

About the software

This software is meant for communication with the deaf and dumb people. It reads and classifies sign language using a CNN.

Humans know each other by conveying their ideas, thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one among the rest is the gift of "Speech". Through speech everyone can very convincingly transfer their thoughts and understand each other. It will be injustice if we ignore those who are deprived of this invaluable gift; the deaf and dumb people. The only means of communication available to the deaf and dumb people is the use of "Sign Language". Using sign language, they are limited to their own world. This limitation prevents them from interacting with the outer world to share their feelings, creative ideas and Potentials. Very few people who are not themselves deaf and dumb ever learn to Sign language. These limitation increases the isolation of deaf and dumb people from the common society. Technology is one way to remove this hindrance and benefit these people.

The communication between a dumb and hearing person poses to be an important disadvantage compared to communication between blind and ancient visual people. This creates an extremely little house for them with communication being associate degree elementary aspect of human life. The blind people can speak freely by implies that of ancient language whereas the dumb have their own manual-visual language referred to as sign language. Sign language is also a non-verbal form of intercourse that's found among deaf communities at intervals the planet. The sign languages haven't got a typical origin and hence hard to interpret. A Dumb communication interpreter is also a tool that interprets the hand gestures to sensibility speech. A gesture in associate degree extremely language is also a certain movement of the hands with a particular kind created out of them. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have corresponding sign in that sign language. In this device Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. This digital glove aims to lower this barrier in communication. It is electronic device that can translate Sign language into speech in order to make the communication take place between the mute communities with the general public possible. A hand gesture recognition system is also used to recognize real time gesture in unconstrained environments. The system consists of three modules: real time hand tracking, training gesture and gesture recognition using pseudo two-dimension hidden Markov models. In this they have used a Kalman filter and hand blobs analysis for hand tracking to obtain motion descriptors and hand region.

Sign language recognition (SLR) is an evolving research area in computer vision. The challenges in SLR are video trimming, sign extraction, sign video background modelling, sign feature representation and sign classification. All the problems are attempted in the past have met considerable amount of success and are instrumental in development of the state of the algorithms for SLR. Gesture recognition uses powerful imaging and artificial intelligence-based algorithms for classification. Current trends show an urge to bring gesture recognition into mobile environments. Sign language is visual mode of communication between two hearing impaired or hard hearing people. The communication foundations are based on finger shapes, hand shapes, hand movements in space with respect to body, hand orientations and facial expressions. The humans are trained exclusively to hand such huge amounts of information for years. For machine translation, the problem transforms into a 2D natural language processing problem. Many 1D/2D/3D models are proposed in literature with little success to bring the model close to real time implementation.

Sign language recognition (SLR) has transformed with technology upgradation from 1D, 2D to 3D models in the last 2 decades. In 1D, SLR is based on 1D signals acquired from a hand gloves and classified using signal processing methods. However, 1D methods are not up to the mark in terms of accuracy, and require hardware, complex circuitry, processor, etc. Also, the hand images are inherently 2 dimensional or 3 dimensional in nature. If we reduce it to one dimensional electrical signal, using some flex sensor, there will be a huge loss in data. With the development of modern methods like ML, DL, AI, ANN, CNN, etc. we can deal with higher dimensional image data directly through software like Python.

System Requirements

Operating System: Windows

Python Software Distribution: Anaconda 3, Version 2020.11

Software Packages: NumPy*, Pandas, Matplotlib, Seaborn, TensorFlow, Keras, OpenCV, PIL, SMTPLIB*, Collections*

Editors: Spyder 4.1.5, Jupyter Notebook

Google Account with SMTP access enabled.

Additional Hardware: Webcam**

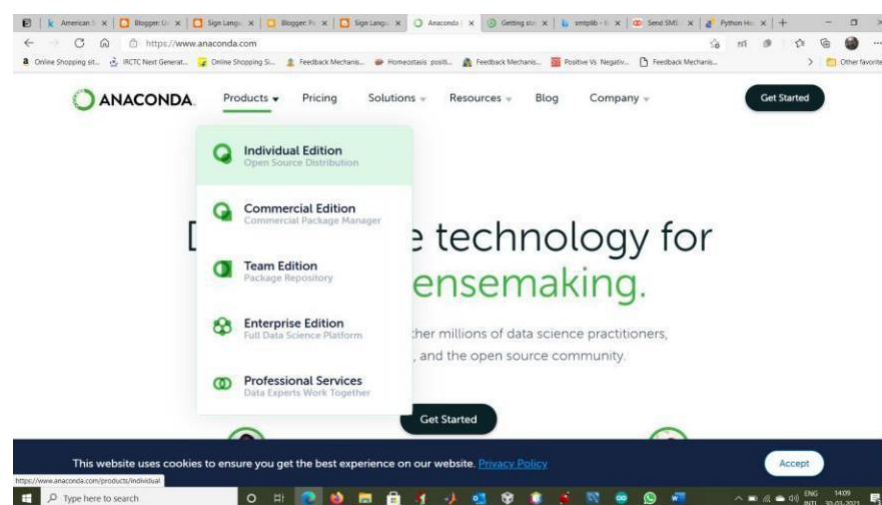
*These packages come in-built. They don't need to be installed. Those without this mark need to be installed.

