# CANCER DETECTION USING CONVOLUTIONAL NEURAL NETWORK

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**Abstract**

An artificial intelligence algorithm known as an oral, or convolutional neural network, may examine medical photos to find oral cancer. It uses several layers of convolution pooling to identify patterns and features in the images. This aids CNN in categorizing and locating potentially malignant oral cavity regions. With 177,384 deaths from oral cancer in 2018, oral cancer is a serious worldwide health concern that is especially common in low- and middle-income nations. The study employed a Convolution Neural Network (CNN) for classifying oral cancer cases. Their findings suggested that CNN performs better in the detection of oral cancer compared to other methods[4].. The data used here is basically a primary datasets. Warin, Kritsasith, et al in his research paper he has tried to explain AI-based CNNs detect oral lesions, aiding early oral cancer detection, potentially improving diagnostic rates[2]. In particular, Convolutional Neural Networks (CNNs) have demonstrated encouraging performance in a range of medical image processing applications. CNNs have been extensively employed in automated whole-slide analysis for the purpose of cancer identification. Most often, a wide range of parameters, such as sensitivity, specificity, accuracy, and area under the receiver operating characteristic curve (AUC-ROC), are used in the proposed CNN-based system.

**Keywords:** Convolutional Neural Network, Detection of oral cancer, Image processing techniques.

## 1. Introduction

Convolutional Neural Network is what CNN stands for. CNN is a subset of deep learning that is used extensively for image analysis and recognition and is included in the artificial intelligence domain. One of the most prevalent cancers in the world, oral cancer is marked by high rates of morbidity, mortality, and delayed detection. Oral cancer, which comprises malignancies of the lip, various oral tissues, and the oropharynx, is the 13th most prevalent type of cancer globally. This study evaluated deep learning-based computer vision techniques for the automated identification and categorization of oral lesions in order to facilitate early detection of oral cancer, most prevalent cancer of the head and neck, oral. cancer has a 5-year survival rate. We have used a primary dataset for detection .In research paper of Warin, K., Limprasert, W., Suebnukarn, S., Jinaporntham, S., Jantana, P., &Vicharueang, S. (2022) he as used a dataset comprising 980 oral photographic images was divided into 365 images of OSCC, 315 images of OPMDs and 300 images of non-pathological images. Multiclass image classification models were created by using DenseNet-169, ResNet-101, SqueezeNet and Swin-S. Multiclass object detection models were fabricated by using faster R-CNN, YOLOv5, RetinaNet and CenterNet2[2]. Determining the risk of oral potentially malignant disorders (OPMDs) leading to cancer is a challenging undertaking that typically precedes oral cancer. OPMDs are defined as visible mouth lesions, tongue cancer. CNNs have the ability to accurately identify worrisome areas or lesions in oral cavity pictures, including photos and radiographic scans. Although older adults account for the bulk of occurrences, there is a growing trend of younger people developing oral cancer, which is frequently linked to human papillomavirus (HPV) infection. Oral cancer is a dangerous illness that can seriously affect a person's general health and quality of life. Reducing risk factors, raising public awareness, and detecting oral cancer early are essential to lessening its impact and improving the prognosis of those who are impacted. Early detection and intervention can be facilitated by routine dental examinations and screenings. There are 18.1 million new instances of cancer worldwide, with 48.4% of those cases occurring in Asia. In 2018, this illness claimed the lives of about 9.6 million people. Cancer kills one in six individuals and is the primary cause or the second most common cause of premature death in 134 out of 183 countries worldwide. Cancer will always be a burden as life expectancy rises, communities change, and epidemiological patterns shift.

## 2 PROPOSED SYSTEM

This study evaluated automated methods for detecting oral lesions in real photos of oral cancer in order to diagnose the disease early. Convolutional neural networks were used to process the images for image classification. They proposed a deep CNN algorithm for classifying oral cancer, focusing on oral cancer classification using deep learning techniques. They referenced a technique discussed by Deepak Kumar et al[1].

