###### Instructions for using Blender to stabilize footage

* Open Blender
* Change from default 3D view to 2D view: Press on the editor type button in the top-left corner () and select “Movie Clip Editor”
* Click Open at the top of the screen, and copy-paste the location of your footage, or navigate to the location of your footage, then double-click on the file to open. Can also drag and drop from Windows Explorer straight into the Blender window
* At the top-right of the opened movie clip you will find clip info including frame rate. You will need to ensure that your output frame rate matches the original clip frame rate by clicking on the Output tab () in the lower-right panel, and adjusting the frame rate as needed
* Extend the displayed clip length to the total clip length by pressing “Set Scene Frames” in the top-left corner
* Go to the first frame by pressing Shift+LeftArrow
* Find a distinct spot and press Ctrl+Click
  + Ideally, the object will be small and distinctive, and centered in the viewfinder in the top-right corner, so that it’s easy for a human to adjust it manually to the desired location if the algorithm struggles
* Navigate to the “Track” tab in the top-right panel
* You can change the size of the tracker by pressing S and moving the cursor to make it bigger or smaller, rotate th tracker by pressing R, and move the tracker by pressing G
* Add second bounding square by pressing Alt+S (this large bounding square indicates where Blender will be using for the pattern it finds in the smaller bounding box)
* In the left panel, click on Tracking Settings -> Tracking Settings Extra, and set the desired correlation (0.90 recommended)
* Once the tracker is set up, Alt+RightArrow () or Alt+LeftArrow () will track the object one frame at a time, while  (or Ctrl+T) and  (or Shit+Ctrl+T) will track frames until an ambiguous frame is encountered
* If you need to offset the tracking location, use GG on the keyboard to move the tracker to a new location
  + This keeps the tracker window on the original object, but uses the new location/object to determine the tracking
  + Tracking the original object by proxy is less accurate, and it’s desirable to minimize the number of frames during which this happens
  + It’s desirable to have the “proxy” location as close as possible to the original object location
  + As soon as the original object is in clear view again, go to the top-right panel, Track tab and reset offset to 0,0
* Workflow:
  + Shit+LeftArrow to go to the first frame
  + Ctr+Click to create a tracker
  + Scale it up/down
  + Adjust search box
  + Alt+RightArrow to track one frame to ensure it’s tracking alright
  + Ctrl+T to start tracking all frames going forward until an obstruction occurs
  + When an obstruction is encountered and the viewfinder turns red, click on the viewfinder and adjust the object position in the window by dragging it around, or by dragging around the tracker on the clip display window (zoom in to see the previous/next tracker location)
* Name your markers as “location” and “rotation” (location markers should be decently far from rotation markers to allow for best rotation adjustment)

Stabilizing

* Go to the Stabilization tab
  + Put checkmark for 2D Stabilization
  + put checkmark for Rotation and Scale
* Highlight a “location” marker and click plus at the Tracks for Location window
* In Clip Display at the top-right, put checkmark for Show Stable

Prep for export

* On the top ribbon, click Compositing
* Put checkmark on Use Nodes at the top
* Ensure node wrangler is enabled (to enable, go to Edit -> Preferences ‑> Add-ons -> In the search box enter “node wrangler” and ensure it’s enabled
* Add a Viewer node by Ctrl+Shift\_Click on the Render Layers node (or Shift+A -> Output -> Viewer)
* Delete the Render Layers node by clicking on it and hitting X or Delete on the keyboard, or right-click -> Delete
* Add a Movie Clip node by pressing Shift+A -> Input -> Movie Clip
* Ctrl+Shift+Click on the Movie Clip node to connect it to the Viewer node
* Connect the Movie Clip node to the Composite node by dragging from the yellow Image dot on the Movie Clip to the yellow image dot on the Composite node
* On the movie clip node at the bottom, click the drop-down menu and select the clip of interest
* Use V to zoom out and Alt+V to zoom in (or go to the View tab on the right and press Fit)
* Add Stabilize 2D node by clicking Shift+A, typing in “stabilize 2D”
* Drop the Stabilize 2D node onto the line connecting Movie Clip node to Composite node
* Connect the Stabilize 2D node with Viewer by Ctrl+Sfift+Click on Stabilize 2D node (or connecting the yellow dot on Stabilize 2D with the yellow dot on the Viewer)
* In Stabilize 2D node, click the drop-down menu, and select the video for which stabilization tracks were made (it should be the same as the video selected in the Movie Clip node)
* Can scrub through the footage to ensure the stabilizations worked. Can zoom in and out of the timeline by hovering the cursor over the grey time line at the bottom of the screen and scrolling the mouse wheel in or out. It is helpful if you can see the entire timeline of the clip, which is depicted with light-grey color as opposed tro dark grey.

Export

* In the Context. Render  tab on the right, select Eevee for Render Engine
* In the Context. Output  tab on the right:
  + check frame rate and End frame number
  + specify the output format (PNG for images, FFmpeg with MPEG-4 Container in Encoding for MP4 videos)
  + choose 0% compression for PNG, or lossless Output Quality for MP4
  + click on the browse  button to specify output location and output file name
* In the output tab, experiment with different X and Y resolution values, then press Render -> Render image to see if all the pixels fit
* Also experiment with recentering the image by changing Target X and Y values: in the Layout ribbon on the stabilization tab on the right below autoscale in “Target” section you can adjust the centre of the image by changing the values of X and Y.
  + Try this on the first frame and last frame and a frame or frames in between
* Shift+LeftArrow to go to the first frame
* In the top ribbon, click Render -> Render Animation, or Ctrl+F12