Matlab codes

bp : bodyparts

lk : likelihood

cam,ch : camera

sn : snout -> 1

lear : left\_ear -> 2

rear : right\_ear -> 3

he : head -> 4

bc : bodycenter (hump) -> 5. It is different from centroid (=center of gravity)

tb: tailbase -> 6

lfrontp : left front paw -> 7

rfrontp : right front paw -> 8

lbackl : left back leg -> 9

rbackl : right back leg -> 10

There are 4 useful codes in Matlab :

- code\_centroid\_all\_bp : generate files summarizing all calculations (centroid coordinates, instantaneous velocity...)

- analyse\_freq : given previous results, returns different ways to filter data

- Code\_stats\_all\_bp : given previous results, generates statistics about percentage of visible bodyparts per camera, number of bp visible during the video...

\_ Code\_video\_all\_bp : creates a video plotting the centroid and the polygon shaping the mouse over the original videos (for a condition)

**1 Code\_centroid\_all\_bp :**

How to use it : place the csv files resulting of DLC analysis of the videos you want to analyze in a folder.

Be sure the files within the folder are ordered by name (you should have ch01\_video1 / ch01\_video2 / ch02\_video1/ch02\_video2).

Be sure the files are named as : ch01\_20200915114500\_001\_avi\_3AXEDLC\_resnet50[...]\_filtered.csv (no \_converted, no missing \_avi, etc.)

Be sure to have no other csv files in the folder than the ones you want to analyze (place the already analyzed csvfiles elsewhere)

Change the pathway in the 1st subsection of the code to the one containing your files

Change the pathway in the last subsection of the code to the one you want to export your results to

Run the code. In the end, you should have a txt file and a xlsx file (ex : "Analysis\_table\_3AXEDLC" "Results\_3AXEDLC"). Sometimes an underscore at the end of the file pops; it's because the length of the experimental tags change (ex 3AXEDLC and 10AXEDLC)

What does it calculate : given the coord of bodyparts determined with each network, it

- determines the best camera and keeps the coordinates of this camera,

- calculates the polygon representing the mouse and the coordinates of the centroid at each frame

- calculates instantaneous speed at each frame, filters the data

- calculates stats data such as percentage of visible bp per camera, mean percentage of bodyparts during video

Coord\_bodyparts : regroupes the choice of the best cam and its coordinates. Column C : camera based on sum of lk only, col D : choice of cam and cam stays the same if sumlk(cam1)=sumlk(cam2), col E : same as D but the sxitch of camera is cancelled if it lasts less than 3s, col F : indicates if sum of lk for cam 1 and cam 2 are equal (=1) or not (=0)

Coord\_centroid : Pt 1, 2, ... 10 : gives the points used to create the polygon. Point 1 = snout, point 2=leftear... (complete list at the beginning of this file)

Analysis\_table : y is for the instantaneous spd without outliers due to the switch of camera, y\_filtered is y after filtering based on median, y\_wo\_movmean : y\_filtered after smoothing based on mean.

\_filter indicates median filter, \_wcam : withcam (ie outliers due to camera switch are kept), wo : withoutcam (ie outliers due to camera switch were removed).

\_missing : Nan removed

Percent\_bodypart\_per\_camera : gives the percentage of visible points (ie points with lk >0.7) for each camera and for the camera chosen by the algo. For ex, 0% = no visible points, 50%=5 visible points. If the % of visible points given best cam is < % given the other camera, maybe it's due to the >3s criterion.

Nb\_bp\_per\_time : Indicates for how many frames we have x nb of visible points (lk>0.7). row 1 : nb of frames; row2= duration (=nb of frames\*40), row3=percentage of time (nb frames/nb total of frames)

Ch01\_3AXEDLC, Ch02\_3AXEDLC : coordinates givent by csvfiles and likelihood calculation (lk\_corr=1 if lk>0.7 and if lk(t-1) or lk(t+1) >0.7)

**2 Analyse\_freq** :

calculates the instantaneous speed and filters it given different filters. The files also calculates the mean of y\_wo\_movmean of a certain period (ex, if period=10, the video is divided into 10 periods of same duration, and the mean of the speeds in each period are calculated and ordered in a list

Code\_stats\_all\_bp : calculates Percent\_bodypart\_per\_camera and Nb\_bp\_per\_time like the Code\_centroid\_code. Base itself on the last Sry and Cc calculated by the code Code\_centroid.

**Code\_video\_all\_bp** :

creates a video displaying the labeled or the original video, the centroid and the polygon representing the mouse.

v\_cam1 = video cam 1, v\_cam 2=video cam 2 (the DLC one or the original), numberOfFrames must be changed by the user (I've never tried to run the code with more than 1000 frames).

You must have analyzed the video beforehand with Code\_Centroid\_all\_bp and kept the "Results" variable (saving the workspace might come in handy). If you analyzed more than one condition in a row with code\_centroid, you should change in the code the 2d value of Results to give it the value "nb\_condition\_expm+1" eg the order of your condition +1 (ex if you're interested in the 5th video that was analyzed, you should have Results{2,6} and not Results{2,2}

Also, please mind changing the name of the video each time, as it overwrites the previous one if the name and pathfile are different. The pathfile of the newly created video is the same as the code file

Concerning the input video : if you use the DLC labeled videos, since they are .mp4, they must be converted to avi. For that, many methods exist, one of them is using VLC media player to convert it to .avi, install a x264vfw converter then launch VirtualDub (with an Xvid compressor). With VirtualDub, you can cut the original video to make them lighter for Matlab and compress them with xvid (xvid MPEG4 codec)

Then you must input the entire videopath in the code.

Please mind that for some reason, the conversion from mp4 to avi using xvid might add frames (2 in general). This is displayed in the code line 41, "frame+2". You might need to adapt this value. Also adapt the NumberOfFrames to make it smaller than the total number of frames (if you have frame+2 and your video has in total 1000 frames, NumberOfFrames must be 998 or less).

The Yaxis being inverted is normal (same axis as Deeplabcut)