Emotion and Pain Detection in Virtual Medical Consultations

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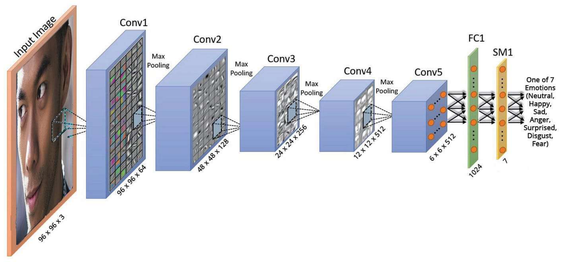
Abstract

This paper aims to test a working emotion detection prototype using Convolutional Neural Networks (CNN) and Cascade classifier. The research aims to identify usage of emotion and pain detection in virtual medical consultations to aid doctors in their diagnosis.



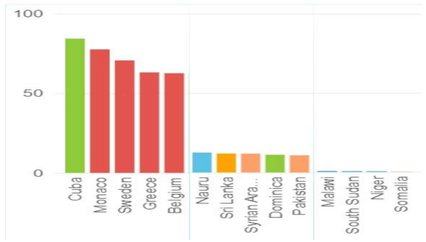
Source:: https://medium.com/analytics-vidhya/building-a-real-time-emotion-detector-towards-machine-with-e-q-c20b17f89220

Research Question

Can facial expressions be analyzed to draw out emotions to aid in better diagnosis in virtual consultation sessions between medical caregivers and patients?

Motivation

- During covid pandemic I wondered if we could do online consultations with doctors and if it would be effective.
- Helps connectivity between a doctor and a patient (primary doctor/doctor the patient is used to)
- Increases the accessibility of doctors
- Increases availability of medical services, especially for patients from rural areas



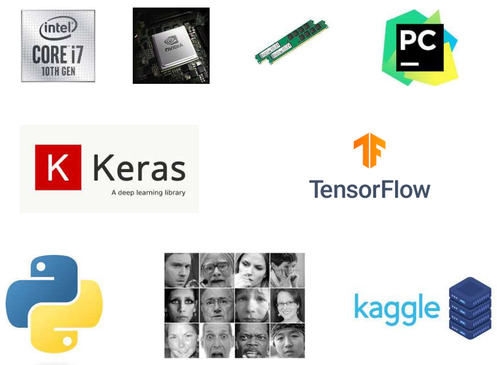
Medical doctors per 10,000 people

Source: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/medical-doctors-(per-10-000-population)

Goals of Project

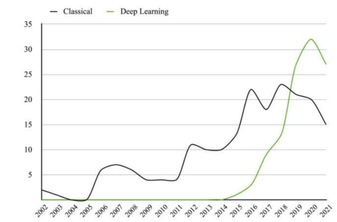
- To see if emotion and pain detection is feasible to aid in the diagnosis of patients in a virtual interaction
- If this helps in diagnosis of diseases, can the quality of medical services in virtual environments improve?
- Scale up virtual diagnosis in medical fields

Materials



Methodology

- Researched a code that would be feasible to use as a prototype for this project
- Identified FER-2013 dataset which includes 35,887 images from 7 different classes
- Prototype uses cv2 library for real time computer vision
- Keras library was used for artificial neural networks
- Tensorflow library for machine learning and artificial intelligence
- Cascade Classifier is used to classify the images into classes