**This is not required for laptops as they have an in-built webcam. For desktop computers, webcam is required.

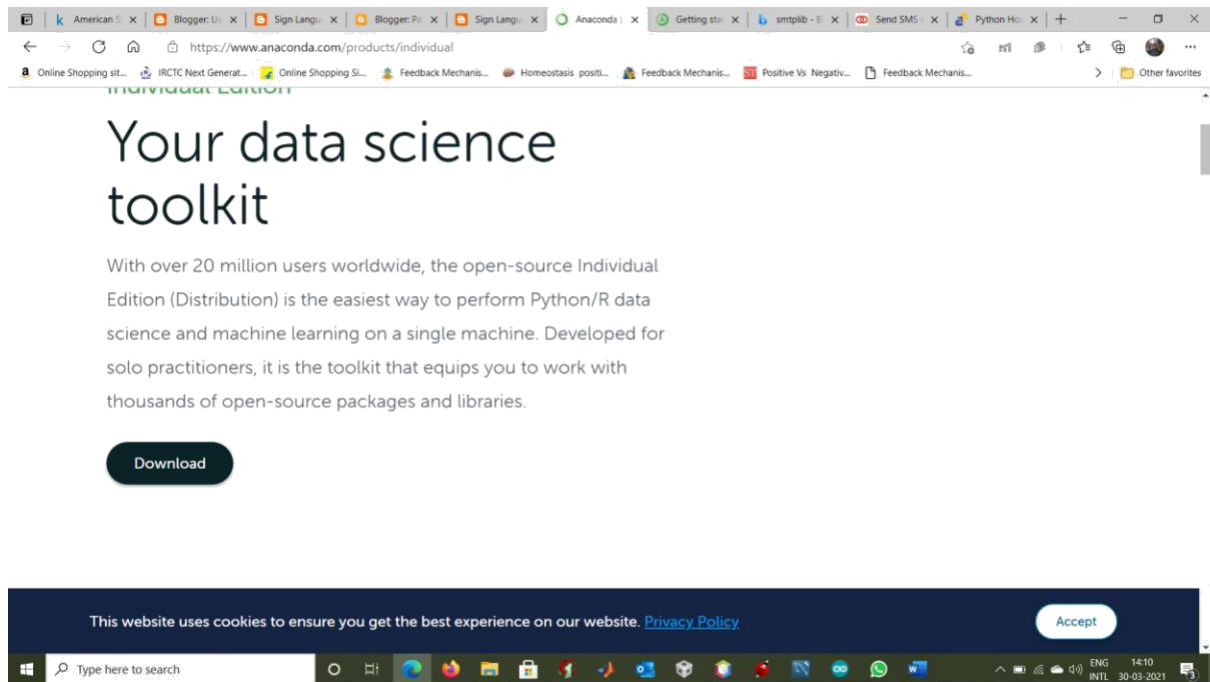
Environment Setup

Setting up Anaconda

Log on to <https://www.anaconda.com/>



Hover over to Products and click on Individual Edition.

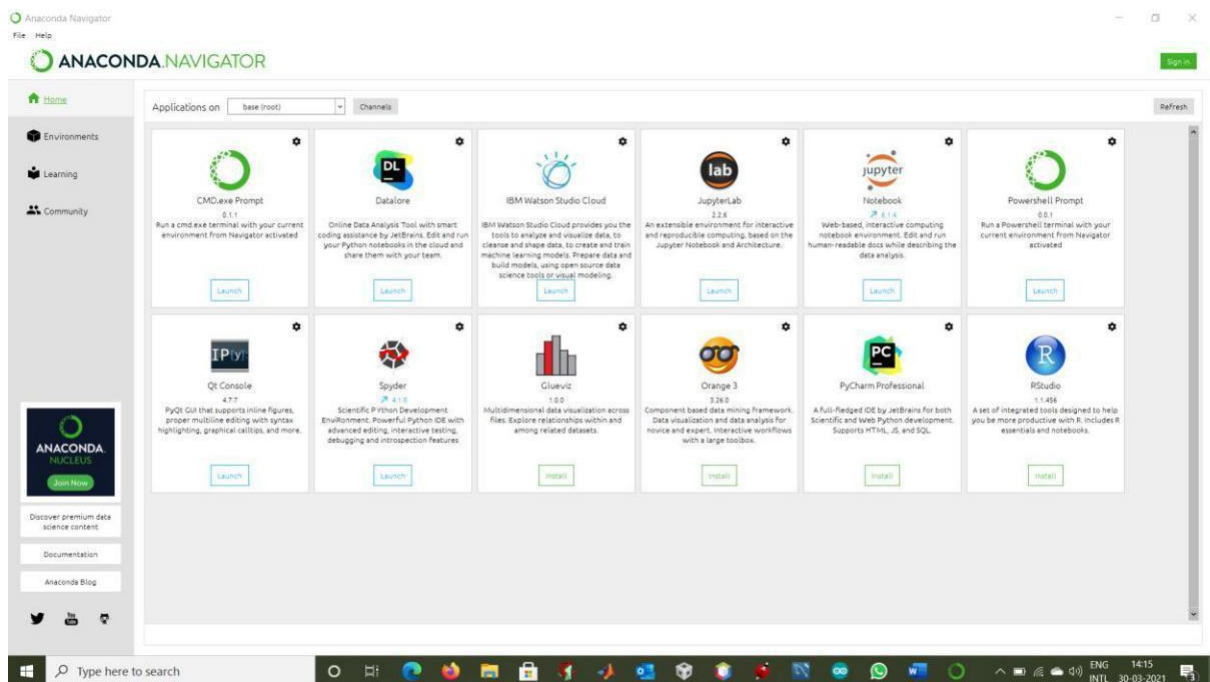


Click on download.

Once the download finishes, run the executable file and go through the installation steps. Note that the Anaconda software **must be stored in a directory whose path has no spaces**.

While going through the installation, there will come an option asking whether to use this software **JUST FOR ME (RECOMMENDED)** or **FOR MULTIPLE USERS**. Click on **Just For Me (recommended)**.

Once the installation is complete, you can access the Anaconda Navigator.

