Predicting the Attention Rate of Patients by Monitoring their Emotions

Deployment Recommendations Report

Version 1.0

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AREYA

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Contents

Deployment Framework

Areya is a machine learning model trained and evaluated on a custom made Convolutional Neural Network algorithm solely on JupyterLab environment. Its primary goal is to recognize the emotions expressed by many patients in a general clinic and/or in a hospital after they have undergone a critical operation such as primary some type of surgery. Since, the period after the patient has been operated on is highly crucial in order to infer if the operation was performed single handedly successful or if some parts require more attention, this model will act as a prime medium between the patients and their respected doctors by illustrating the emotions felt by a patient directly to the practitioner.

Moreover, the model's ability to classify emotions is limited to the four prime emotions which are Angry, Happy, Relaxed and Sad. This is essentially done to enable quick decision making as to assist the patient, solely meaning if the emotions expressed by a patient are positive i.e., Happy and Relaxed, there wouldn't be any action performed rather the model would put more focus onto the patient in case of any drastic change while on the other hand, if negative emotions i.e., Angry and Sad are expressed, a type of notification can be seen on the real life camera displaying "This patient needs immediate care" message. Currently, our Areya is able to successfully perform and deliver the message by using the default camera of the user but when considering deployment and creating a social impact, further ideas can be taken into considerations when forming our notification panel.

Data Storage and retrieval

Training data Storage

Both of the training and test data are stored as images on my local computer and for future and more secure use of the data, the data has been stored on google cloud as well. By storing the data on cloud, the benefits the user can get is to be able to build a ML system in cloud too.

Data Size

The dataset consists of two folders for training and testing consisting 4 folders each containing images of jpg format of our 4 emotions Angry, Happy, Relaxed and Sad. The training folder contains 26,216 images making up to 39.1 MB and 102 MB on disk. The testing folder consists of 5,212 images oh 7.79MB in total with 20.3MB size on disk.

Retrieve the data for training

Since the data is stored in the Google Cloud Service bucket, it can be easily retrieved and used to build new models and/or make alternations on the Google Cloud Platform.

Retrieve data for prediction

The original idea for saving the emotions and the images of the patients, in a database through which necessary or responsible engineers can check performance. A request can be made by using an internal API, which when given permission, the access can be formed.

Frameworks and tooling

Visioned Impact

The vision impact of my model area is to primarily enhance the contact, relationship, and understanding of a doctor with its patient after undergoing surgery. Since this is a critical time frame where in coming to a conclusion about the health condition of patient is necessary and if there is a medium provided to the doctors to regulate and monitor the emotions illustrated by various patients in an organization, a doctor would be at ease and would be able to assess and provide better health care to all of the patients and make them feel at home. The main areas I believe this model can impact is as follows:

1. Through employing the model in a software or an application with giving real life changes felt by email felt by patience patient to the doctor, the doctor wouldn't have to physically go and assess every patient. For assessing and taking care all the patients need the nurses what have a higher role in doing so. Through the use of this platform the doctors shall be able to assess and provide enhanced care to the ones would deeply require immediate response and care.

2. Secondly since this model holds the power to save the data or in our case images if for instance the model, he doesn't comply with the emotion the developer can go collect feedback and fix the issue. That provides stability and security and quick decision making and improving the experience of its end users.

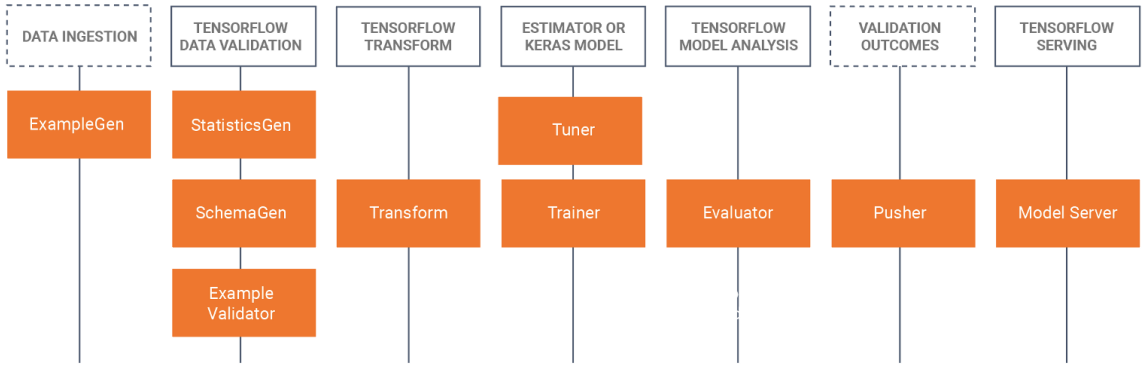
3. Thirdly considering the current situation with many people being affected every second this is a vital need in tackling and saving lives of the ones who need it the most.

