

Supplementary information

AVMIB is an easy-to-use, standalone, portable software written using MATLAB appdesigner tool and packaged with MATLAB Runtime. Therefore, it can also execute on machines that do not have MATLAB installed. This document will guide users through the process of setting up and running AVMIB on Linux, Windows 10 and Mac OS. Download AVMIB_App_Installer folder from the following link which contains the installers for all the three OS.

<https://drive.google.com/drive/folders/1EsOeKxI8AV__MG25w8gKD9tFnd8TkODc?usp=sharing>

The link contains the following 3 folders: *Linux_for_redistribution*, *MAC_for_redistribution*, *Win10_for_redistribution* as shown in Fig. 1

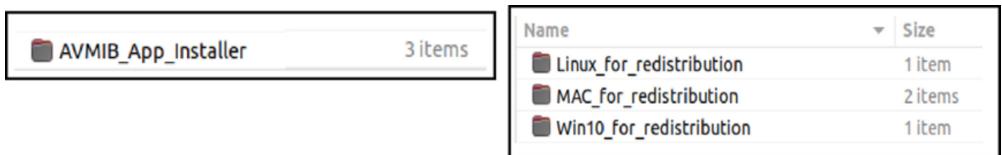


Fig. 1 AVMIB software installer folders

1. Guidelines for MAC:

1.1 How to install AVMIB desktop application

Open the *MAC_for_redistribution* folder which contains *MyAppInstaller_mcr.app* file, double click on the application file to launch the installer and choose paths to the AVMIB application and MATLAB Runtime as shown in Fig 2 and Fig. 3



Fig. 2 AVMIB software shared folder structure

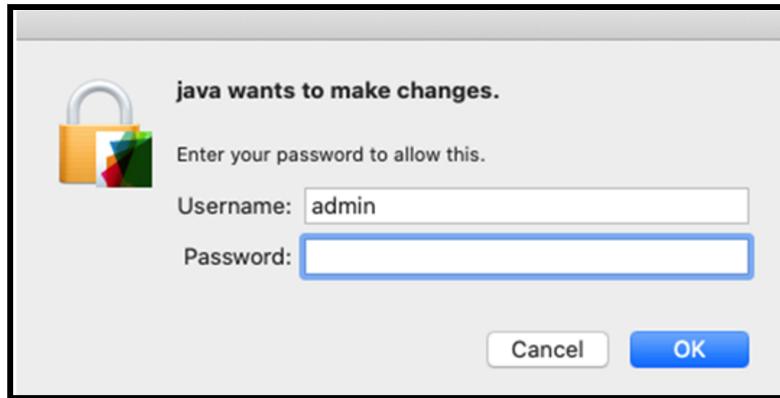
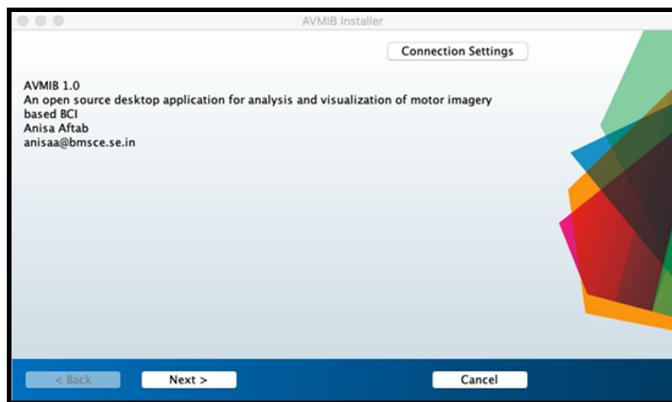
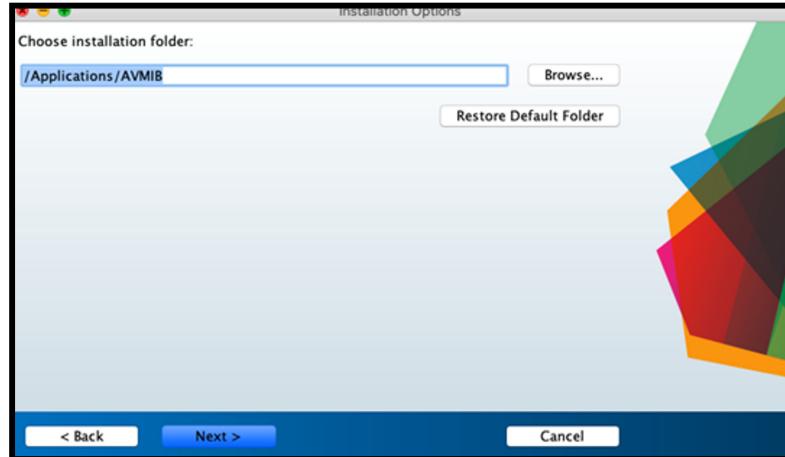
1.2 How to run AVMIB desktop application:

Step 1: After the installation, launch the app as demonstrated in Fig. 4.