### 2.2.1 SCOPE OF THE PROJECT

The purpose of oral cancer imaging is to identify oral cancer or precancerous lesions that may develop into oral cancer at an early stage, when the disease is most easily removed and has the best chance of recovery.

2.2.2 ADVANTAGES OF PROPOSED SYSTEM

• In comparison to the current system, this process may operate faster. • Compared to existing techniques, this one is user-friendly, low cost, and requires standard hardware requirements.

2.2.3 DISADVANTAGES OF EXIXTING SYSTEM

• The process of machine learning may take longer.

• High-end hardware is required for machine learning, which increases processing costs

## 3.Literature survey

A review of the literature on oral cancer detection encompasses a broad spectrum of studies, approaches, and developments in the field. The identification of risk factors for oral cancer, such as alcohol use, sun exposure, HPV infection, and tobacco use, has been the subject of numerous research. Studies demonstrate how important lifestyle variables are in the development of oral cancer. This paper discussed various detection modalities for oral cancer, stressing the importance of a sensible approach to early detection to improve outcomes[8]. In order to increase survival rates and prognoses, early detection is essential. Numerous screening procedures, such as visual inspection, biopsy, and imaging techniques, have been investigated. New developments in imaging technology, such PET scans and optical coherence tomography, have the potential to improve early detection. Interest in biomarker research is significant. Researchers are searching for particular biochemical, genetic, and protein indicators linked to oral cancer. Studies have shown that regions with high rates of betel nut and tobacco consumption also have greater rates of buccal cancer. Risk factors for buccal cancer include betel nut chewing, alcohol and tobacco use, HPV infection, and exposure to toxins in the environment.

## 4.Block Diagram

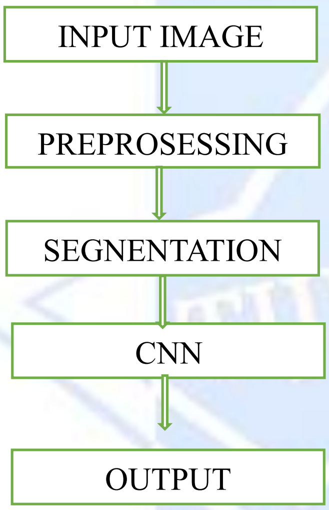


Figure 3.1: Block Diagram

## 5.Algorithm used

5.1 CONVOLUTIONAL NEURAL NETWORK

Convolutional neural networks, a type of feed-forward neural network, process data using a grid-like architecture to analyze visual images. It is also known as a ConvNet at times. An object in a photograph is located and classified using a convolutional neural network. This is the first step in the process of eliminating valuable components from an image. The paper focused on oral squamous cell carcinoma (OSCC), highlighting that it constitutes more than 90% of oral cancers. They emphasized the importance of comprehensive clinical examinations for detection[]. In a convolution layer, the convolution action is carried out by a number of filters working together. One way to conceptualize each image is as a matrix of pixel values. This study utilized a CNN for automated early detection of oral cancer. They referenced Uthoff's work, who used a CNN to classify pairs of autofluorescence and white light images[3]. Additionally, a 3x3 filter matrix is present. Move the filter matrix over the image and compute the dot product to produce the convolved feature matrix. The term "ReLU" refers to the rectified linear unit.After the feature maps have been collected, the next step is to move them to a ReLU layer. ReLU sets all of the negative pixels to 0 by doing an operation element per element. A corrected feature map including the network's nonlinearity is the outcome. The dimensionality of the feature map is reduced through the pooling process's downsampling. The updated feature map is now run through a layer of pooling to produce a pooled feature map. Identify the classes more precisely. The error is computed and backpropagated at this point. To enhance the model's performance, the feature detectors and weights are changed. The network then continues to train on the data as the process is repeated over and over. The pooling layer uses a range of filters to identify different areas of the image, including edges, corners, bodies, feathers, eyes, and beaks. The next step in the process is flattening. Every 2-Dimensional array that is produced from pooled feature maps is compressed into a single, long continuous linear vector. The fully linked layer receives the flattened matrix as input in order to classify the image.

