Auxetic Deformation

Distance Calculation Program

André Sebastiani Mafei (University of Campinas)
Matheus Gomes Fonseca (University of São Paulo)

The program is composed by 3 main files, all with commented codes for better understanding.

plotmaker.py – is the main file going to be read by terminal, containing the inputs and the sequence of all operations.

plotfunc.py – contains the functions called by plotmaker.py

setimage.py – contains the function used to display the frames and interact with the user clicks

If some change needs to be made, look for the part desired to be changed at plotmaker.py code then search for the involved commands and rewrite the code.

Installing the program

Requirements:

Mac OS

Python 3.8.2
Go to windows app store, search for python and download the latest version. You can also search for this release version at *https://www.python.org/downloads/*
Just download and execute it.

Download **PIP Python Package Installer** for easier download of the following libraries (https://www.liquidweb.com/kb/install-pip-windows/)

Download following Libraries:
-OpenCV 4 (run *pip install opencv-python* on terminal)
-Numpy (run *pip install numpy* on terminal)
-SciPy (run *pip install --user numpy scipy matplotlib ipython jupyter pandas sympy nose* on terminal)
-Matplotlib (run *python -m pip install -U matplotlib* on terminal)

Windows 10

-Python 3.8.2
Search for the latest release version at *https://www.python.org/downloads/*
Just download and execute it

-Download **PIP Python Package Installer** for easier download of the following libraries

Just go to your terminal and type:

```
curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py
```

Then, use terminal to go to the directory you saved get-pip.py and type the following command:

```
python get-pip.py
```

Download following Libraries:
-OpenCV 4 (run *pip3 install opencv-python* on terminal)
-Numpy (run *pip3 install numpy* on terminal)
-SciPy (run *pip3 install --user numpy scipy matplotlib ipython jupyter pandas sympy nose* on terminal)
-Matplotlib (run *python -m pip install -U matplotlib* on terminal)

Using the program

Opening:

-Create a folder and save all three files on it.
-Open you OS terminal
-Change the directory to the folder containing the files
-Run `python3 plotmaker.py` , then you will be asked for the first inputs.

Use:

1) First, enter the **path of the video** when the program asks.
2) Enter the **number of points** that will be selected (**Even number**, as distances needs 2 points to be calculated)
3) Enter the **number of frames** you would like to analyze. The more data you collect, more reliable will be the results.

   This samples are going to be passed through a BSpline algorithm to create a curve with the distance variation. A Polinomial (3rd degree for less then 5 samples, 7th degree for more then 5 samples) fit is also included for comparison.

The program will now display the frames and the user should click on the points desired to be measured.

ATTENTION: the points needs to be clicked on a sequence, in order to measure distances between couples of points. Look at this example with 8 points (4 measured distances):

