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Detection of Cavity from the analysis of Dental Images using Machine Learning

18EC74 : UG Internship Presentation

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Department of Electronics and Communication Engineering

Outline of the Presentation

- Profile of the organization & department
- Activities of the organization
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Certificate of Completion of Internship

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CoC/ISE/Internship/001/22-23

RV COLLEGE OF ENGINEERING®

(Autonomous Institution affiliated to VTU, Belagavi)

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Internship Certificate

This is to certify that ***Mr./Ms. Pragya Sen,*** *1RV19EC126, VII Semester B.E. Electronics and communication Engineering of RV College of Engineering, Bengaluru has satisfactorily completed Internship on* ***'Visual Computing - Detection of Cavity from Dental Image Analysis using Machine Learning',*** *during September-October 2022 (6 weeks).*

Mr. Sudhanva B.	Dr. Anala M.R.	Dr. K.N.Subramanya
Director, Bhargawa Info Tech Solutions (P) Ltd.	Coordinator, COC-Visual Computing	Principal, RVCE

Profile of the Organization

- Internship is carried out under Centre of Competence in Visual Computing in collaboration with Bhargawa Info Tech Solutions Pvt Ltd (BITS).
- It is classified as Non Govt Company and is registered at Registrar of Companies, Bangalore.
- It conducts R & D on Smart home and automation devices. BITS has following units:
    - Products
    - Services
- It offers many products of Home appliances automation devices, industrial appliances such as wireless water controller, smart home systems.
- It offers services such as maintenance of websites and creation of multimedia presentation of other firms.

Activities of the organization

- **Appliance Control:** Automation of lights, fans, switches, TV, AC, Geyser etc.
- **Security Devices:** Door & gate locks, CCTV, access control, breach notifications etc.
- **Scene Control:** Set of automated actions for scenarios like sunset, vacation, dinner time etc.
- **Voice and app assistant:** Integration with voice assistants like Alexa, Google Home, Siri.

Profile of the Department

- Centre Of Competence - Visual Computing
- The Centre of Competence located in department of Information Science and engineering, RVCE provides computing facilities, offers Training and execute consultancy services
- It facilitates skill enhancement programs in various domains like Computer Vision, Mobile app development, Machine learning and Deep learning with Python frameworks etc.
- The facility in CoE enables the execution of computationally intensive projects and research works in the area of Virtual Reality and Augmented Reality, Edge Computing, Parallel Programming, Artificial Intelligence and Machine Learning and many more.

Tasks performed during internship

- Understanding the concepts of Python-libraries, Machine Learning and various algorithms and Image processing
- Developed a model for Detection of Cavities from the analysis of Dental Images using Machine Learning
- Performing Data augmentation to increase the size of the dental image dataset

INTRODUCTION

Dental and Oral diseases are very common and half of the world population suffers from it. Due to poverty or unhygienic practices, these diseases are common. This project is focused on detecting cavities using dental images.

Recent developments in Machine Learning and Artificial Intelligence have helped a lot in medical science.Artificial Intelligence (AI) is employed extensively in dentistry to identify both normal and abnormal structures and diagnose diseases from the numerous medical images collected during a clinical routine.

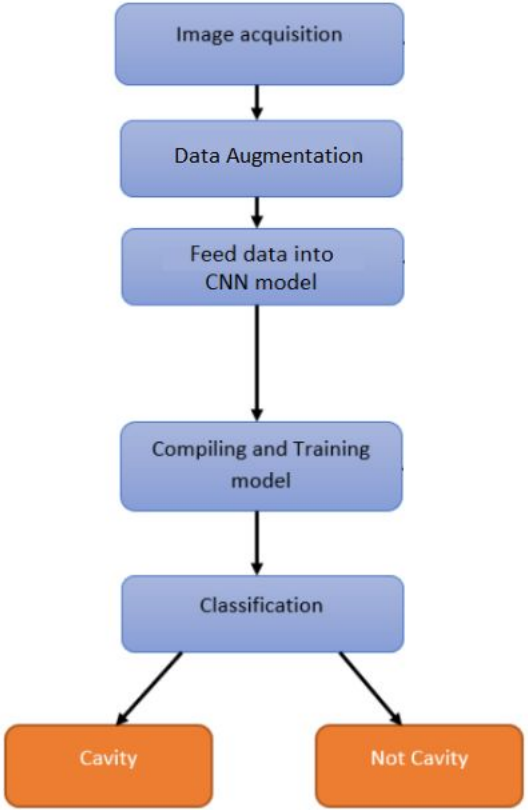
INTRODUCTION

Thanks to these algorithms, diagnosis and treatment of diseases can be done efficiently.This project used dental images and applied deep **Convolutional Neural Network (CNN)** to detect cavities.

OBJECTIVES

- To detect dental cavities from dental images by using an Artificial Intelligence (AI) system.
- To find the best suitable Machine Learning algorithm for the same.
- To validate the diagnostic results using Machine Learning.

