Instructions for Multi-Object Tracker for Mice (MOT-Mice)

The source code is available at https://github.com/ZhangChenLab/Multi-Object-Tracker-for-Mice-V1.2

MOT-Mice was developed and tested on MATLAB R2019b using an Nvidia GeForce GTX 1080 Ti GPU with 11 GB memory.

1 MOT-Mice toolbox

1.1 File description

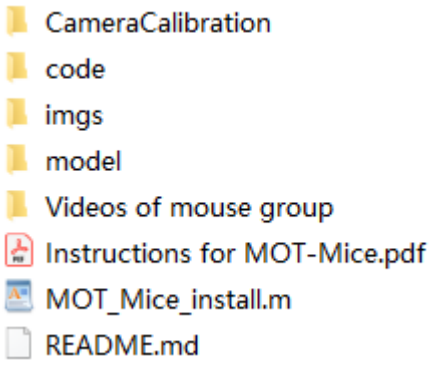

Fig. 1 Folders or files in MOT-Mice toolbox

Table 1 Description for Folders or files in MOT-Mice toolbox

Folder or file	Description
code	The function library of MOT-Mice
CameraCalibration	Checkboard images and code used for camera calibration. Download from zenodo first: https://zenodo.org/record/4265809#.X6oyBtN1SvY
model	Trained trace prediction model, and mouse detection models for mouse detection. Download from zenodo first:

	https://zenodo.org/record/4261622#.X6fiYtN1SvY
Videos of mouse group	Multicamera videos of mouse group. Top-view camera: camera4. Side-view cameras: camera1,2,3. Download from zenodo first: https://zenodo.org/record/4261722#.X6ftDdN1SvY
MOT_Mice_install.m	Install the MOT-Mice toolbox by adding folders (CameraCalibration, model, and code) to search path.
imgs	Description images used in github.
README.md	Simple instruction file in github.
Instructions for MOT-Mice.pdf	Instructions about install and running the MOT-Mice toolbox.

1.2 Install

Run the file “MOT_Mice_install.m” to install MOT-Mice toolbox.

2 Camera calibration

2.1 File description

Note: please download the files from zenodo first:

https://zenodo.org/record/4265809#.X6oyBtN1SvY

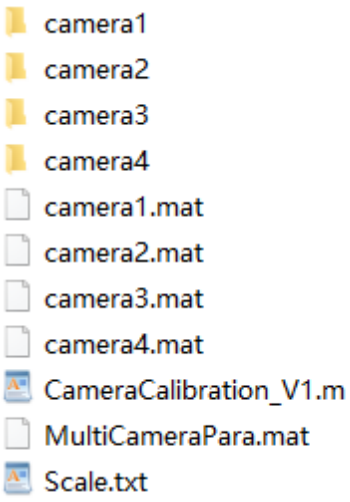

Fig. 2 Folders or files in the folder of ‘CameraCalibration’ in MOT-Mice toolbox

Table 2 Description for the folders or files in the folder of 'CameraCalibration'

Folder or file	Type	Description
Camera1	Input	Checkboard images recorded by camera1.
Camera2	Input	Checkboard images recorded by camera2.
Camera3	Input	Checkboard images recorded by camera3.
Camera4	Input	Checkboard images recorded by camera4.
Scale.txt		Scale factor for the checkboard images in the folders of camear1, camera2, camera3, and camera4.
CameraCalibration_v1.m		Codes to achieve camera calibration.
Camera1.mat	Output	Result file for camera1 modeling.
Camera2.mat	Output	Result file for camera2 modeling.
Camera3.mat	Output	Result file for camera3 modeling.
Camera4.mat	Output	Result file for camera4 modeling.
MultiCameraPara.mat	Output	Result file for multicamera calibration.

2.2 Running

Run the file "CameraCalibration_v1.m" to achieve multicamera calibration.

2.3 Results

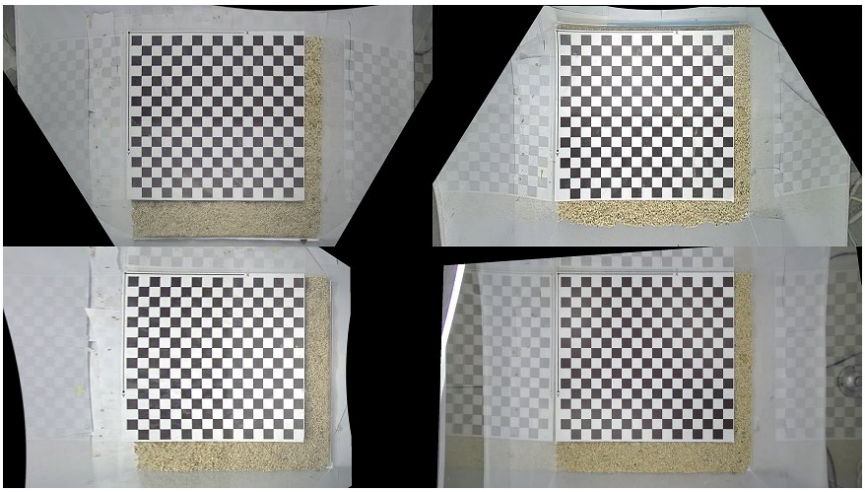

Fig. 3 Results for multicamera calibration

3 Model

Note: please download the files from zenodo first:

https://zenodo.org/record/4261622#.X6fiYtN1SvY

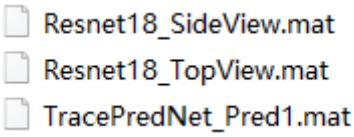

Fig. 4 Files in the folder of 'model' in MOT-Mice toolbox

Table 3 Description for the files in the folder of 'model'