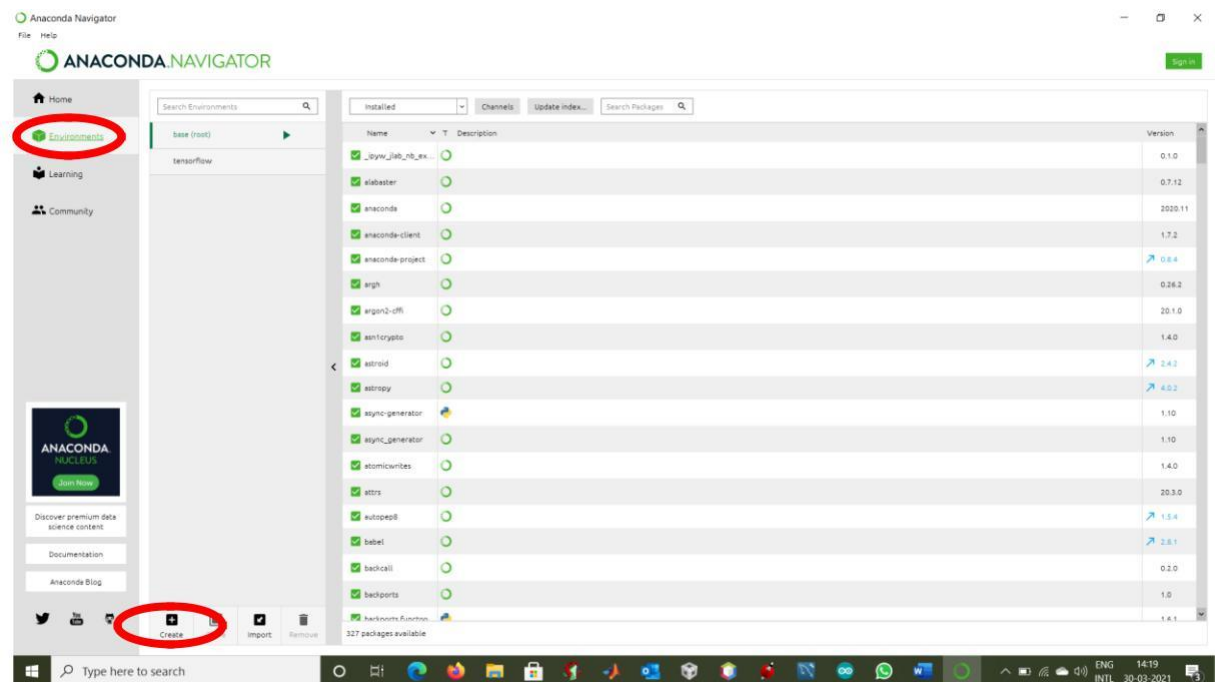


Setting up the TensorFlow Environment

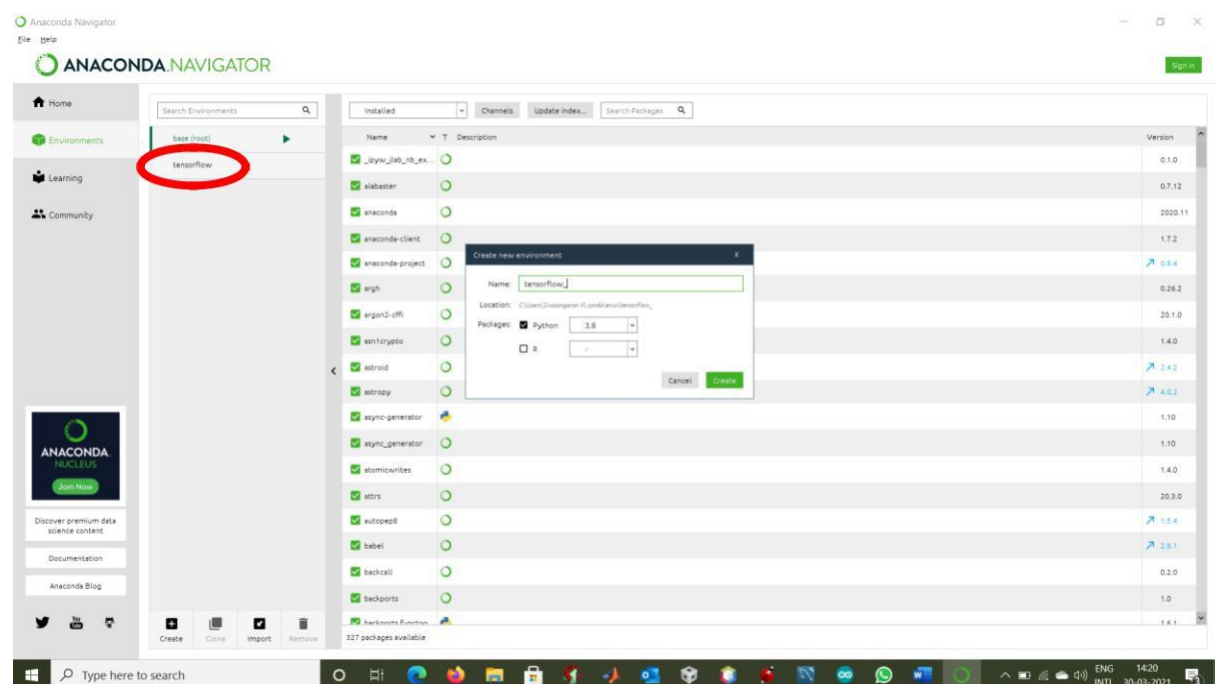
In Anaconda, an environment is a space where we can install libraries and program, which can be accessed only in that environment. By default, on installing Anaconda, everything comes in the BASE

environment. But we can create new environments for writing different programs. If we create an environment named ENV, and install Pandas in ENV environment, then programs done in ENV environment cannot be run in the BASE environment, and vice versa, if the BASE environment does not have Pandas.

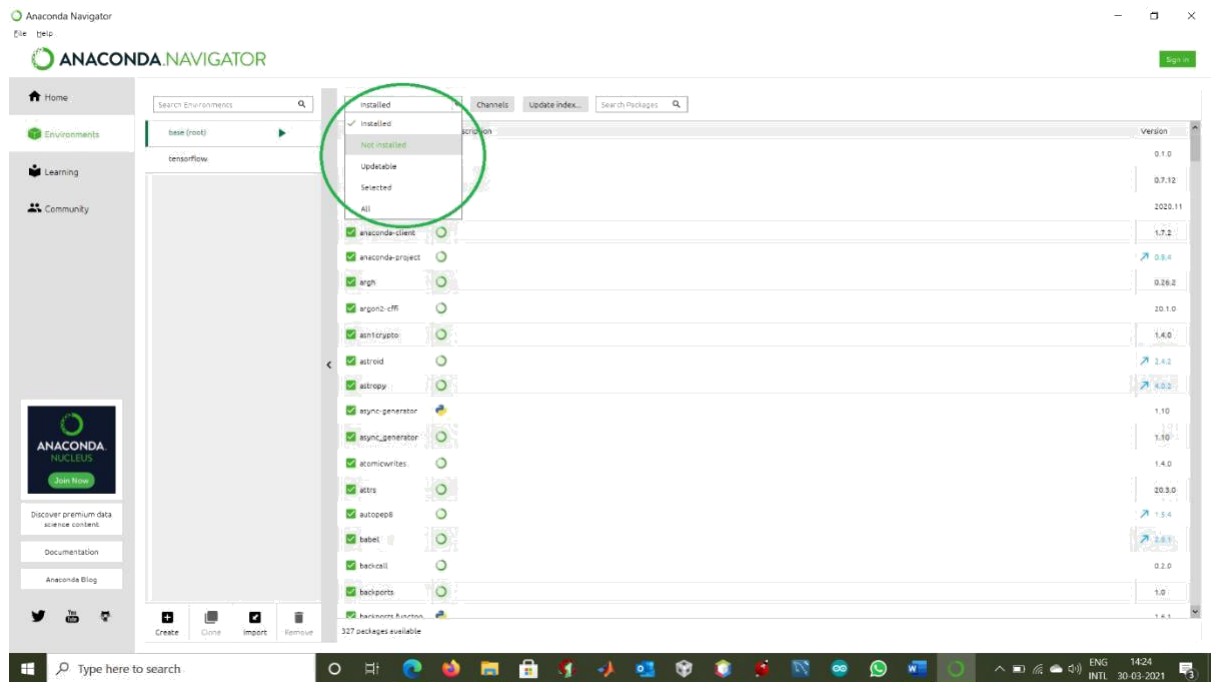
TensorFlow is a special software which cannot run in Anaconda (base) environment. It needs an environment of its own. To create a new environment, click on environments.