Step 2: The first interface display will appear (Fig. 5). From this page user can navigate to different GUI pages and explore the functionalities as explained in sec 1.3.

1.3 Testing AVMIB desktop application:

The folder *Video_Tutorials\Testing_AVMIB/Desktop_App* contains all the videos that provide a demo on various AVMIB desktop app features presented in *Code availability* section. The features it includes are:

a**b****c**

- Plot EEG
- Subjectwise accuracy

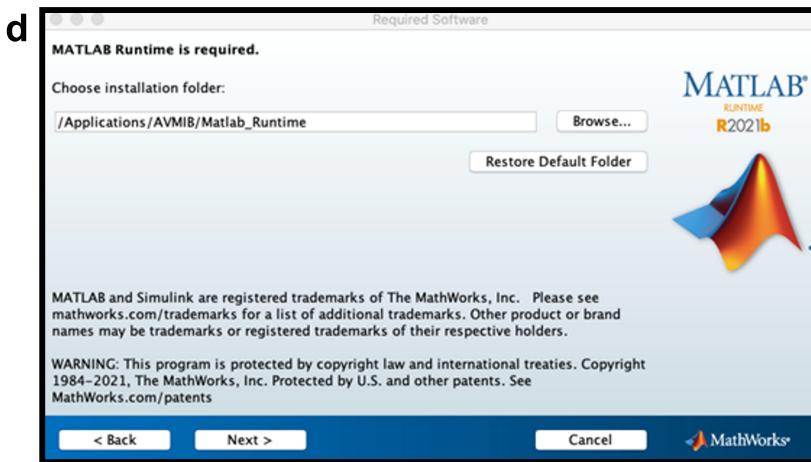
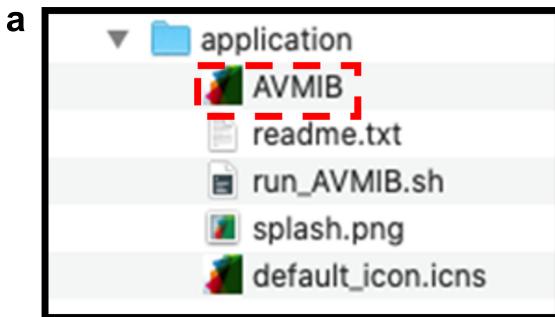


Fig. 3 Installing the application-(a) The admin need to allow installer to launch, (b) After admin allows, this installer page opens up, click on Next >to begin the installation (c) Choose installation folder for the application (d) Choose installation folder for the MATLAB Runtime



- Performance metrics
- Topoplot

1.3.1 Plot EEG

Displays the raw and filtered EEG plot of each of the subjects from each data-set before and after filtering upon selecting data-set and subject from drop-down menu as shown in Fig. 6. There are three BCI competition data-sets available for the demo. Each data-set contains a specific number of subjects. See the video tutorial for more details.

1.3.2 Subjectwise accuracy

Displays classification accuracy of the classifier and CSP matrix learning time of all the subjects in each data-set for each of the CSP and RCSP algorithms upon selecting data-set and algorithm from drop-down menu in the form of a table and bar graph as shown in Fig 7. See the video tutorial for more details.