4. Fourthly it will be providing high security which would not allow usage of the data for illegal or for unfair means. In order to get the data for any purpose mainly research or education, the organizations head can contact the necessary people involved and discuss the case which shall result in providing the data or not.

Tool for the task at hand

Since our model is fully made on JupyterLab with Python as our programming language, moreover with using libraries Tensorflow and Keras for model building and tuning for our dataset of images, the use of Tensorflow Extended (TFX) which is an open-source tool released and used internally at Google, for building pipelines.

This is due to the reason, that the TFX has vital frameworks, libraries, and components for defining, launching, and monitoring the performance of many machine learning models while deployment and production. It additionally provides flexibility in working with our dataset from cloud, since our dataset is also available on cloud service. Below is the brief visualization, illustrated what libraries we can use for validation, serving, and transforming.



Choices of tools

The tools used are Python programming language mainly with libraries Tensorflow and Keras for model's architecture entirely on JupyterLab environment which open-source tools. This offers high efficiency since the programming language is highly compatible and offers a lot of support with many other environments and uses the system's CPU power and time.

Additionally, since our dataset is saved on my local computer, that can be requested through contact but while on Google Cloud Platform, which is a paid and managed cloud service. The reason for choosing GCP was mainly to gain an experience in working with GCP which was offered by my university and considering the positive traits it offers such as efficient back and quick recovery, quick setup and deployment and being cost-efficient. Using GCP would provide great stability in performance, storage, and security.

Platforms/targets supporting the tool

Areya is essentially saved with all it's weights and epochs values in an h5 format file offered by Keras library. This makes Areya run efficiently and can be used by anyone who has access to Python learning environment.

Feedback and iteration

Getting feedback from Areya is our main priority mostly because, it explains us how users i.e., doctors and specialists are being benefitted from this model. The approach for gaining valuable feedback from our end users will be to use Tensorflow Model Analysis which is a platform provided by Tensorflow library for model evaluation in TFX. TensorFlow Model Analysis allows you to perform model evaluations in the TFX pipeline and view resultant metrics and plots in a Jupyter notebook. Specifically, it can provide:

1. Metrics computed on entire training and holdout dataset, as well as next-day evaluations
2. Tracking metrics over time
3. Model quality performance on different feature slices
4. Model validation for ensuring that model's maintain consistent performance

Ensuring Continuous Delivery

For ensuring continuous delivery, if future versions of Areya are to be implemented with high enriching and fulfilling features, the author would stay in contact with the several hospitals and clinics, who are active users of this model. In additional, by having fruitful communications with our client, the release of our model can again be available through cloud system and/or locally serving it.

Key aspects of this deployment

The key motive behind deployment Areya into hospitals and clinics is with the mission to serve and enhance the relationship between patients and doctors. By better understanding of the real-life emotions felt by patients at different stages, would help doctors produce essential results to tackle and provide a better reliable and safe solution to make the patients feel more at home.

Conclusion

In conclusion, the goal of creating this Areya.Inc is to improve the situation of the busy healthcare professionals in understanding the emotions of their patients after a surgery has been performed so as to offer them homelike care. This would eventually be made by keeping in mind all of the aspects of ethical, human values, privacy concerns and the direction the Areya.Inc can take in the coming years. The technology ensures to guarantee the safety and integrity of its users while complying with the laws and regulations on data protection. By continuous feedback and deployment of Areya, the model can be accessed to the hospitals and clinics who aim at using Artificial Intelligence in improving their business model and perform data driven solutions.