Folder or file	Description
Resnet18_SideView.mat	Mouse detection model for side-view cameras (camera1, camera2, and camera3).
Resnet18_TopView.mat	Mouse detection model for top-view cameras (camera4).
TracePredNet_Pred1.mat	Trace prediction model.

Note: please ensure that these three model files are in the folder of 'model' before further operations.

4 Unmarked mouse group tracking

Note: please download the files from zenodo first:

https://zenodo.org/record/4261722#.X6ftDdN1SvY

There are six independent examples in total. Here we use the example of mouse 6_2.

4.1 File description

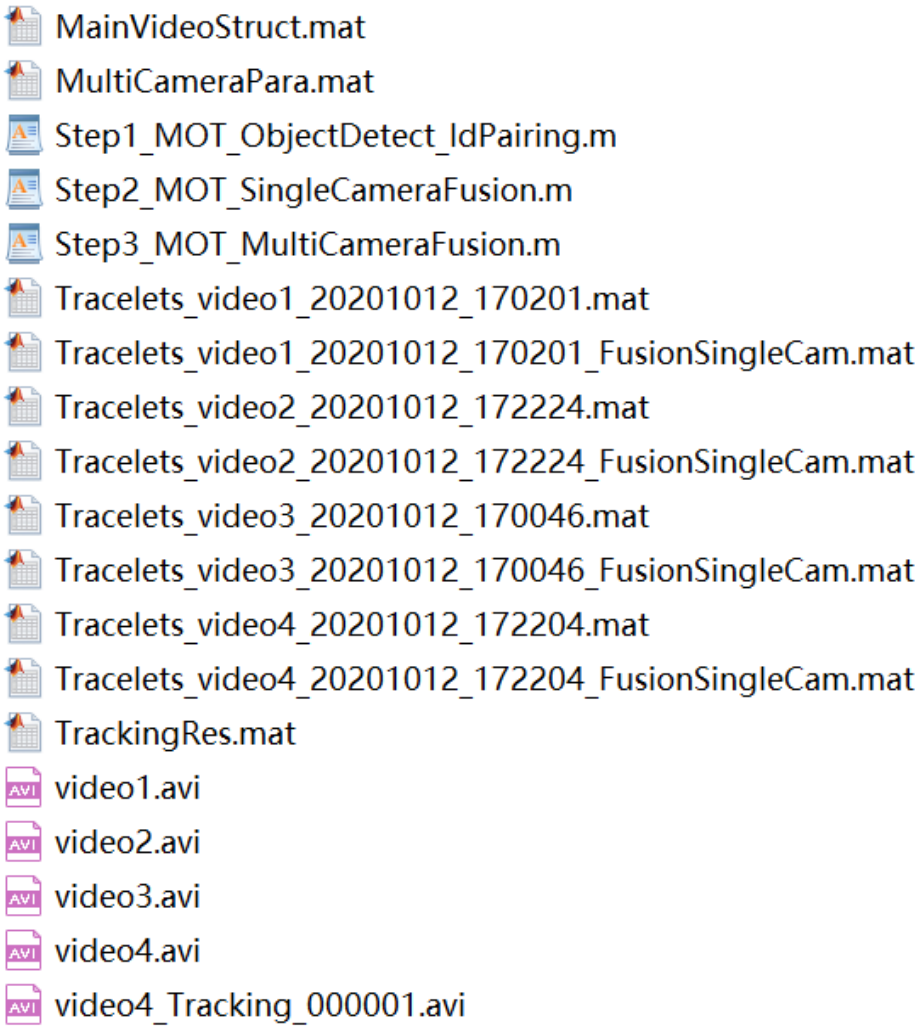

Fig. 5 Files in the folder of 'mouse 6_2'