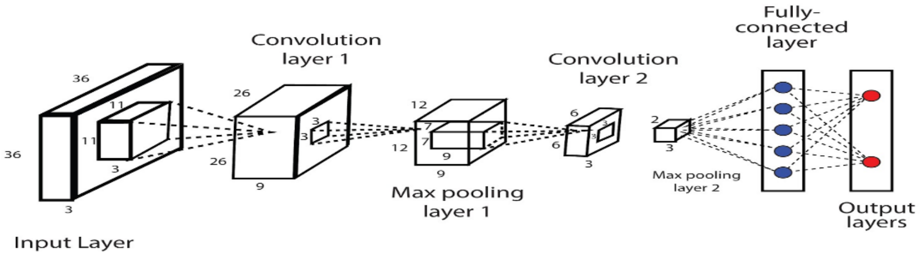


Figure5.1: Illustration of proposed Convolutional Neural Network (CNN)

**6.Working**

The features of many of the photographs in the dataset used for this study might be utilized to categorize different kinds of ants. There were a total of 1000 photos used for training and 300 images used for validation; the distribution of training and validation data was 70% and 30%, respectively. CNN comprises an output layer in addition to input and hidden layers. Fully connected, pooling, ReLU, and convolutional layers are the most common types of hidden layers. The model's initial input for images consists of RGB photographs, where the colors mix to form a three-dimensional matrix, which can be seen in figure below.

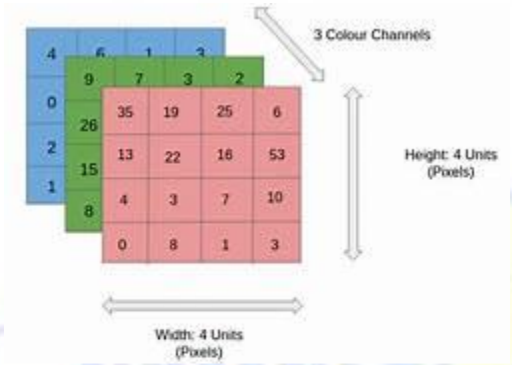


Figure 6.1: Image as a pixel matrix

Following that, the images are scaled for binary classification. They are scaled down to 200x200x3 pixels since the neural network cannot be given multiple-sized matrix images. The images are subsequently subjected to maximum pooling convolutional layers. A 200x200x3 picture with 16, 3x3 ReLu-activated filters and a 2x2 max pooling layer is applied at the first convolutional layer in order to extract as many pixels as is practical. By adding more convolutional layers with 32 and 64 filters of size 3x3 and a ReLu activation function over the 200x200x3 picture, along with a max pooling layer of size 2x2, the network's number of channels is increased, improving the accuracy of the model.

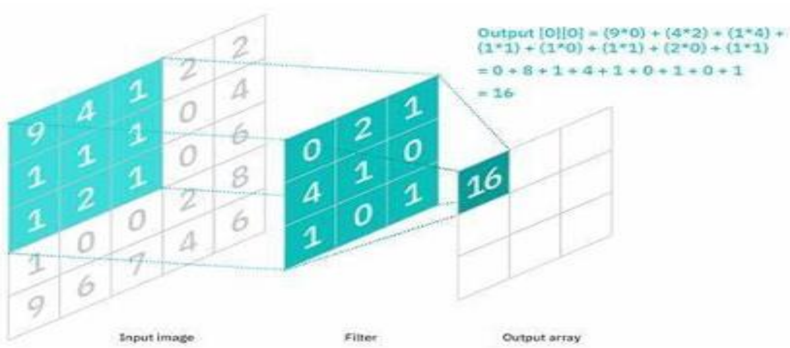


Figure 6.2: Illustration of Convolutional Process

In the pooling layer, mean or max pooling is used to reduce the data. Figure 6.2 shown as an illustration of the pooling process.