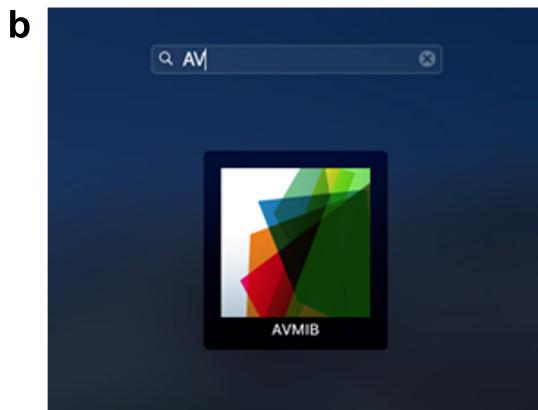


Fig. 4 Launching the application- Either from -(a) installation folder by double clicking AVMIB.app file (enclosed in the red dashed rectangle). Or from (b) launchpad by typing the installer name and then clicking on the installer

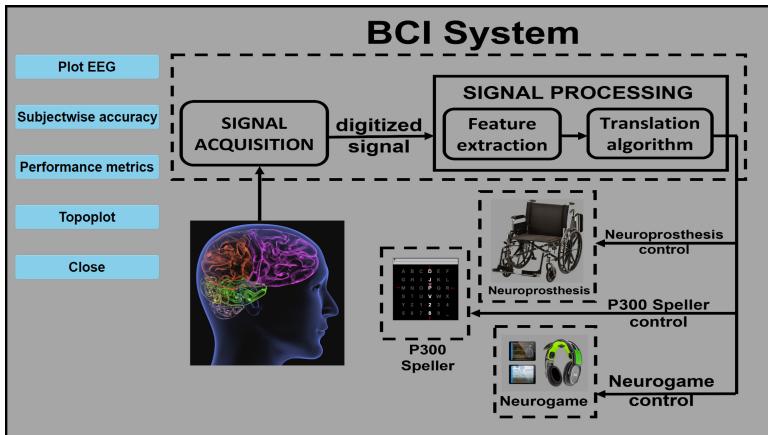


Fig. 5 The launch screen of the app

1.3.3 Performance metrics

Displays the performance metrics such as, Sensitivity, Specificity, Precision, Recall, Confusion matrix and AUC-ROC curve for each subject from each data-set for each of the CSP and RCSP algorithms upon selecting data-set, algorithm and subject from drop-down menu as shown in Fig 8. See the video tutorial for more details.

1.3.4 Topoplot

Displays the topographical map of each subject from each data-set for each of the CSP and RCSP algorithms corresponding to the movement imagination upon selecting data-set, algorithm, subject and filterpair from drop-down menu as shown in Fig 9. See the video tutorial for more details.

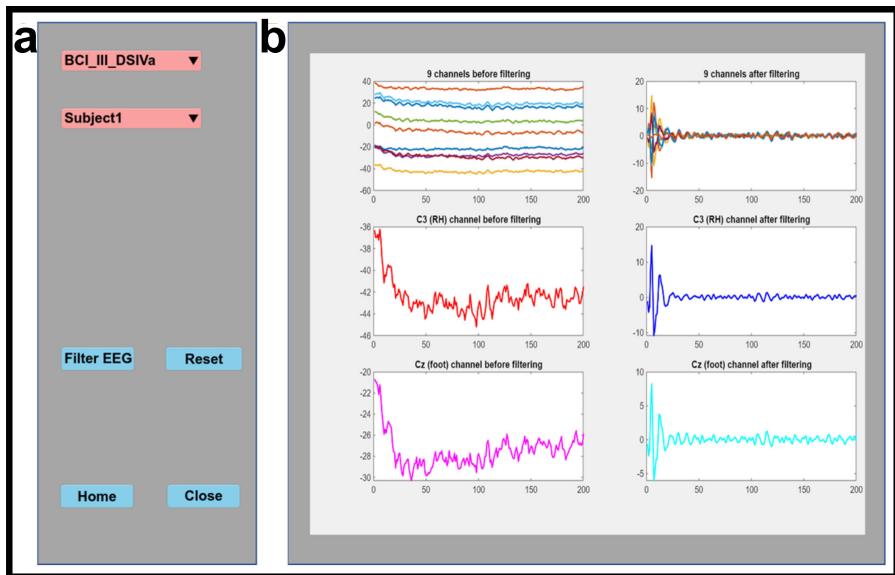


Fig. 6 Graphical interface of Plot EEG GUI page -**(a)** Drop-down menu and button panel for the selection of data-set and subject. **(b)** Raw and filtered EEG signal of Subject1 from BCI_III_DSIVa data-set

