Methods for Video Analysis in Bio-medical Images (an ImageJ based tutotial)

A few links : http://gibbs.engr.ccny.cuny.edu/technical/Tracking/RoachTrack.php

for MATLAB fans *or* http://fiji.sc/Fiji or http://icy.bioimageanalysis.org/ or http://www.ipol.im/

I chose Fiji.
Resources: http://www.math-info.univ-paris5.fr/~lomn/Cours/CV/Material/
(file *TPVideo.pdf* and software fiji-linux64.Core.tar.gz and Data)(For the lecture see /Cours/CV/BME/)

Part 1 : Optical Flow

- Start by applying a **small** rigid transform to an image like the *blobs.gif* one. ***Menu Transform/Interactive Rigid (exists in Fiji : rotate 5 degrees and translate 5 pixels if not available)***

- Save *blobs.gif* as *blobs1.gif* and the transformed one as *blobs2.gif*.

- Open the two images and make a stack out of both of them. ***Menu Images/Images to Stack (or so)***

→ a stack is like a video sequence for us ? Can it be like a 3D image ?

- Apply the plugin ***Optical Flow/Gaussian approach*** *and check the Display color map box*. Analyze the results. *(exists in Fiji in the menu Plugins/Optic Flow)*

→ What does it mean Gaussian here ?

- Do it again after applying an ***Integral Image Filter*** like the ***Mean***.

→ Are the results very different ? Do you know the difference between Mean and Median filtering ?

- From *books*, create an image sequence by importation of the folder *books* ***(Images to Track)***. Then apply image processing on it for pre-processing and then use the ***Optical Flow*** menus.

- Then compute various optical flows with ***bij/FlowJ*** *(install the plugin from http://bij.isi.uu.nl/ and http://webscreen.ophth.uiowa.edu/bij/flowj.htm or my website) (exists in Fiji in the menu Analyze/Optic Flow)*

→ Lukas and Kanade is the extended algorithm based on the one described in the lecture.

- From two medical images from a sequence like *t420.tif* and *t421.tif (from the ISBI 2015 challenge http://www.codesolorzano.com/celltrackingchallenge/Cell_Tracking_Challenge/Datasets.html)* find **differences**, **SIFT points of correspondences**, **flow etc.**

→ what kind of images are they?

- With *t026.tif* et *t027.tif* create a stack, binarize by threshold adjustment, remove outliers, filter with a mean and process the gaussian optical flow. Try the ***Lucas-Kanade*** one in ***Analyze/Optic Flow***

→ *is it adapted to this sequence ?*

Part 2 : ffmepg to manipulate video sequence

It is a tool very useful for video editing (linket to the codev library lib-av). Find below examples :

ffmpeg -i input.avi -c:a aac -b:a 128k -c:v libx264 -crf 23 output.mp4
ffprobe -show_streams -i "file.mp4"
mediainfo Dream.House.sample.mkv
avprobe -show_streams file.mp4
ffmpeg -i slow.mp4 -s 320x240 -c:a copy smallslow.mp4
ffmpeg -i video.avi -an -vcodec rawvideo -y video2.avi
ffmpeg -i redcar.mp4 -i redcareverse.mp4 -filter_complex "blend=all_mode='overlay':all_opacity=1.0" output3.mp4

You need to distinguish between the container mp4 and the coding scheme like h264 bitstream see an example from **https://stackoverflow.com/questions/7333232/concatenate-two-mp4-files-using-ffmpeg)**

ffmpeg -i input1.mp4 -c copy -bsf:v h264_mp4toannexb -f mpegts input1.ts
ffmpeg -i input2.mp4 -c copy -bsf:v h264_mp4toannexb -f mpegts input2.ts
ffmpeg -i "concat:input1.ts|input2.ts" -c copy output.mp4

- Explain why some *avi* videos in the tutorial folders cannot be read by Fiji.
- Find a solution
- Please create the videos *redcaroverlay.mp4* video.

Part 3 : Tracking

- Open the image *Track_for_TrakMate* from the samples menu.
- Project the stacks on one image with max intensity (Menu ***Image/Stack/ZProject***)
- Threshold it with Adjust threshold.
- Try to use the TrackMate plugin (https://imagej.net/Getting_started_with_TrackMate and https://imagej.net/TrackMate)
- Then launch the tracker ***MTrack2*** *(http://fiji.sc/MTrack2 and http://www.imagescience.org/meijering/software/mtrackj/)*
- Redo it with another threshold to remove or add noise.
- Which tracks to keep ?

To go beyond (Fiji is always evolving by plugin additions in labs : yourself soon :-)) :

- The **ToAST** plugin (Tool for Automated Sporozoite Tracking or more generally to adress the questions of motility directionality http://fiji.sc/ToAST) with image *Malaria Sporozoites*

- The MOSAIC plugin to efficiently track multiple targets.
  http://courses.washington.edu/me333afe/ImageJ_tutorial.html
  http://mosaic.mpi-cbg.de/ParticleTracker/ and http://fiji.sc/Particle_Tracker
  http://mosaic.mpi-cbg.de/?q=downloads/imageJ

- Explore the Python examples in the Repertory Python (check if cv2 is installed)
  $python mon_programme.py [argument1]
  Other programmes here also :
  http://www.math-info.univ-paris5.fr/~lomn/Cours/CV/SeqVideo/Material/TPVideoPython/