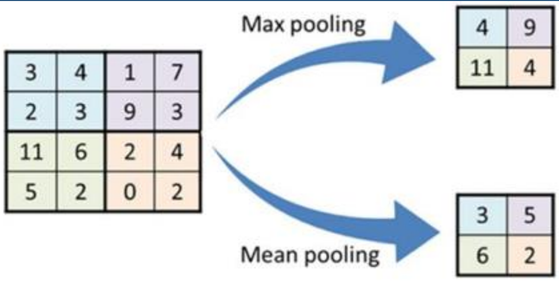


Figure 6.3: Pooling Process

The pooled feature maps' two-dimensional arrays are then flattened to produce a single, large continuous linear vector. After two dense layers with SoftMax activation functions are applied, images are categorized using the output of convolutional layers.

**6.1 TYPES OF ORAL CANCER**

It is true that there are several distinct areas of the oral cavity where oral cancer can develop, including the lips, gingiva, palate, buccal mucosa, and labial mucosa. Every site could have distinctive qualities and a different presentation.

Figure 6.1.1: Types of Oral Cancer

**7. RESULTS**

CNNs have proven to be highly accurate in their classification of images related to oral cancer. They can be trained to identify characteristics and patterns that the human eye might miss, which will result in more accurate and consistent diagnoses. Early-stage oral cancer detection is critical for enhancing treatment outcomes, and CNNs are capable of doing so. Better survival rates and less invasive treatments are made possible by early cancer detection.The supervised learning model is superior to the traditional, untrainable techniques. CNNs have the speed to analyze vast amounts of medical pictures, which can help with diagnosis and possibly speed up patient treatment. In underdeveloped or remote areas, CNN-based systems can be connected with other technologies, such telemedicine platforms, to provide remote screening and diagnosis.The proposed CNN model can classify different ant species with good performance and gives low error.It's crucial to remember that although CNNs have demonstrated significant potential in the identification of oral cancer, they cannot take the role of medical experts. Instead, they can be a useful tool to help doctors identify patients more quickly and accurately.

```
Epoch 1/10
6/6 [==============================] - 79s 12s/step - loss: 0.4224 - accuracy: 0.7895
Epoch 2/10
6/6 [==============================] - 22s 4s/step - loss: 0.4095 - accuracy: 0.8772
Epoch 3/10
6/6 [==============================] - 23s 4s/step - loss: 0.3966 - accuracy: 0.8772
Epoch 4/10
6/6 [==============================] - 24s 5s/step - loss: 0.3688 - accuracy: 0.8772
Epoch 5/10
6/6 [==============================] - 21s 3s/step - loss: 0.3729 - accuracy: 0.8772
Epoch 6/10
6/6 [==============================] - 21s 3s/step - loss: 0.3565 - accuracy: 0.8772
Epoch 7/10
6/6 [==============================] - 21s 3s/step - loss: 0.3630 - accuracy: 0.8772
Epoch 8/10
6/6 [==============================] - 21s 4s/step - loss: 0.3655 - accuracy: 0.8772
Epoch 9/10
6/6 [==============================] - 22s 4s/step - loss: 0.3286 - accuracy: 0.8772
Epoch 10/10
6/6 [==============================] - 26s 4s/step - loss: 0.3345 - accuracy: 0.8772
```

## 8.Future scope

Improved Accuracy: CNNs have shown remarkable performance in image recognition tasks, and their application in analyzing oral cancer images can lead to more accurate detection and classification of different types and stages of oral cancer.

Early Detection: Early detection is crucial for effective treatment and improved survival rates in oral cancer patients. CNNs can assist in the early identification of suspicious lesions or abnormalities in oral cavity images, enabling healthcare professionals to intervene at an earlier stage.

Automated Screening: CNN-based systems can automate the process of screening oral cavity images, reducing the burden on healthcare professionals and enabling more efficient and widespread screening programs. This can be particularly beneficial in regions with limited access to specialized healthcare services.