Table 4 Description for the files in the folder of ‘mouse 6_2

Folder or file	Type	Description
video1.avi	Input	Video recorded by camera1.
Video2.avi	Input	Video recorded by camera2.
video13avi	Input	Video recorded by camera3.
video1.4vi	Input	Video recorded by camera4.
MainVideoStruct.mat	Input	Information about the top-view camera.
MultiCameraPara.mat	Input	Information about the multicamera calibration.
Step1_MOT_ObjectDetect_IdPairing.m		Code for mouse detection and identity pairing to generate tracklet.
Tracelets_video1_20201012_170201.mat	Output	Tracking result for camera1 after running the code of step1.
Tracelets_video2_20201012_172224.mat	Output	Tracking result for camera2 after running the code of step1.
Tracelets_video3_20201012_170046.mat	Output	Tracking result for camera3 after running the code of step1.
Tracelets_video4_20201012_172204.mat	Output	Tracking result for camera4 after running the code of step1.
Step2_MOT_SingleCameraFusion.m		Code for single-camera tracklet assembly.
Tracelets_video1_20201012_170201_FusionSingleCam.mat	Output	Tracking result for camera1 after running the code of step2.
Tracelets_video2_20201012_172224_FusionSingleCam.mat	Output	Tracking result for camera2 after running the code of step2.
Tracelets_video3_20201012_170046_FusionSingleCam.mat	Output	Tracking result for camera3 after running the code of step2.
Tracelets_video4_20201012_172204_FusionSingleCam.mat	Output	Tracking result for camera4 after running the code of step2.
Step3_MOT_MultiCameraFusion.m		Code for tracklet assembly by multicamera fusion.
TrackingRes.mat	Output	The final tracking results for unmarked

		mouse group after running the code of step3.
video4_Tracking_00000 1.avi	Output	The exported tracking video after running the code of step3.

Note: the date information in the name of result files generated in step1 and step2 denotes the moment of saving files.

4.2 Running

1) Run the file “Step1_MOT_ObjectDetect_IdPairing.m” to generate tracklet by mouse detection and identity pairing.

2) Run the file “Step2_MOT_SingleCameraFusion.m” to achieve single-camera tracklet assembly.

3) Run the file “Step3_MOT_MultiCameraFusion.m” to achieve multicamera fusion, and get the final tracking results and the tracking video.

Note: Step 1 will take several hours to run. GPU will accelerate the running of the program. Use the command of “gpuDevice” in MATLAB to test whether MATLAB can recognize a GPU normally. In the quick test, you can directly run steps 2 and 3, and the program uses the pre-saved results of step 1 by default.

4.3 Results

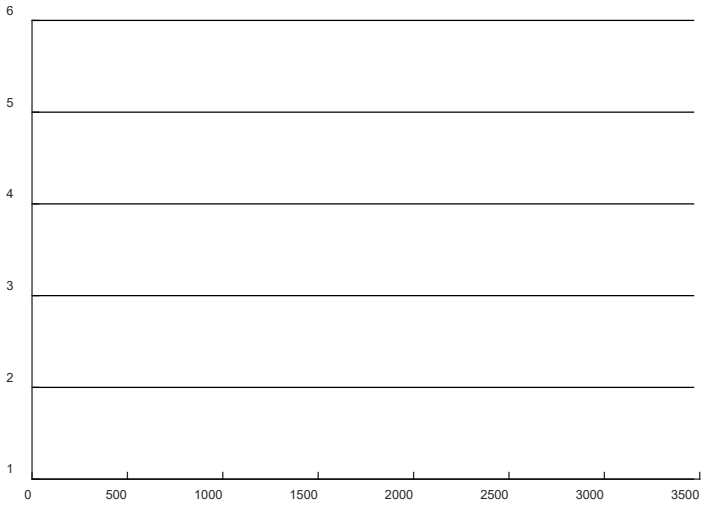

Fig. 6 Gantt charts of the final tracking results

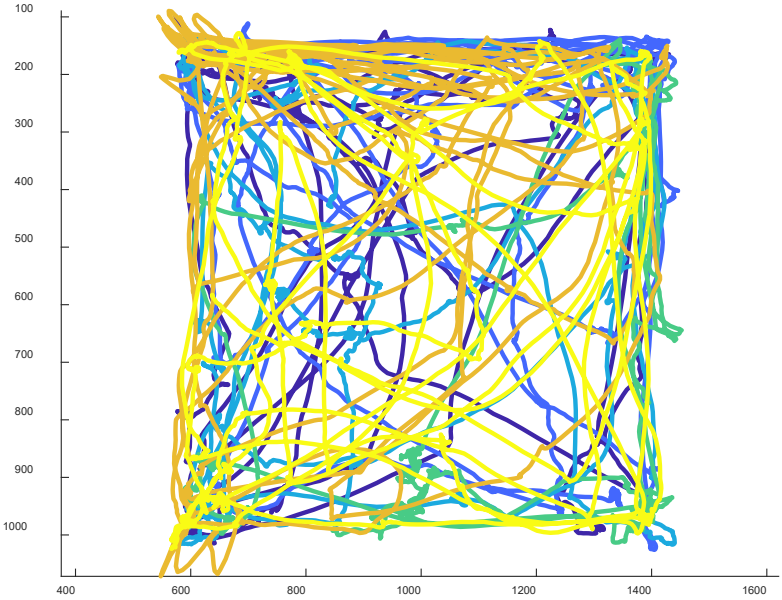

Fig. 7 2D trace plot of the final tracking results

Fig. 8 One sample frame of the tracking video.