METHODOLOGY



DATASET DESCRIPTION AND AUGMENTATION

The dataset contains in total 884 images belonging to 2 classes, i.e., cavity and no cavity. They have been split into train and test folders in 8:2 ratio. There are 708 images belonging to class 1 and 176 images belonging to class 2.

Images were in JPG format in the dataset. ImageDataGenerator from keras.preprocessing.image in python was used. 20% of images from the dataset were used for testing along with random horizontal flip. A zoom range of 0.15 and rotation of 20% was used for data augmentation purposes for our model

TOOLS AND TECHNOLOGIES USED

- Jupyter Notebook
- CNN
- TensorFlow
- MobileNet

ABOUT CNN

- A convolutional neural network, or CNN, is a deep learning neural network sketched for processing structured arrays of data such as portrayals.
- CNNs are very satisfactory at picking up on design in the input image, such as lines, gradients, circles, or even eyes and faces. They can be run directly on an underdone image and do not need any preprocessing.
- CNN contains many convolutional layers assembled on top of each other, each one competent of recognizing more sophisticated shapes.

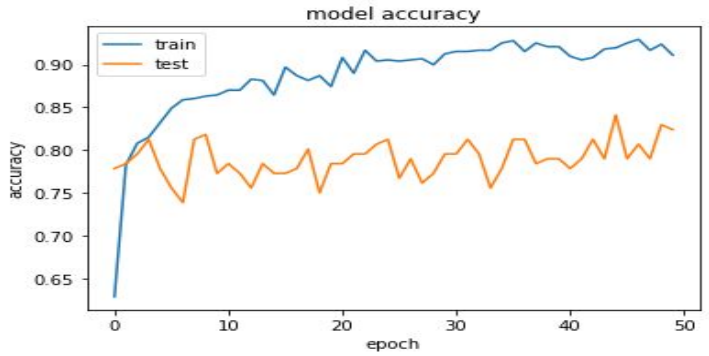
Model Training

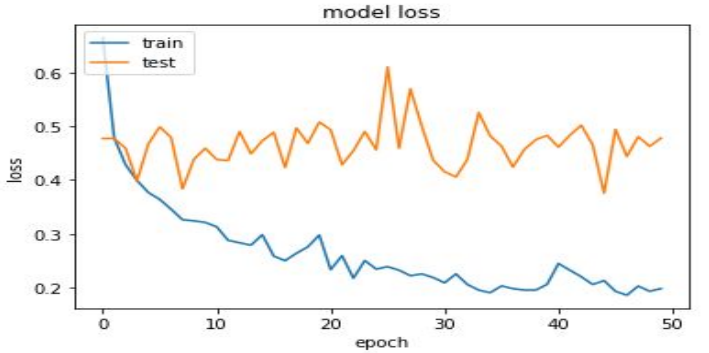
```
model.compile(
  optimizer='adam',
  loss='sparse_categorical_crossentropy',
  metrics=['accuracy'])
```

```
EPOCHS = 50
history = model.fit_generator(train_gen,
                    epochs=EPOCHS,
                    validation_data=test_gen)
```

```
Epoch 45/50
36/36 [==============================] - 31s 872ms/step - loss: 0.2126 - accuracy: 0.9195 - val_loss: 0.3755 - val_accuracy:
0.8409
Epoch 46/50
36/36 [==============================] - 32s 897ms/step - loss: 0.1927 - accuracy: 0.9251 - val_loss: 0.4941 - val_accuracy:
0.7898
Epoch 47/50
36/36 [==============================] - 32s 873ms/step - loss: 0.1855 - accuracy: 0.9294 - val_loss: 0.4441 - val_accuracy:
0.8068
Epoch 48/50
36/36 [==============================] - 32s 891ms/step - loss: 0.2024 - accuracy: 0.9167 - val_loss: 0.4807 - val_accuracy:
0.7898
Epoch 49/50
36/36 [==============================] - 32s 875ms/step - loss: 0.1928 - accuracy: 0.9237 - val_loss: 0.4627 - val_accuracy:
0.8295
Epoch 50/50
36/36 [==============================] - 32s 879ms/step - loss: 0.1978 - accuracy: 0.9110 - val_loss: 0.4782 - val_accuracy:
0.8239
```

RESULT


model accuracy
train
test
accuracy
epoch
0.90
0.85
0.80
0.75
0.70
0.65
0
10
20
30
40
50


model loss
train
test
loss
epoch
0.6
0.5
0.4
0.3
0.2
0
10
20
30
40
50

*

Outcome of the Internship

The following skills were gained during the internship:

- Python Programming and Machine Learning like CNN
- Explored classification based machine learning algorithms such as Naïve Bayes, KNearest Neighbors, Decision Tree, SVM
- Different regression techniques such as Linear Regression, Logistic Regression, Polynomial and Bayesian Regressions are learnt
- Application of engineering knowledge in industries
- Able to comprehend the functioning of the organization and department

Thank You