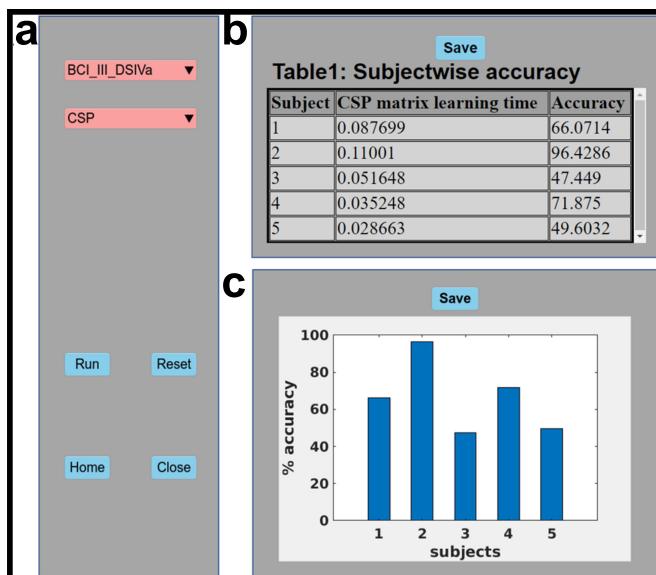


Fig. 7 Graphical interface of Subjectwise accuracy GUI page -**(a)** Drop-down menu and button panel for the selection of data-set and algorithm shown by dotted line. **(b)** & **(c)** The performance accuracy of the classifier and CSP matrix learning time of each subject from data-set BCI_III_DSIVa for CSP algorithm

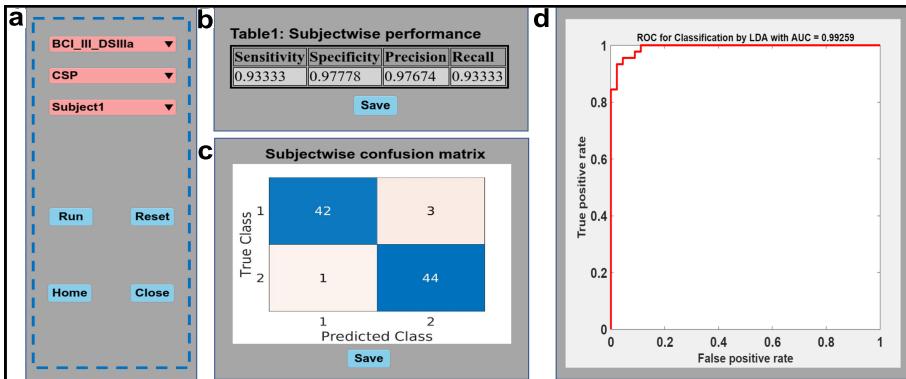


Fig. 8 Graphical interface of Performance metrics GUI page - (a) Drop-down menu and button panel for the selection of data-set, algorithm and subject shown by dotted line. (b) Performance metrics (Sensitivity, Specificity, Precision and Recall) of Subject1 of data-set BCI_III_DSIIa for CSP algorithm in tabular form. (c) The confusion matrix of Subject1 of data-set BCI_III_DSIIa for CSP algorithm. (d) The AUC-ROC curve for Subject1 of data-set BCI_III_DSIIa for CSP algorithm

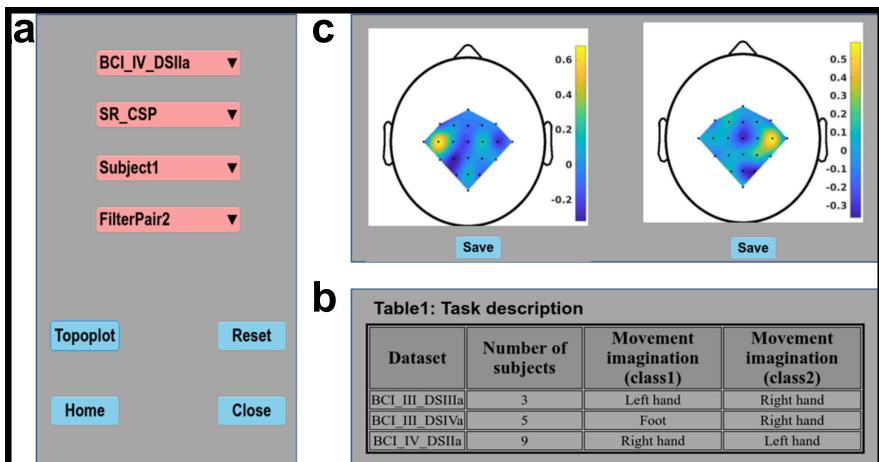


Fig. 9 Graphical interface of Topoplot GUI page - (a) Drop-down menu and button panel for the selection of data-set, algorithm, subject and filter pair shown by dotted line. (b) The task description table for all the three BCI competition data-sets under consideration. (c) The topographical map of Subject1 from data-set BCI_IV_DSIIa for SR_CSP algorithm and FilterPair2