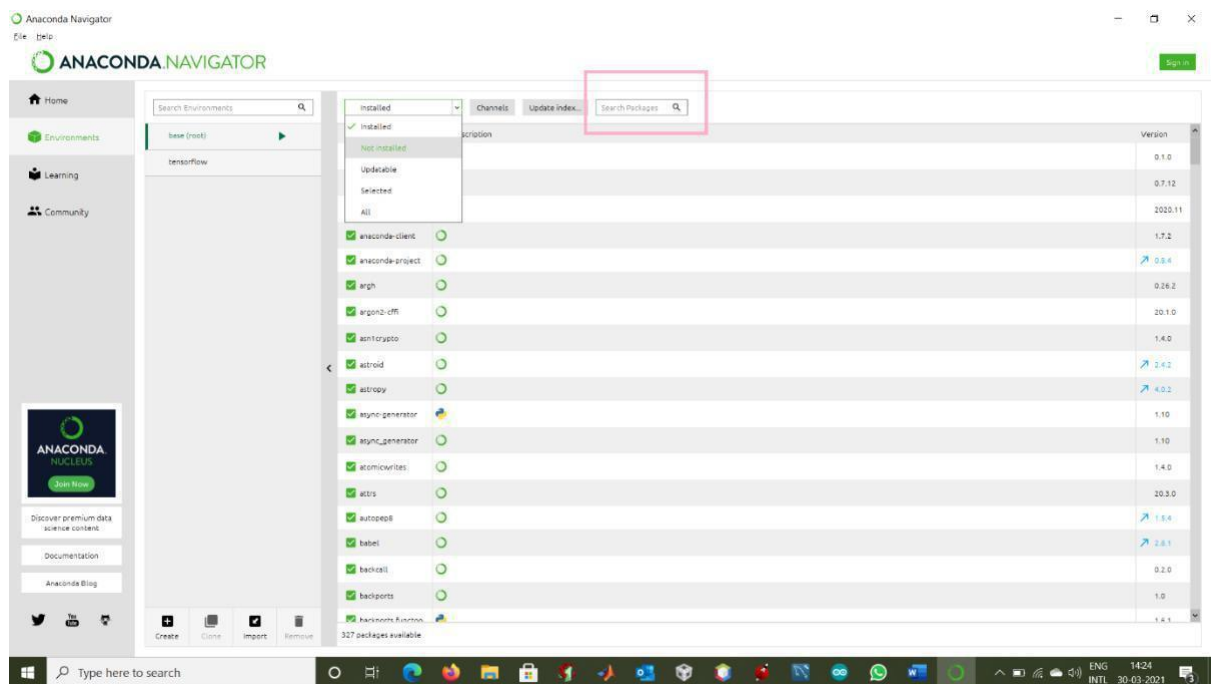
Click on the create button, type tensorflow (in lowercase), and click on create.



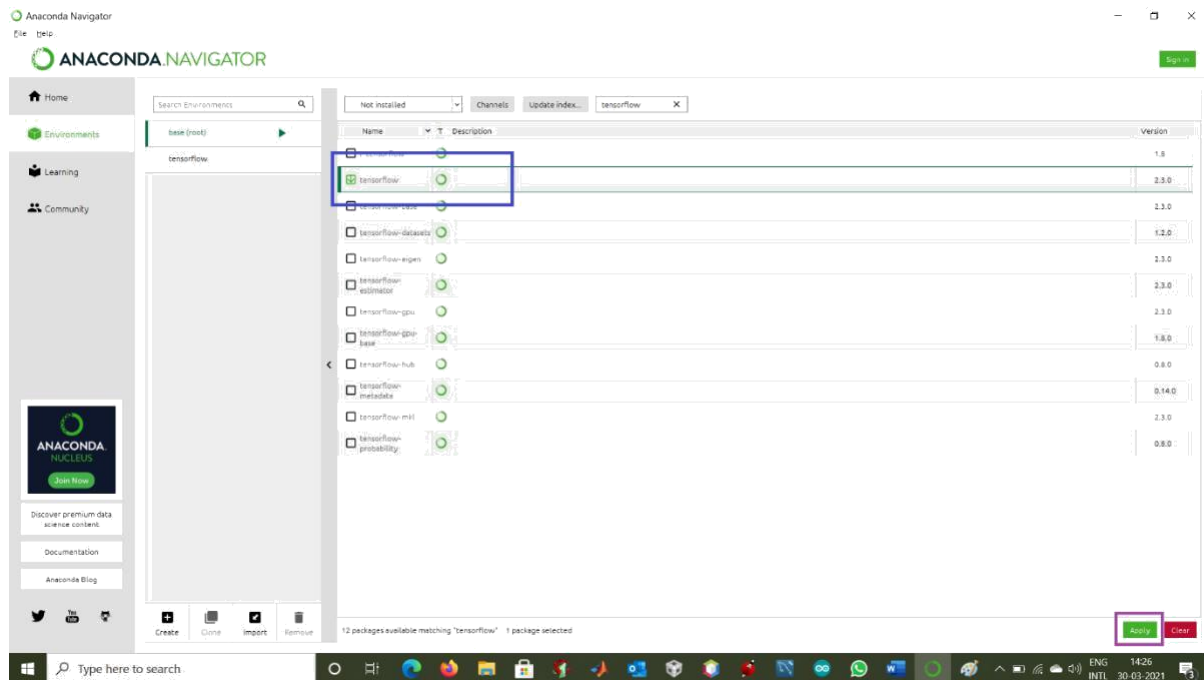
Click on tensorflow.



Go to the drop-down menu and select Not Installed.



