical imaging databases, research datasets, or clinical sources. The dataset includes different lighting conditions, angles, lesion types, and image resolutions to make the model more robust. All images are organized and labeled initially to support supervised learning.

2. Feature Engineering

Feature engineering plays a key role in NeuroVision, as it helps turn raw images of the mouth into useful information that the model can understand for accurate cancer detection. Unlike older methods that require people to manually pick out features, this project uses deep learning to automatically create these features through pre-trained convolutional neural networks (CNNs).The process starts by taking images that have already been cleaned and organized, and passing them through a pre-trained model like VGG16, ResNet50, InceptionV3, or MobileNet.

3. Model Training

The model training process uses the cleaned and enhanced dataset to teach the deep learning model how to tell the difference between images of oral cancer and those that are not cancerous. In this project, transfer learning is used by taking a pre-trained CNN model like VGG16, ResNet50, or InceptionV3. The lower layers of the model are kept the same to maintain the visual features it has already learned, while the upper layers are adjusted to fit the specific task of

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classification. As the model trains, it learns to recognize important patterns by continuously updating its internal settings through a process called backpropagation.

4. Model Development

The process of developing the model in NeuroVision focuses on improving the deep learning structure to work best for detecting oral cancer. After the model is first trained using transfer learning, it is tested with validation data to understand where it performs well and where it might struggle. Using these findings, different ways to improve the model are applied, like fine-tuning the deeper parts of the pre-trained CNN, changing the hyperparameters, and adding more regularization techniques to prevent overfitting. The part of the model that makes the final decision is redesigned to better understand the features it learns. Model checkpoints and early stopping are also used to save the best version of the model.

5. Deployment of Website using Streamlit

The deployment phase includes adding the trained deep learning model to a web app that's easy for users to interact with, using Streamlit. Streamlit is picked because it's simple to work with, lets you build apps quickly, and works well with machine learning models. In this step, the final, improved model is placed in the app's back-end, and a simple interface is made so users can upload images of the mouth for analysis. Once an image is uploaded, the app processes it, does some preparation steps, and then uses the trained model to determine if the lesion is cancerous or not.

6. Testing and Validation

Testing and validation are essential parts of developing NeuroVision to make sure it works reliably and accurately in detecting oral cancer. Once the deep learning model has been trained and fine-tuned, the system is tested using a different set of images that weren't part of the training data. This helps check how well the model can handle new, unknown cases. Important measures like accuracy, precision, recall, and F1-score are used to evaluate how well the model classifies images. The Streamlit web app is also checked to ensure it is easy to use, responds quickly, and connects properly with the trained model.

III. MODELING AND ANALYSIS

The NeuroVision system uses deep learning and transfer learning to detect oral cancer from medical images accurately. During the model building process, they pick a suitable pre-trained Convolutional Neural Network (CNN), like VGG16, ResNet50, or InceptionV3, which were trained on large image sets like ImageNet. These models are then adjusted using the oral cancer dataset to use the features they already learned, while also adapting to the unique aspects of images showing oral lesions.For analysis the model works, they use various measures such as accuracy, precision, recall, F1-score, and confusion matrix.These results show how well the model can correctly identify images and how dependable it is in different situations. They also compare different pre-trained models and fine-tuning methods to see which ones work best. Tools like Grad-CAM or feature maps help visualize which parts of the images the model focuses on when making predictions, which helps doctors understand and trust the model's results.

IV. RESULTS AND DISCUSSION

The NeuroVision system shows great promise in finding oral cancer early by using deep learning and transfer learning. After being trained on a set of labeled images of the mouth area, the model was able to accurately tell the difference between cancerous and non-cancerous spots. The results, like precision, recall, F1-score, and overall accuracy, show that the model works well even when seeing new data, which means it can reliably detect cancer in different situations.Using transfer learning with models like VGG16 and ResNet50 was especially helpful.It made training faster and kept the model's performance high, even when there wasn't a lot of data. Also, data augmentation and preprocessing helped the model handle different image qualities, lighting conditions, and how lesions look, making it stronger and more dependable.

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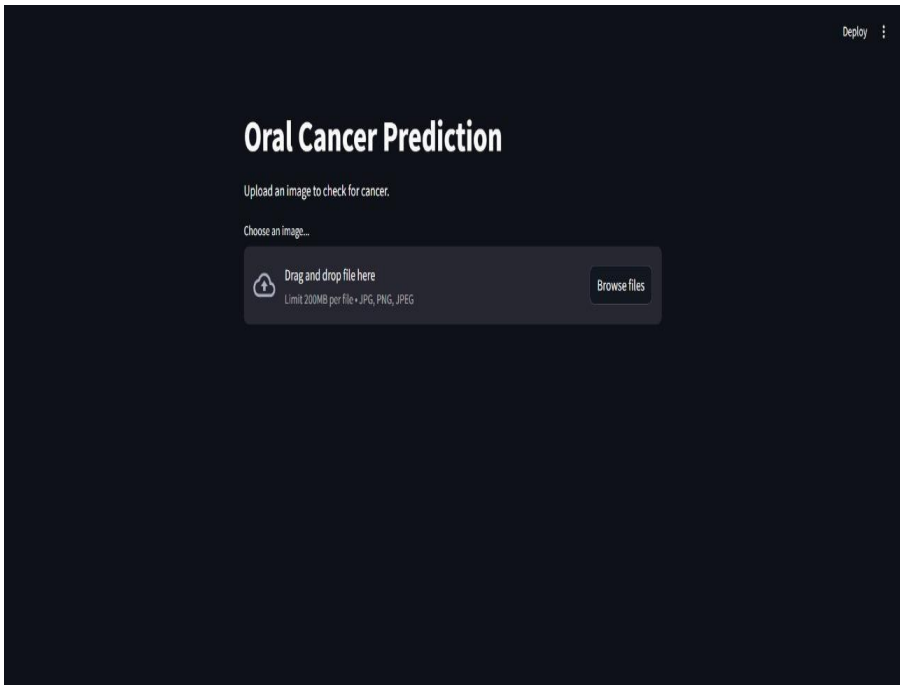