2. Guidelines for Linux desktop:

2.1 How to install AVMIB desktop application

Step1: Open the *Linux_for_redistribution* folder which contains *MyAppInstaller.mcr.install* file. Open terminal in this location and type the following command as shown in Fig. 10. `chmod +x MyAppInstaller.mcr.install`

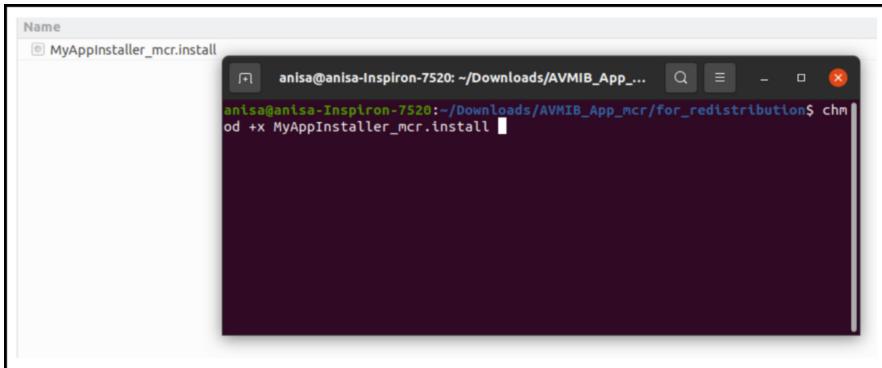
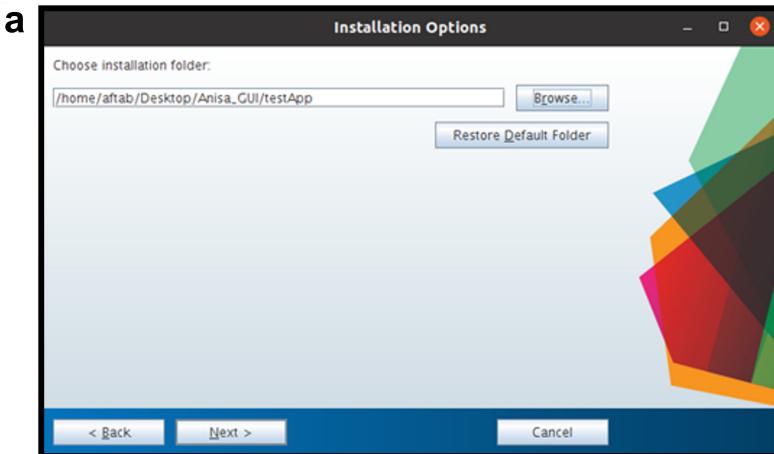


Fig. 10 The AVMIB installer shared folder

Step2: Next enter the following command in the same terminal: *./MyAppInstaller_mcr.install*

It will ask for the AVMIB package and MATLAB Runtime installation folder (Fig 11). Here the AVMIB package installation is done in a separate folder named *testApp* and the MATLAB Runtime is installed in a separate folder *MATLAB_Runtime*, inside *testApp*. After this step installation will be completed. Close the terminal.

AVMIB package (Fig 12(a)) and MATLAB Runtime path (Fig 12(b)).



