plusTipSeeTracks

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OVERVIEW

plusTipSeeTracks is a graphical interface allowing the user to load and visualize the results of movies analyzed by plusTipGetTracks.
This document explains how to use the plusTipSeeAnalysis interface. The main workflow can be decomposed into three major steps:

1) Load an existing project analyzed by plusTipGetTracks
2) Select select a visualization ROI and a time range (optional)
3) Select an output directory
4) Generate visualization (maps or movies)

VISUALIZATION MODES

The plusTipSeeTracks interface supports four types of visualization modes:

- Track overlays (see Applegate *et al.* 2011, Fig. 5B):
  Overlay tracks on a frame of the movie, with the option to select individual tracks for more information about them

- Spatial maps of MT dynamics (see Applegate *et al.* 2011, Fig. 6):
  Overlay dynamics information on a frame of the movie.

- Track movies (see Applegate *et al.* 2011, Supplementary Movie 4-7):
  Make a movie of either all tracks within a region, within a frame range or one or more individual tracks.

- Speed movies (see Applegate *et al.* 2011, Supplementary Movie 8):
  Make a movie where comets are color-coded by speed (microns/min)

TRACK TYPE

Quick Reference for Track Overlays and Track Movies

1. growth (red solid)
2. forward gap (pause) (cyan dotted)
3. backward gap (shrinkage) (yellow dotted)
4. unclassified gap (magenta dotted)
5. forward gap reclassified as growth (green solid)
6. backward gap reclassified as pause (blue dotted)

PROJECT SETUP

SELECT PROJECT

This step allows you to choose a single projects (i.e. roi_1 folder) for visualization.
If "Load projList" is checked, you will be asked to select one or more projList.mat files containing the directory paths to various projects you have previously created. If "Load projList" is unchecked, you will select a parent directory containing previously-created projects.
If "Narrow down list" is checked, a window will pop up asking for one or more search strings. These are strings of characters that can be used to narrow down the number of projects you have to scroll through when selecting from a long list. For example, if "ctrl" appears anywhere in the file path to your control movies, you may enter "ctrl" into the search string list. Only those projects matching all the query strings will appear. If "Narrow down list" is unchecked, this step is bypassed and all the projects will appear in the list.
From the resultant list of projects, select a single project and click on OK. Once a project is chosen, it can be used for multiple visualization (*e.g.* track overlay followed by speed movie). You can choose a new one at any time, or click "Reset" to start over.

TROUBLESHOOTING

- If you have created a roi_x directory but have not run tracking and post-processing, it will not appear in the list.
- Track overlays, MT dynamics maps, track and speed movies can only work with one project at a time.
- If no projects are found, check to make sure there are no spaces anywhere in the directory path or file names.
- If you get the message "Select any directory above input directory", the root of your Matlab current directory does not match the root directory where your project is stored. Point to the relevant server location.

SELECT SAVED ROI

Click the button if you want to load a saved roiYX.mat file, which contains the coordinates of a region you have previously selected.
These are saved during project setup with plusTipGetTracks and also for each movie that is generated. Once you load a ROI, it can be used for multiple tasks (e.g. track overlay followed by movie making). You can choose a new one at any time, or click "Reset" to start over with no ROI. If no ROI is chosen, the whole image will be used for track overlays, you will be prompted to select a new ROI for track movies.

CHOOSE FRAME RANGE

Default is all frames. For track overlays, partial tracks will be shown if they exist partially outside the frame range.

SELECT OUTPUT DIRECTORY

Select the directory where track and speed movies as well as MT dynamics maps should be saved. Note that tracks overlays are not automatically saved.

SPATIAL MAPS OF MT DYNAMICS

This tools allows to generate three series of dynamics maps for a given projects:

- a series of histograms of the stacked speed, lifetime, and displacement distributions for growth, fgap, and bgap sub-tracks.
- Spatial maps of the growth, fgap, and bgap sub-tracks color-coded by speed, lifetime, and displacement.
- Spatial maps of the initiation and termination sites for fgaps and bgaps.