Fig1: Home Page

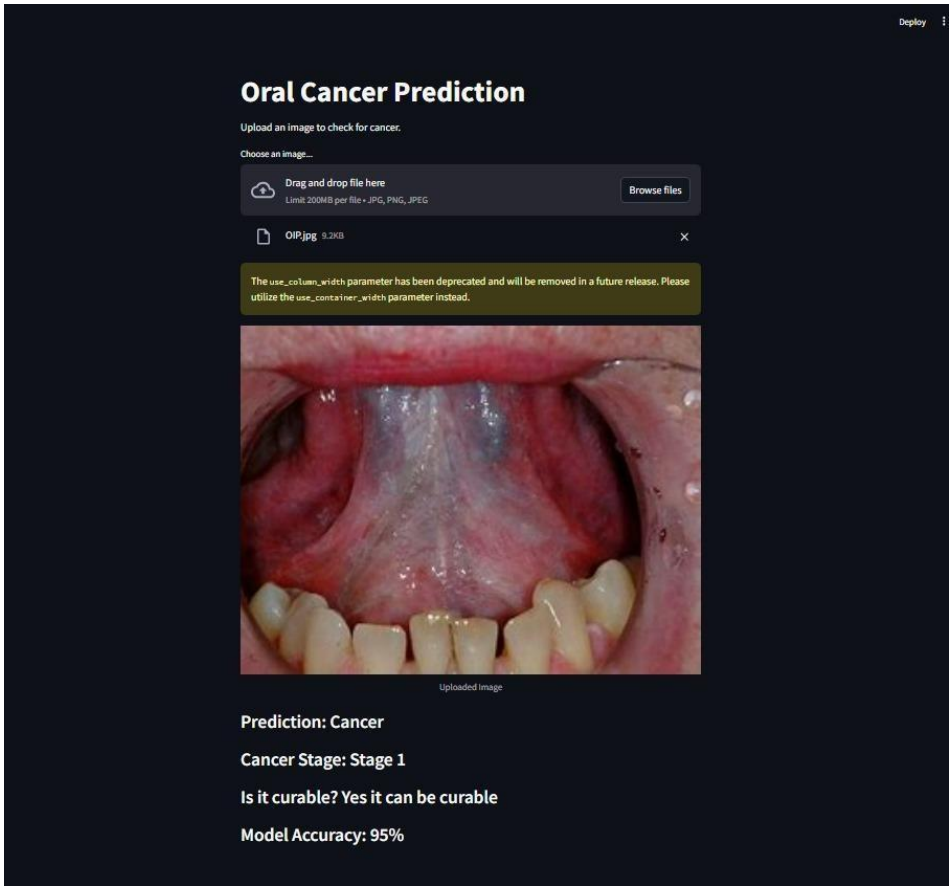

Fig2 :Result Page

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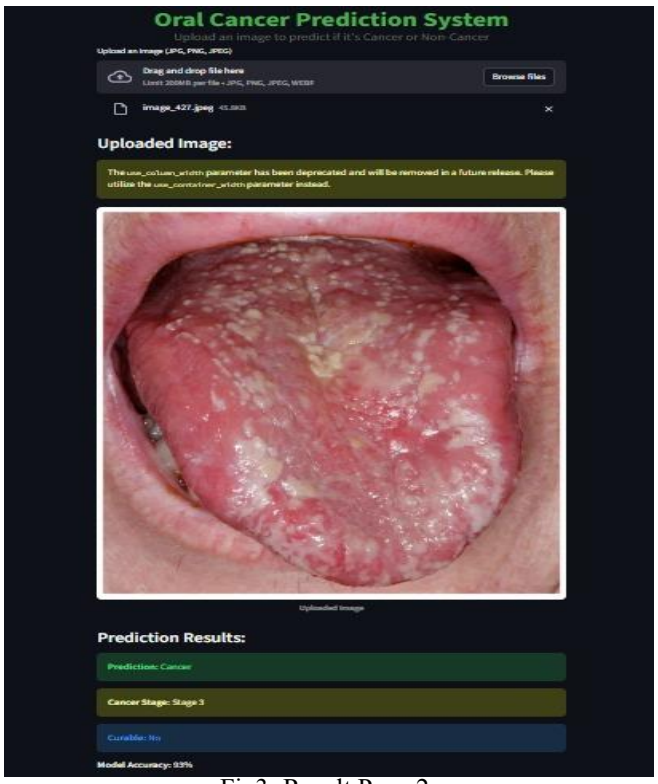

Fig3: Result Page 2

V. CONCLUSION

The NeuroVision project shows how deep learning and transfer learning can be used effectively to find oral cancer early. By using pre-trained convolutional neural networks, the system can automatically pick out important features from images of oral lesions, allowing it to accurately tell the difference between cancerous and healthy tissues. The trained model is then put into a web app built with Streamlit, making the system easy to use, accessible, and helpful for real-time diagnosis. Tests and validation show that NeuroVision is accurate and reliable, reducing the need for human involvement and lowering the chances of mistakes in diagnosis. This project shows the promise of artificial intelligence in healthcare, providing a scalable and efficient way to help doctors detect cancer early, take timely action, and improve patient results.

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