2.2 How to run AVMIB desktop application:

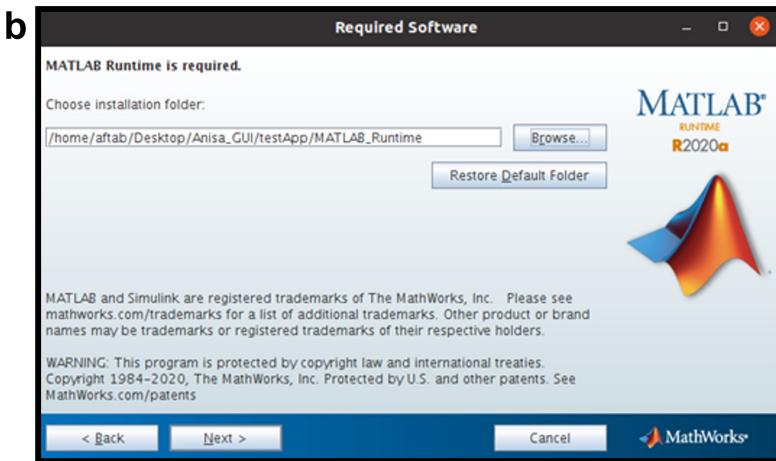


Fig. 11 Installing the application-(a) Choose installation folder for the application (b) Choose installation folder for the MATLAB Runtime

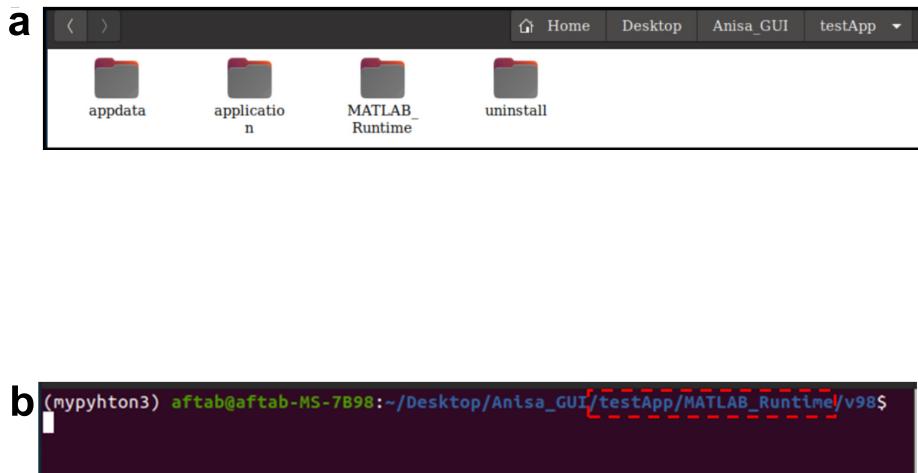


Fig. 12 (a) AVMIB package installation folder and (b) MATLAB Runtime path

Step1: After the installation, in the current folder (i.e. *testApp*), *application* folder will be generated in which the following files will be present as shown in Fig. 13 by dotted box.

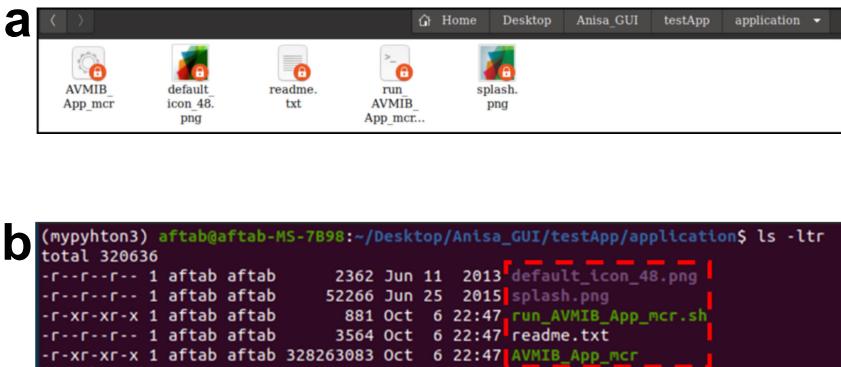


Fig. 13 (a) & (b) Content of the application folder as shown by dotted box.

Step2: To run the AVMIB desktop application open terminal in this location, enter the following command in the terminal as shown in Fig 14 by dotted box.

./run_AVMIB_App_mcr.sh <MATLAB Runtime folder path/v98>

Here MATLAB Runtime path is (Fig 15)

testApp/MATLAB_Runtime



Fig. 14 Command for running AVMIB

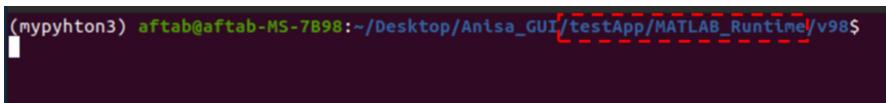
Step3: The first interface display will appear. From this page user can navigate to different GUI pages and explore the functionalities as shown in Fig 5.