All spatial maps are generated from the microtubule information within the frame range and appear as an overlay on an image chosen by the user (*e.g.* first frame of frame range).
The three edit boxes allow the user to control the maximum speed, lifetime and displacement for the color-coding of the tracks. If set to max, the function uses the 95% percentile as the maximum value.

SPEED MOVIES

"Maximum speed" is the maximum speed used in the jet color map (e.g. an input of 20 will map all speeds faster than 20 to 20 and range from dark blue at 0 to deep red at 20). The default option (max) uses the whole range.

- Circles - growth
- Triangles - forward gap (fgap)
- Squares - backward gap (bgap)

The "Save as AVI" check box determines whether the movie will be saved as .MOV (default) or .AVI. The AVI option crashes in some versions of Linux, so it is advised to leave this box unchecked when working in Linux.
The "Make Speed Movie" button calls plusTipSpeedMovie.m.

TRACK MOVIES

The "Detected Comet Display Options" radio buttons and the "Display Tracks" checkbox control how the detected comets and tracks are displayed in the movie:

- All comets, current frame only: displays ALL the detected comets from a given frame in that frame only.

- All comets, all frames: displays ALL the detected comets (ie including those that did not get incorporated into a track), color-coded by frame. This option is useful for checking whether a tracking mistake might be due to a missed detection or to a wrong link, for example.
- Comets in tracks only, all frames: displays only the comets used in the tracks, color-coded by frame, such that comets in a track appear shortly before and after a track.
- None: use this option if you want to make a movie of the raw data or if you only want to show the track without the detected comets.

The "Individual Track Numbers" text box can be used to make movies of individual tracks. The track numbers correspond to those found in the first column of projData.nTrack_sF_eF_vMicPerMin_trackType_lifetime_totalDispPix, the matrix containing the tracking results after post-processing.

You may find it useful to select tracks using the Track Overlays tool and copy and paste the track numbers into this text box. Or, load projData manually and look for interesting tracks to plot.
Please note that the individual track movies are still bounded by the frame range given and the frames in which the track exists, i.e. if the frame range chosen in Step 3 is 10-20, and the individual track of interest goes from frame 15 to frame 30, the movie will only contain frames 15-20.
If the "Individual Track Numbers" text box is empty, all tracks will be shown for the ROI.
The "Dual panel with raw images" function creates a movie where the raw image is shown on the left and the detection and/or track overlay is shown on the right.
The "Save as AVI" checkbox determines whether the movie will be saved as .MOV (default) or .AVI. The AVI option crashes in some versions of Linux, so it is advised to leave this box unchecked when working in Linux.

NOTES

The size of the image is automatically maximized to your screen (while preserving the aspect ratio) when using the interface. To make smaller movies, see the magCoef input in plusTipTrackMovie.m and run from the command line.
Also, RGB images can be used by placing them in the "images" subdirectory at the same level as the project. If other colors for the track overlays are desired, they can be set in plusTipPlotTracks.m near the end in the "for iColor=1:6" loop.
The "Make Track Movie" button calls plusTipTrackMovie.m.

TRACK OVERLAYS

All tracks within the frame range will appear as an overlay on an image chosen by the user (e.g. first frame of frame range).
If "Select Tracks" is checked, the user will be prompted to click one or more times on the image. Information about the tracks will appear in the Matlab command window as follows:
Track: trackNumber Frame: frame closest to where user selected
  [trackNumber, start frame, end frame, speed (microns/min), track type, lifetime (frames),

displacement (pixels)]

Track Types:

1. growth (red solid)
2. forward gap (pause) (cyan dotted)
3. backward gap (shrinkage) (yellow dotted)
4. unclassified gap (magenta dotted)
5. forward gap reclassified as growth (green solid)
6. backward gap reclassified as pause (blue dotted)

The track numbers selected will then show up in a new text window below the "Plot tracks" button. These are useful if, for example, you want to quickly make a movie of the track you selected. You may also see all compound track profiles by loading the projData.mat file from the 'meta' folder and viewing:
projData.nTrack_sF_eF_vMicPerMin_trackType_lifetime_totalDispPix

The "Plot Tracks" button calls plusTipPlotTracks.m. If other colors for the track overlays are desired, they can be set in plusTipPlotTracks.m near the end in the "for iColor=1:6" loop.