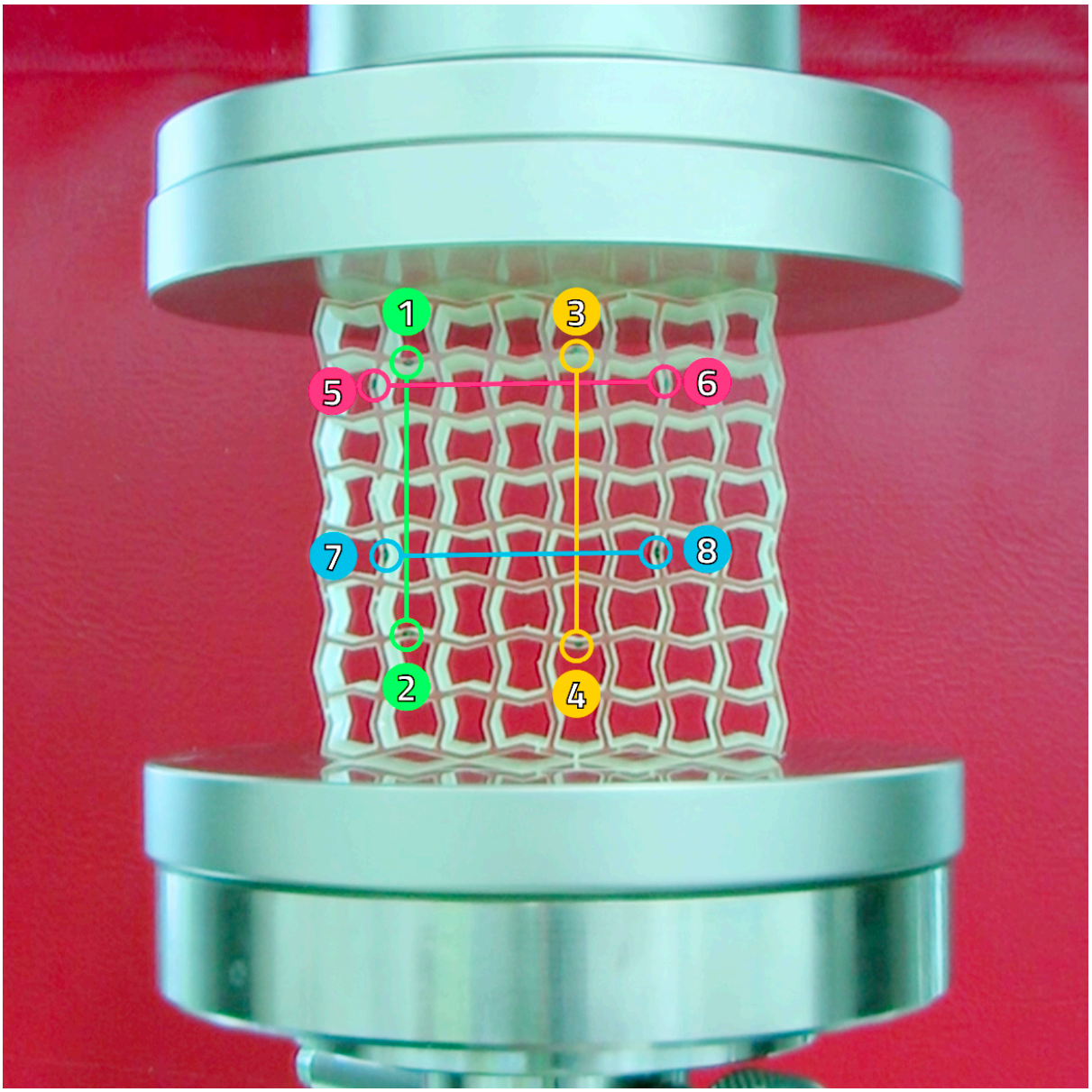

Fig. 1: 4 distances sequence

Controls

In case the user **mistakes a point**, it can be deleted by just pressing " **r** " (repeat).

To **go to the next frame**, just press "**n** " (next).

Results

After the selected amount of frames (samples), the program will ask what the user decides to do.
You can either save the coordinates in CSV (comma separated values) and then work with them in other environment or use the program to plot and visualize the data.

Saving in CSV
You can do this by typing 1 when asked.
The CSV files will be saved on a new folder (CSV Data) in the same directory as the video.

Plotting the data
Type 2 when asked.
In some seconds, curves are going to be plotted in the order of the distances you selected.

In the last 8 points example, for instance, this will be the order:
You can check the title of the graph

1°: 1-2 (green) distance
2°: 3-4 (orange) distance
3°: 5-6 (pink) distance
4°: 7-8 (blue) distance

Close a plot to **open** the next one.

Example

This made using 10 frames, for the same 8 point selection:

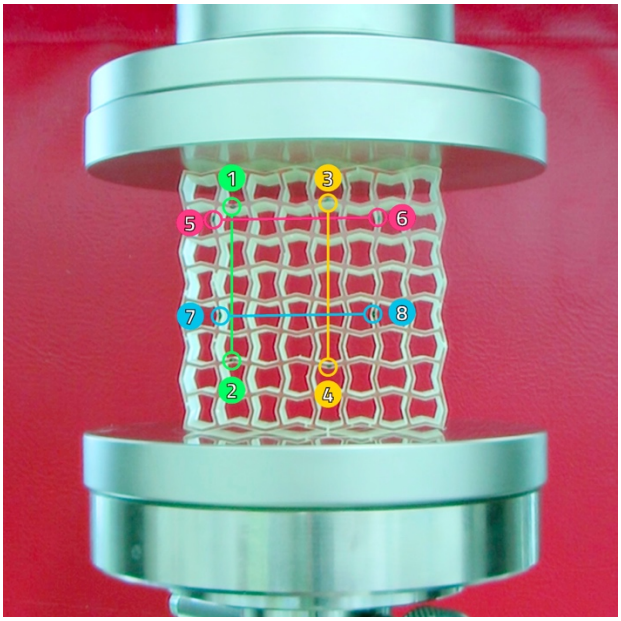

Fig. 2: 4 Distances Sequence Sample

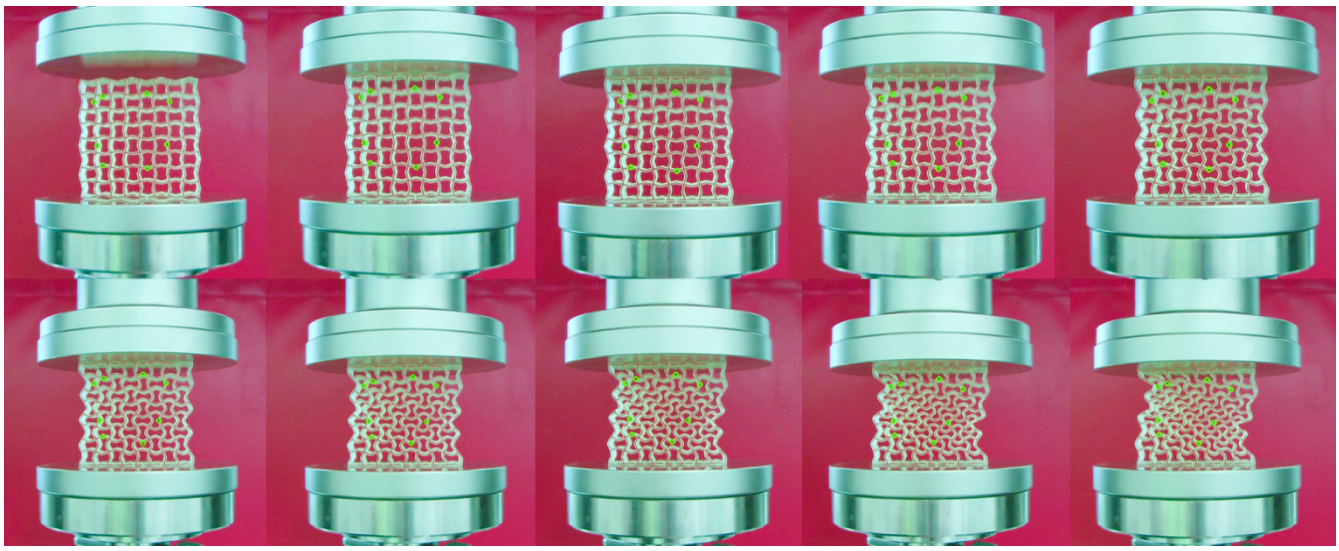

Fig. 3: 10 frames, 8 points selection

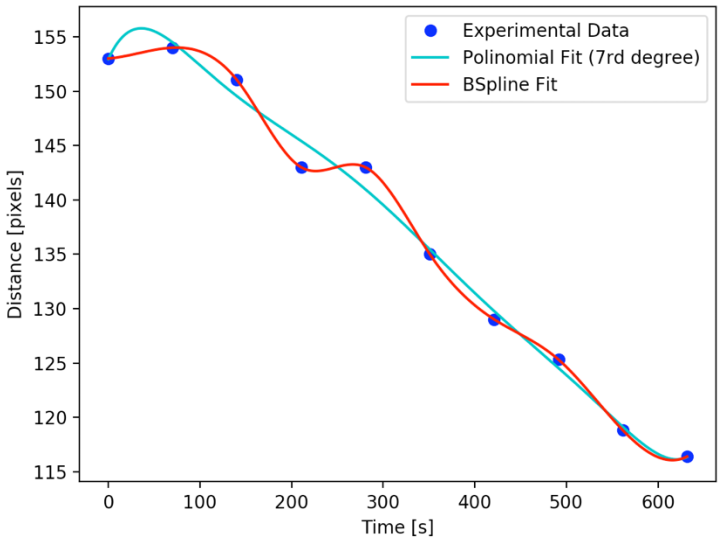

Chart 1: Distance 1 variation

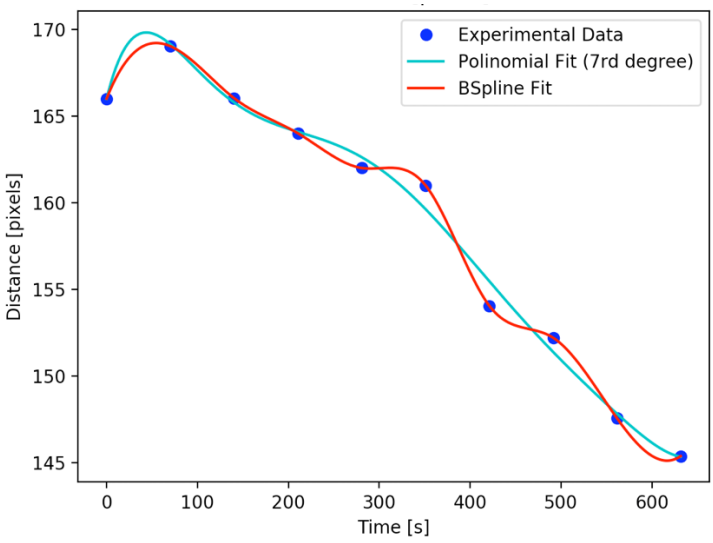