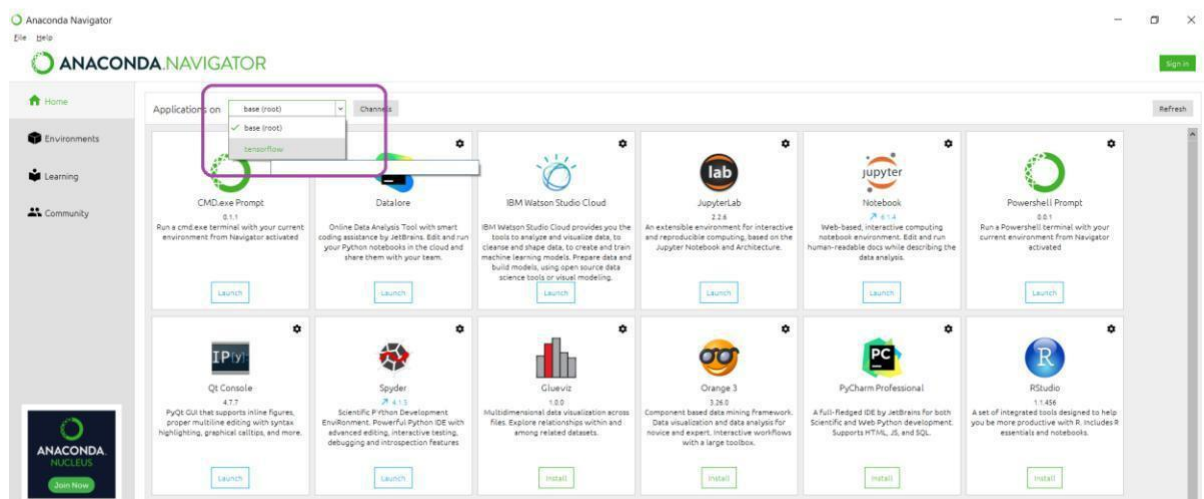
In the Search Packages text box, type tensorflow



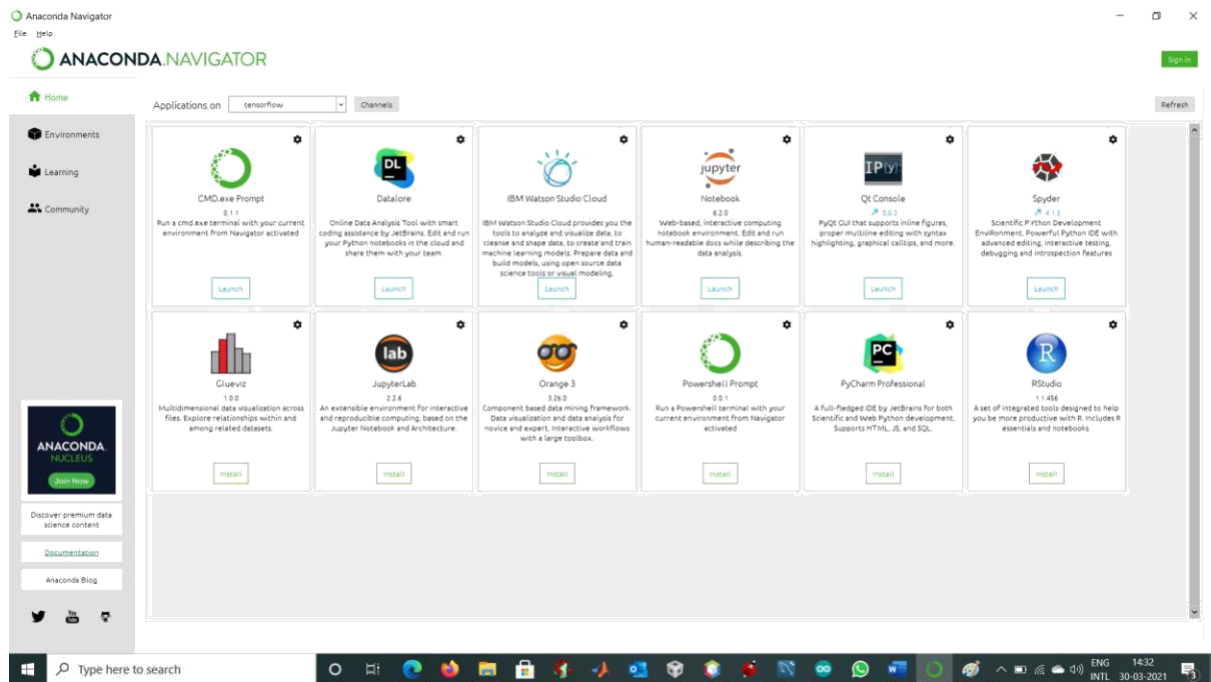
Click on the checkbox near tensorflow, and click Apply. Follow the on-screen instructions for installing TensorFlow. Do the same for Keras, OpenCV and Pillow (* If it is not there in the Not installed section, it might have already been installed). Now the TensorFlow environment has been set up.

Setting up Spyder and Jupyter Notebook

For coding, Spyder and Jupyter Notebook are necessary.



Choose TensorFlow in this dropdown.

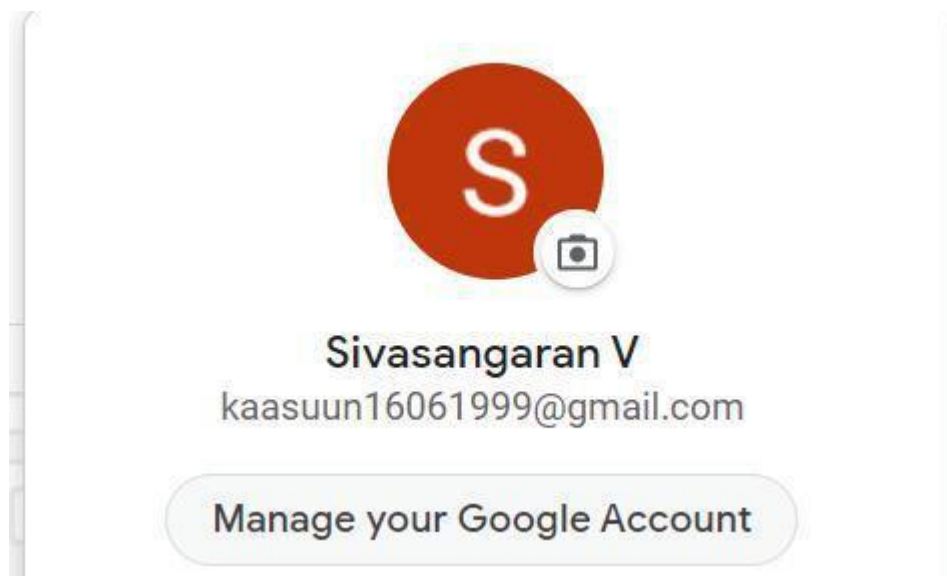


Click on Install near Spyder. This will install Spyder. Do the same for Jupyter Notebook. This step is required only if you will modify or update the software. Otherwise setting up of Spyder and Jupyter Notebook may be skipped.