2.3 Testing AVMIB desktop application:

The steps for testing AVMIB desktop application for Linux are identical as explained in section 1.3

3. Guidelines for Windows 10:

3.1 How to install AVMIB desktop application



```
(mypyhton3) aftab@aftab-MS-7B98:~/Desktop/Anisa_GUI/testApp/MATLAB_Runtime/v98$
```

Fig. 15 MATLAB Runtime path

Open the *Win10_for_redistribution* folder which contains *MyAppInstaller_mcr-001* folder. This folder contains *MyAppInstaller_mcr.exe* file along with other items, double click on the application file to launch the installer and choose paths to install the AVMIB application and MATLAB Runtime as shown in Fig 16(a) and Fig 16(b).

Here a separate folder named *win10_app_test* has been created in desktop as the application installation folder and inside this folder another folder named MATLAB_Runtime has been created to install the MATLAB Runtime as shown in Fig. 17.

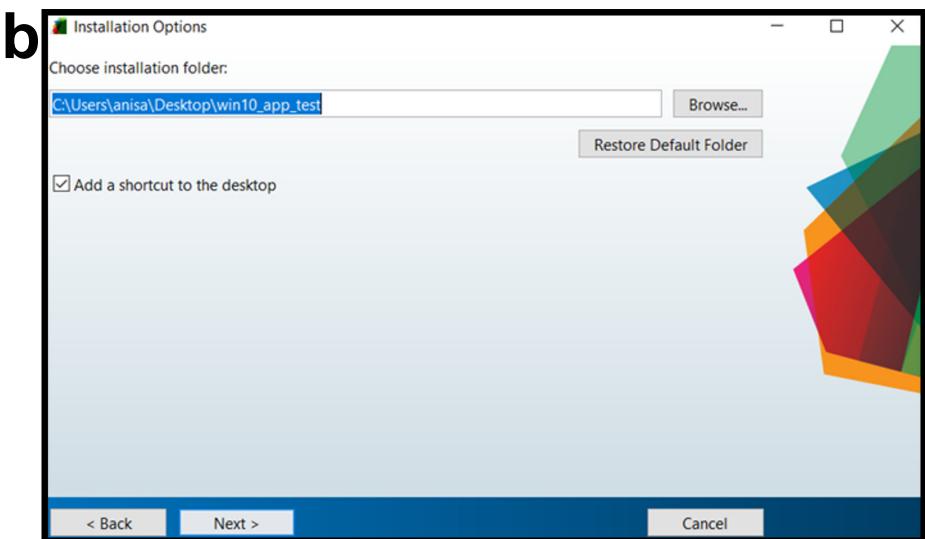
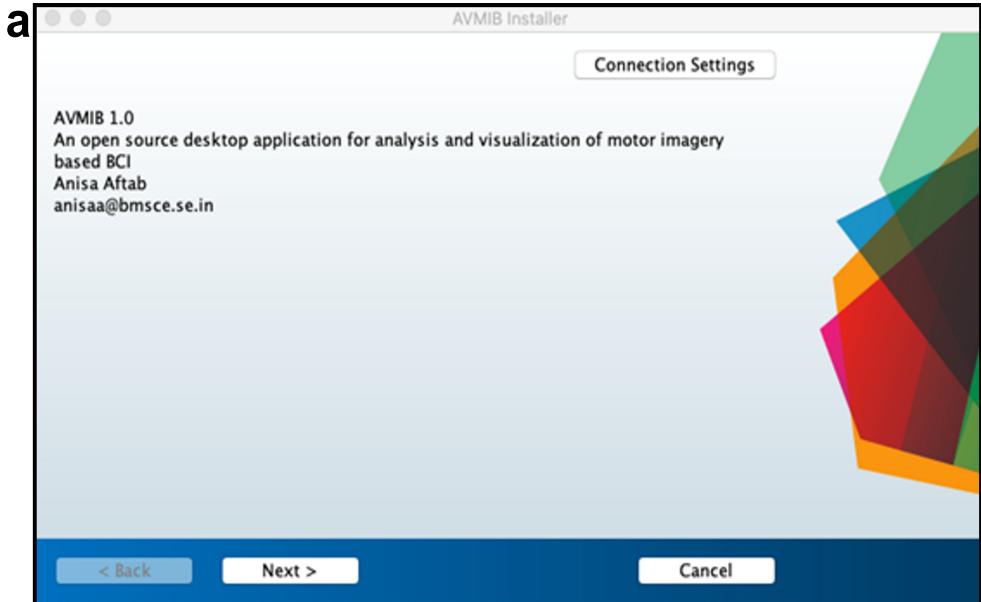


Fig. 16 AVMIB software shared folder structure

3.2 How to run AVMIB desktop application:

Step1: After the installation, launch the app as demonstrated in Fig 18.