Chart 2: Distance 2 variation

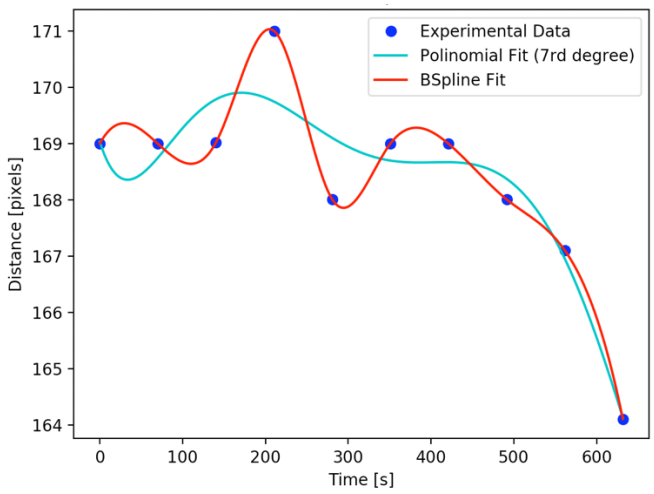

Chart 3: Distance 3 variation

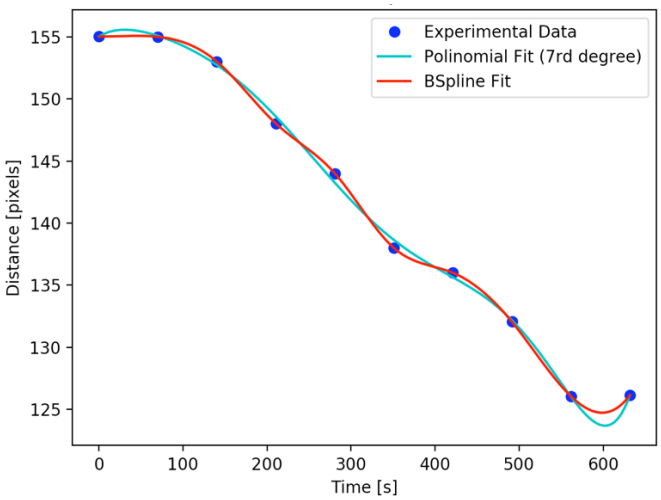

Chart 4: Distance 4 variation

In case of questions, contact:

André Sebastiani Mafei
Mechanical Engineering Student
andresmafei@gmail.com