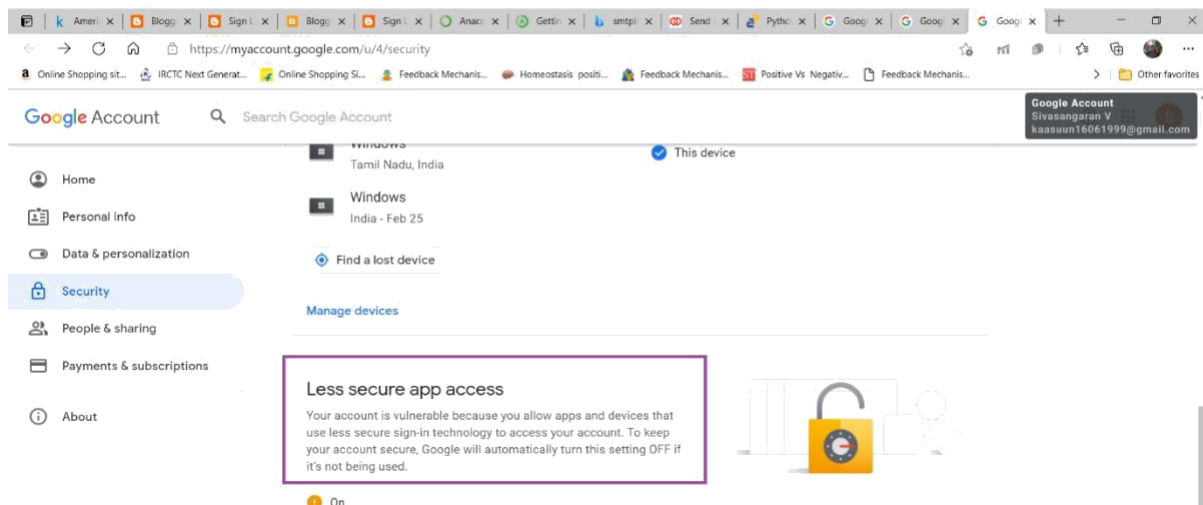
Setting up your Google Account

In order to send mails via Python Scripts, we need to reduce the security of the Gmail account. SMTP is a less secure protocol, which is, by default, denied by Google. By changing this setting, your Google account may be exposed to security threats by other third party software. Hence it is advisable to create a new Google account for using this software alone, and having SMTP enabled, and keeping the newly created Google account confidential for other purposes.

Create a new Google account and login to it. Click on Manage your Google Account.



Scroll down till you reach this point.



Click on this and give the necessary permissions.

Setting up Environment Variables

In order to run the software properly, some of the system environment variables need to be set.

<https://www.computerhope.com/issues/ch000549.htm>

Refer this link for setting up environment variables.

Create a new folder called conda_tmp (precisely that name) in your C drive.

Reset the locations of the TEMP and TMP variables to C:/conda_tmp

Create an environment variable ANACONDA_PATH (precisely that name) to C:\Users\Anaconda3\Scripts, assuming that your anaconda system is installed in C:\Users\Anaconda3.

Uninstalling Anaconda Distribution

<https://docs.anaconda.com/anaconda/install/uninstall/>

Follow this link for anaconda uninstallation. You might want to uninstall the existing Anaconda and reinstall Anaconda to avoid some errors. After uninstalling, remove all the patches manually by typing anaconda in the search bar and removing all Anaconda related software.

