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User Instruction

Note: This document is associated with the paper "A Deep Learning Surrogate of Computational Fluid Dynamics for Thrmbus Risk Formation in the Left Atrial Appendage" authored by Xabier Morales, Jordi Mill, Kristine A. Juhl, Andy Olivares, Guillermo Jimenez-Perez, Rasmus R. Paulsen, and Oscar Camara published at Statistical Atlases and Computational Modeling of the Heart 2019 (STACOM) at MICCAI Lecture notes in computer science 2019.

1. Files provided

Data: Shape_Final.mat , ECAP_Final.mat, TempData.mat, Non-linear_mapping.py, Non-linear_mapping_CrossValidation.py, SimpleFully_CrossValidation.py, UnsupervisedLearning.m, Result_Plotter.m.

Input Data: Shape_Final.mat , ECAP_Final.mat.

Code of DL-model: , Non-linear_mapping.py, Non-linear_mapping_CrossValidation.py, SimpleFully_CrossValidation.py, UnsupervisedLearning.m.

Code for visualization: Result_Plotter.m.

2. System Requirements

OS: Windows (64bit) 7 or 10
Hardware: Intel quad-core CPU, 32 GB RAM

3. Software Requirement

Anaconda: https://www.anaconda.com/download/; we used python 3.7.4

Keras: https://github.com/fchollet/keras

Keras can be install from Anaconda Cloud: https://anaconda.org/anaconda/keras

Tensorflow: https://www.tensorflow.org/, we used Tensorflow 1.13.1

Tensorflow CPU version can be installed from Anaconda Cloud: https://anaconda.org/conda-forge/tensorflow

Matlab (at least 2016b): https://www.mathworks.com/products/matlab.html, we used R2019b

Paraview: https://www.paraview.org/download/; https://www.paraview.org/paraview-guide/

Spyder: https://spyder-ide.github.io/

4. Installation – GPU support

4.1 Install Matlab

4.2 Install Anaconda

4.3 Create a conda enviroment with the following command on Anaconda prompt:

conda create --name myenv	Create new conda enviroment with name *myenv*
activate myenv	Activate the enviroment
conda install tensorflow-gpu=1.13.1	You can change to the version you prefer

4.4 Install Keras in Anaconda

You must install Keras in the same environment that has Tensorflow. Type the following in the same prompt with enviroment activated:

```
conda install -c anaconda keras
```

4.5 Install Spyder in Anaconda

You can find the command in here: https://anaconda.org/conda-forge/spyder

4.6 Setup the MATLAB engine for python

On the same prompt with the environment activated follow the steps in (the ones that are supposed to be for the windows prompt). You might need administrator privileges execute the commands: https://www.mathworks.com/help/matlab/matlab_external/install-the-matlab-engine-for-python.html

4.7 Install required libraries

Lastly, install all the rest of libraries that are used such as ***sklearn*** or ***scipy***.

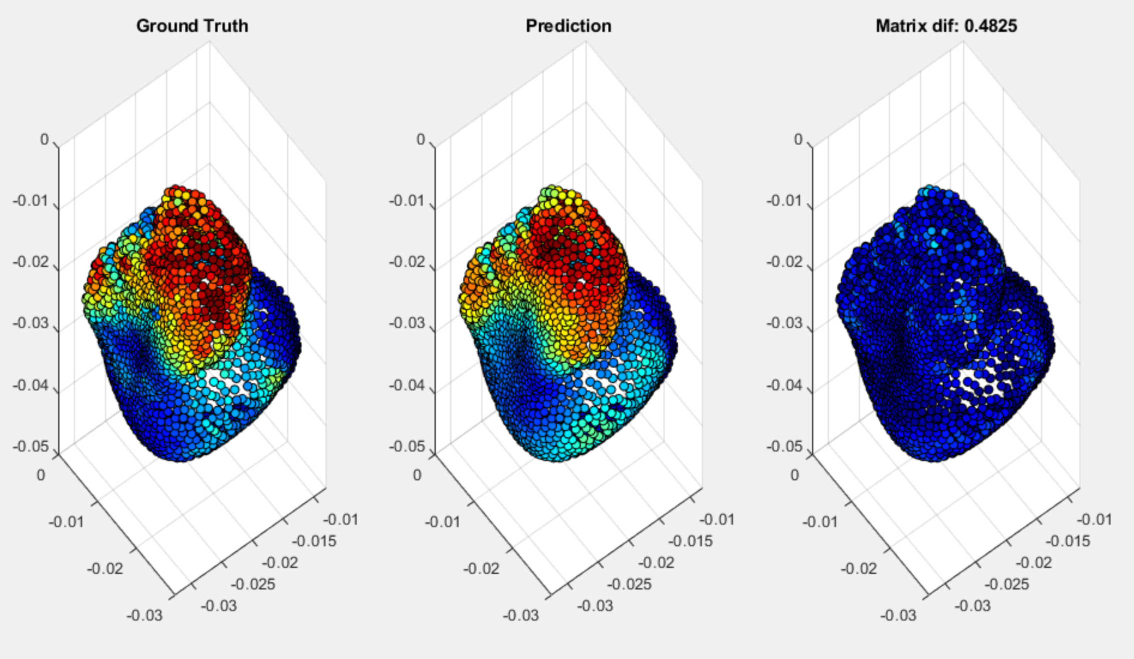
5. Installation – Non GPU support

In case that there isn't a GPU available the installation pipeline is exactly the same as established on section 4, but changing the step 4.3 to:

```
conda install tensorflow=1.13.1
```

6. Usage

Activate the anaconda enviroment and open spyder. Open either one of the three available .py files each containing a different nerual network or task. The ***Non-linear_mapping.py*** file contains the dimensionality reduction (PCA) network. It just trains the network once and returns 21 predicted ECAP mappings which can be visualized with the ***Result_Plotter.m*** script. The other two .py files, ***Non-linear_mapping_CrossValidation.py*** and ***SimpleFully_CrossValidation.py*** contain the PCA and SFC networks respectively, in which a 10-fold cross-validation is performed with 100 repeats. They return the accuracy metrics so that one can benchmark the performance of each network.



A similar figure should appear after running Result_Plotter-m file after completing the neural network testing