Step2: The first interface display will appear (Fig 5). From this page user can navigate to different GUI pages and explore the functionalities as explained in sec 1.3.



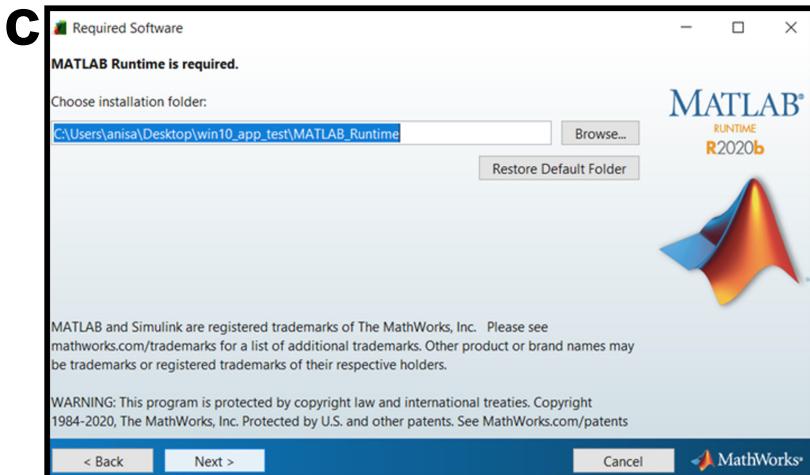


Fig. 17 Installing the application-(a) upon double click this installer page opens, click on Next> to begin the installation (b) Choose installation folder for the application (c) Choose installation folder for the MATLAB Runtime

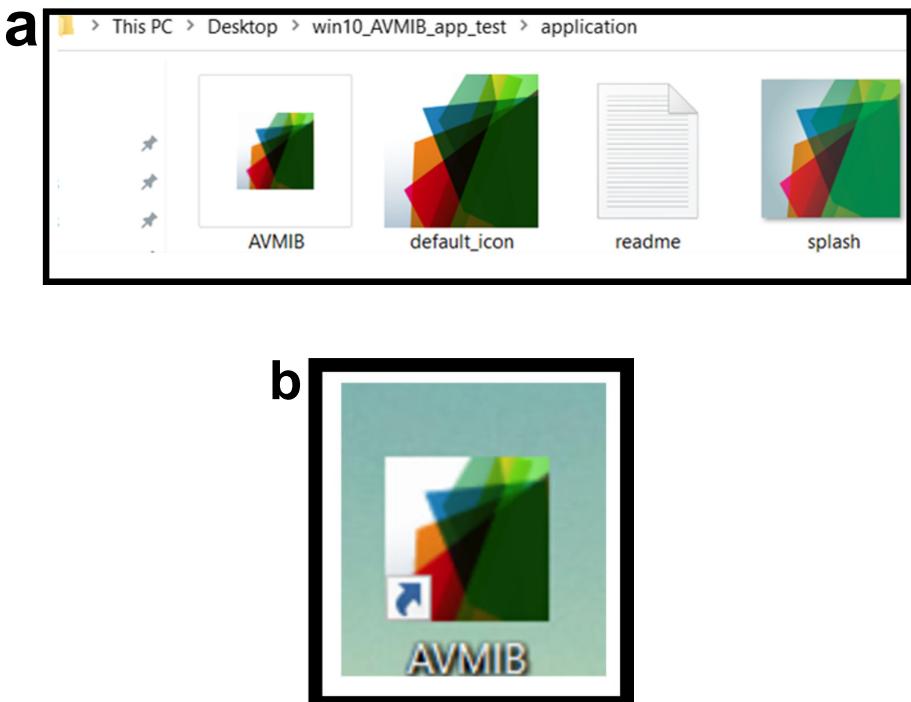


Fig. 18 Launching the application- Either from (a) installation folder by double clicking AVMIB.exe file (enclosed in the red dashed rectangle). or from (b) desktop shortcut created with the application name and double clicking on the installer