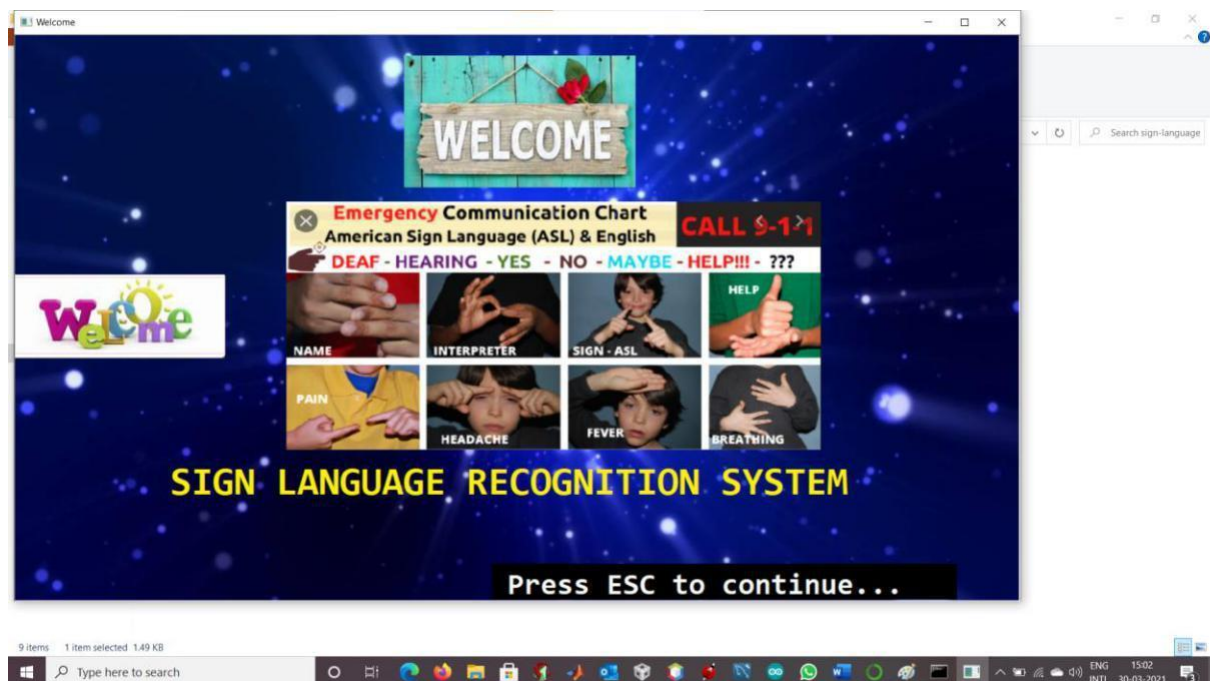
Software Installation

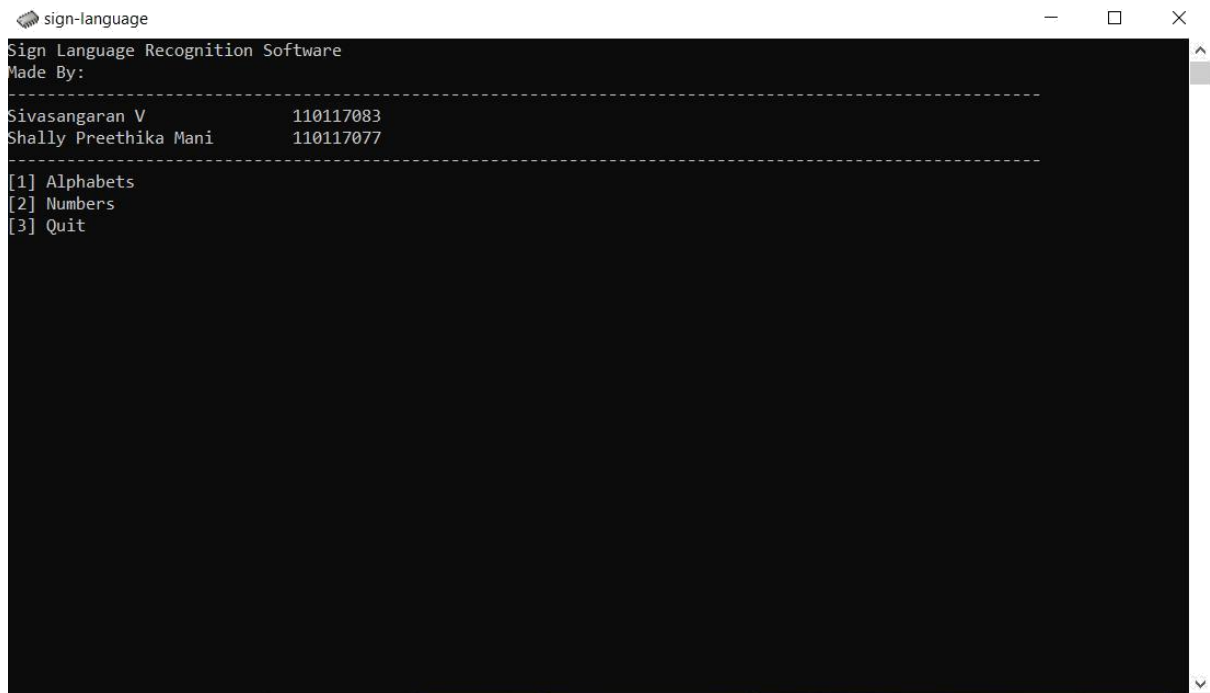
Unzip the zip file downloaded. Or run the exe file and follow the on screen steps. Note that the software is ABSOLUTELY SAFE TO USE. There will be exe files too inside, which can be run IF ANTIVIRUS IS DISABLED. OTHERWISE, THE EXE FILE WILL BE CONSIDERED AS VIRUS. The bat and exe versions do the SAME JOB.

Using the software

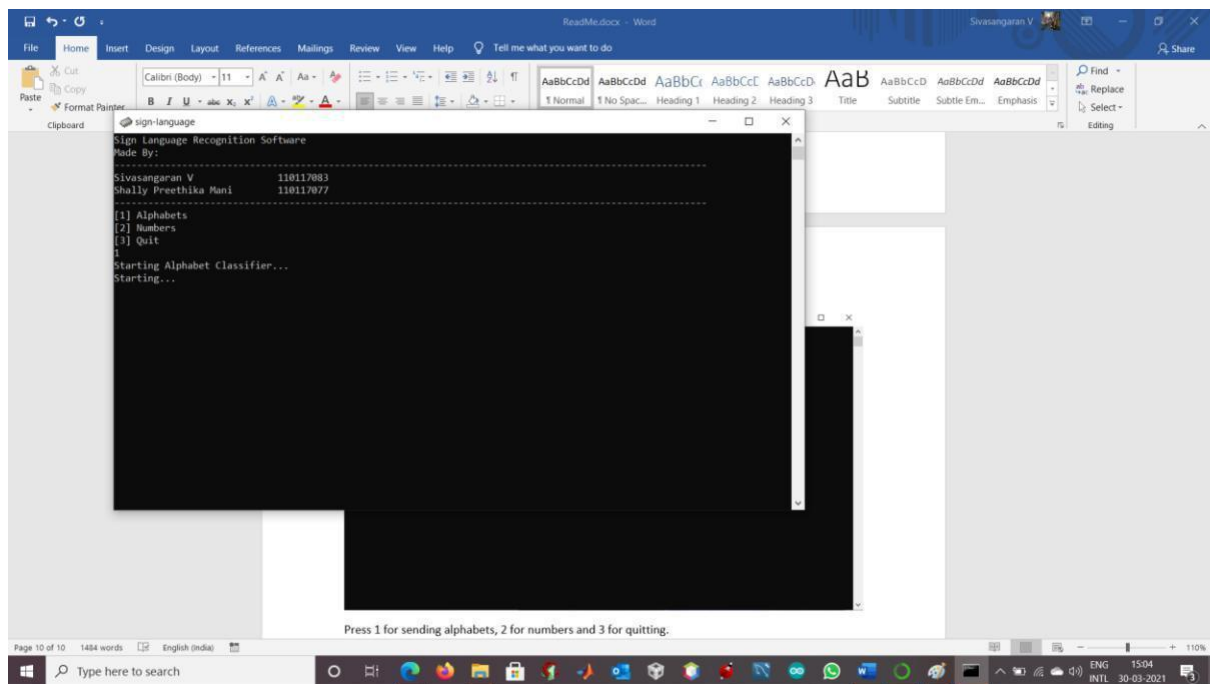
dataset	10-04-2021 11:26	File folder	
glance	10-04-2021 11:26	File folder	
icons	10-04-2021 11:26	File folder	
models	10-04-2021 11:26	File folder	
scripts	10-04-2021 11:26	File folder	
source	10-04-2021 11:26	File folder	
temp	10-04-2021 11:34	File folder	
ReadMe.docx	10-04-2021 12:09	Microsoft Word D...	846 KB
ReadMe.pdf	10-04-2021 11:08	Adobe Acrobat D...	2,217 KB
sign-language.bat	04-04-2021 15:53	Windows Batch File	1 KB