Integration with Imaging Technologies: CNNs can be integrated with various imaging technologies such as digital intraoral cameras, optical coherence tomography (OCT), and multispectral imaging systems to provide a comprehensive analysis of oral tissue morphology and aid in the detection of cancerous lesions.

Personalized Medicine: By analyzing large datasets of oral cancer images along with clinical data, CNNs can help in identifying patterns and biomarkers associated with specific types of oral cancer. This information can contribute to personalized treatment approaches tailored to individual patients.

Remote Diagnosis and Telemedicine: CNN-based systems can facilitate remote diagnosis and telemedicine initiatives by allowing oral cavity images to be captured and analyzed in real-time, even in settings where access to specialized healthcare professionals is limited.

Research and Development: Continued research and development in CNN-based oral cancer detection systems can lead to the refinement of existing algorithms, the development of novel imaging techniques, and the integration of artificial intelligence with other diagnostic modalities for more comprehensive cancer detection and characterization.

## 9.Conclusion

In this research paper, numerous research papers on oral cancer detection and other topics have been examined, and these papers have then been compared. In this study, we use a convolutional neural network to study how to classify cancer images. In comparison to other machine learning techniques, the Convolution Neural Network method with data augmentation has been shown to be more effective for image processing. The suggested model has ache approaching ever greater validation accuracy than any other current model. In order to classify species, we considered numerous oral cancer problems. The purpose of this project is to construct ant species classification system based on convolution neural network (CNN) with data augmentation.

## 10.Reference

[1] PR Jeyaraj, ER Samuel Nadar - Journal of cancer research and clinical …, 2019 – Springer-deep CNN algorithm for classification of oral cancer filtering into … oral cancer classification using deep learning technique. … technique was discussed in reference by Deepak Kumar et al

[2] K Warin, W Limprasert, S Suebnukarn… - Journal of Oral …, 2021 - Wiley Online Library- This study aims to use the convolutional neural network (CNN… classification and detection model for oral cancer screening. … screening and refer patients with suspected oral cancer to the …

[3] RA Welikala, P Remagnino, JH Lim, CS Chan… - … , ISMCO 2020, San …, 2020 – Springer- to the automated early detection of oral cancer made use of the convolutional neural network (CNN) … Uthoff [4] used a CNN to classify pairs of autofluorescence and white light images as …

[4] R Dharani, S Revathy - Journal of physics: conference series, 2021 - iopscience.iop.org- the title of the work, journal citation and DOI. Published under … were classified using the Convolution Neural Network (CNN) … and CNN performs better in the detection of oral cancer.

[5] BK Joseph - Medical Principles and Practice, 2002 - karger.com- detection of oral cancer. Oral cancer screening can take many forms. Clinical examination and biopsy allow the early detection of premalignant and early oral cancers. Screening can be …

[6] MW Lingen, JR Kalmar, T Karrison, PM Speight - Oral oncology, 2008 – Elsevier-screening examinations in oral cancer and evaluate the literature regarding currently available diagnostic tests or techniques that are purported to aid in the detection and diagnosis of …

[7] R Sankaranarayanan, K Ramadas… - Cancer: disease …, 2015 - ncbi.nlm.nih.gov-Oral cancer mortality rates are influenced by oral cancer … the benefits of early detection of oral cancers among users of … whose early detection may improve oral health. Discouraging

[8] O Palmer, R Grannum - Dental Clinics, 2011 - dental.theclinics.com-detection modalities on the market; some are more efficacious than others. A common-sense approach should be brought to the early detection of oral cancer… the detection of oral cancer

[9] R Mehrotra, DK Gupta - Head & neck oncology, 2011 – Springer-Detection of Dysplasia and Oral Cancer There are two approaches in the early detection of oral dysplasia and cancer: 1) oral cancer … oral cancers in asymptomatic patients with an oral

[10] YSL Cheng, T Rees, J Wright - Clinical and translational medicine, 2014 – Springer- human cancers. More than 90% of oral cancers are oral squamous cell carcinoma (OSCC) and the standard method for detection is through a comprehensive clinical examination by