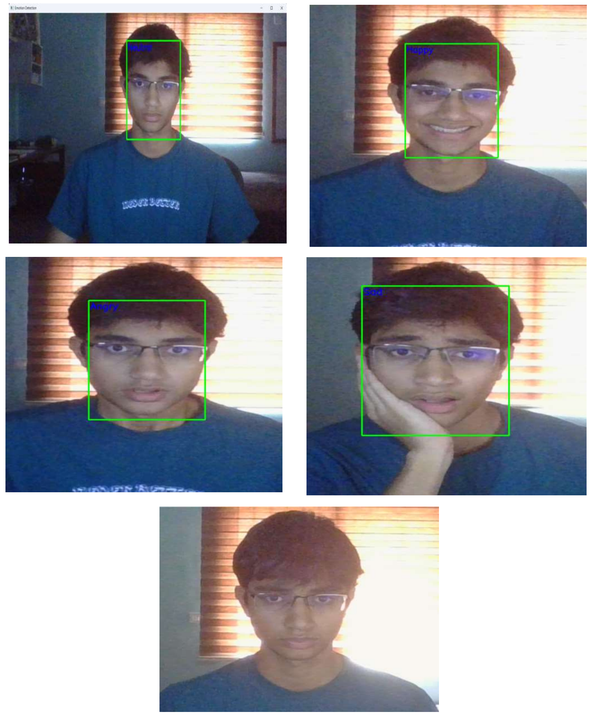
Training the model

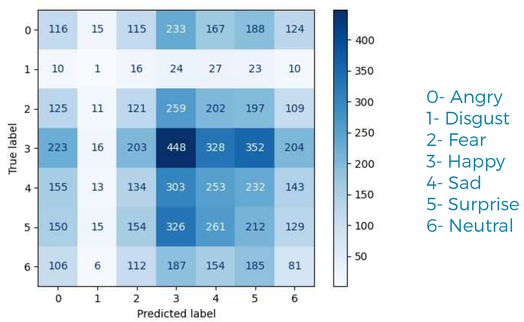
- First the images were rescaled
- All data is preprocessed to grayscale
- Model is trained
- Model structure and weight is saved

Testing the model

- Model Structure and weight is loaded
- Webcam feed is started
- Cascade classifier is trained to draw a box around the identified face(s)
- Face is preprocessed
- Emotions are predicted and displayed in the top left corner

Results





0- Angry
1- Disgust
2- Fear
3- Happy
4- Sad
5- Surprise
6- Neutral

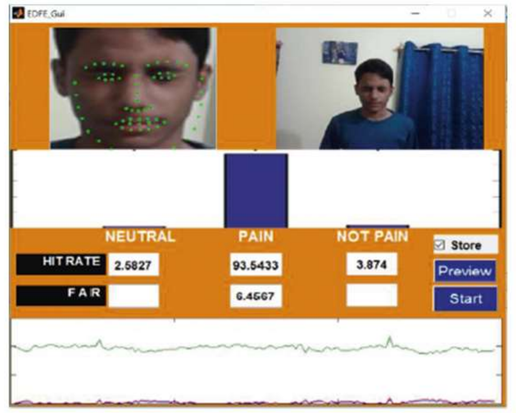
	precision	recall	f1-score	support
0	0.13	0.12	0.13	958
1	0.01	0.01	0.01	111
2	0.14	0.12	0.13	1024
3	0.25	0.25	0.25	1774
4	0.18	0.21	0.19	1233
5	0.15	0.17	0.16	1247
6	0.10	0.10	0.10	831
accuracy			0.17	7178
macro avg	0.14	0.14	0.14	7178
weighted avg	0.17	0.17	0.17	7178

Conclusion

- The prototype simulates detection of emotion in patients
- The model accuracy is only 17%
- More research needs to be done and the prototype needs to be improved on
- Creating a model for pain detection is more difficult due to lack of widely accepted pain scale. Ex. One person may express more pain whereas another may not express as much pain on their face.
- Further testing needs to be done on the constraints of the model
- Ex. Usage of sunglasses, light factors, long hair, jewelry on face, etc.

Scope for future work

- Create synthetic data for pain detection
- Add more images to the dataset for better accuracies
- Explore additional methods of emotion and pain detection to see if it can be implemented
- Find pain images and data from various demographics and ethnicities
- Test the current model on pain data



Source:: https://www.hindawi.com/journals/jhe/2018/7961427/

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