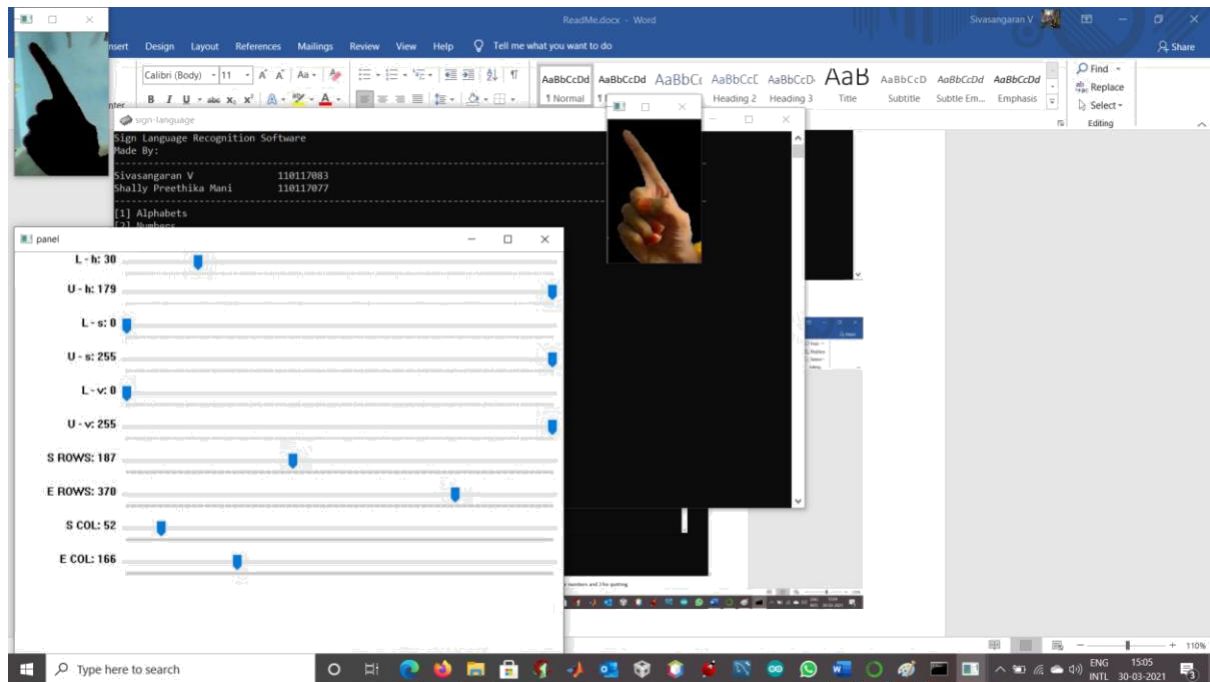
Double click on sign-language.bat. Follow the on screen instructions, and when the panel comes, tune it to just hold the finger and keep the entire background black. Tune the filter and reduce the image size using the panel.





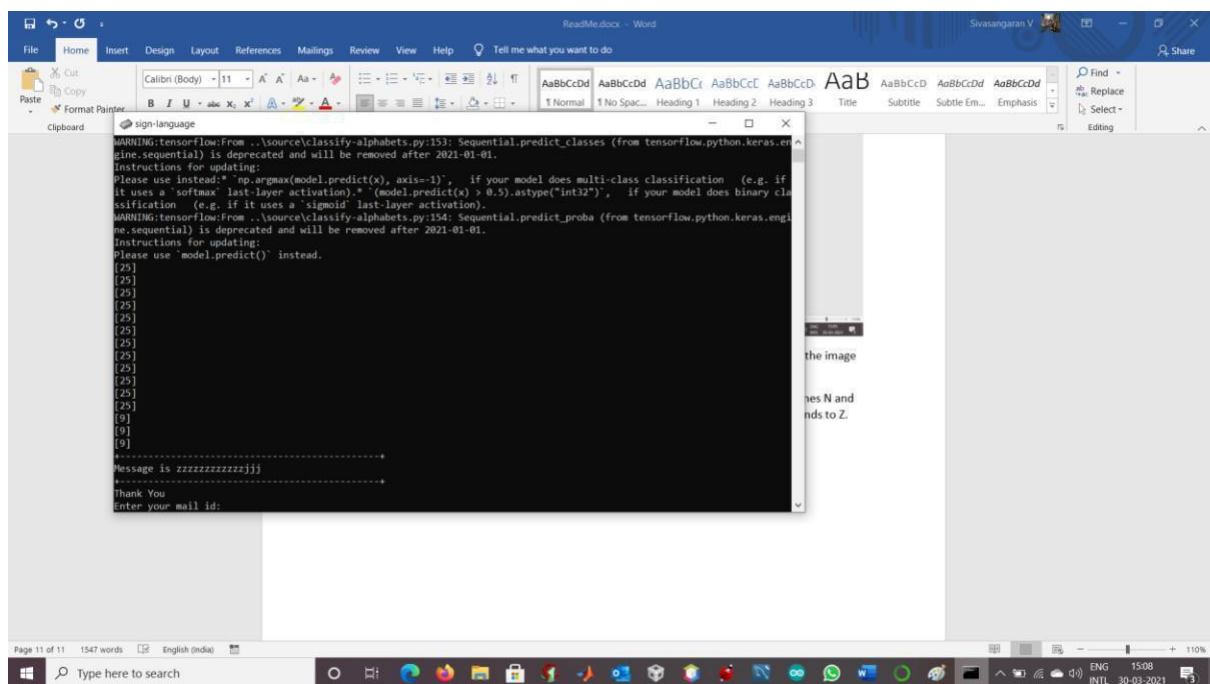
Press 1 for sending alphabets, 2 for numbers and 3 for quitting.





Press N on the keyboard to capture an image. As many times N is pressed, so many times the image will be captured.

Press ESC on the keyboard to capture the current image and stop capturing. If I press 5 times N and then ESC, the output must be "zzzzzz" (or 6 times z). It is because the sign above corresponds to Z.



Now enter your email id (the one which you created just now, with SMTP enabled), password, and the email-id whom you want to send. Follow the screen instructions to come back to the main menu.

Press 3 when you are done.

Further Improvements Possible

This software can be improved to include gestures for simple sentences like hello, sorry, thank you, etc. For this a new program should be written to create a dataset, and a new CNN formed to classify these gestures.

Uninstalling the software

Delete the sign-language folder. Or, run the uninstall file and then delete the sign language folder.