matPTV

This is a particle tracking library for MATLAB. The code is based on a collection of algorithms developed by David Grier, John C. Crocker, Eric Weeks, Eric Dufresnes. See the original algorithms here: http://site.physics.georgetown.edu/matlab/code.html

Usage:

This library is designed to track the motion of fluorescent micro-spheres. It works best when particles are brightly lit on a dark background, and well separated (by at least 1 particle width).

Example Code:

```
%% Load Image Data
DIR = './YOUR IMAGE DIR'
flist = dir(fullfile(DIR,'*.tif')); %list all TIFF images in DIR
nF = numel(flist); %number of pictures in DIR
info = imfinfo(fullfile(DIR,flist(1).name)); %get image size for prealloc
%preallocate memory for images
imstack = zeros(info.Height,info.Width,nF);
%Load Images
for f=1:nF
   imstack(:,:,f) = mat2gray(imread(fullfile(DIR,flist(f).name)));
end
```

```
%% Find Particle Locations
bpass_lnoise = 1; %approximate size of image noise (in pixels)
bpass_sz = 9;   %approximate particle size in pixels
pkfnd_sz = 9;   %size of region around particle center (~bpass_sz) [optional]
pkfnd_th = .001; %minimum threshold for local maxima [optional]
cnt_sz = 9; %approx particle size

cnt = cell(nF,1); %cell array to hold centroid locations in each frame
for f=1:nF
   %apply a bandpass filter to enhance particles
   B=bpass(imstack(:,:,f), bpass_lnoise,bpass_sz);
   %find local maxima
   PKS = pkfnd(B); %use mean image intensity as threshold, no size limit
   %PKS = pkfnd(B,pkfnd_th,pkfnd_sz); %use threshold & size
   %find sub-pixel centroid location
   cnt{f} = cntrd2(B,PKS,cnt_sz); %original method by Greir et al.
   %cnt{f} = cntrd2(B,PKS,cnt_sz); %more accurate, slower (by R.Parthasarthy)
end
```

```
%concatinate results into a form usable by trackPTV()
nrows = 0;
for f=1:nF
    nrows = nrows + size(cnt{f},1);
```

```
end

cnts = NaN(nrows,3);
r=1;
for f=1:nF
    nr = size(cnt{f},1);
    cnts(r:r+nr-1,1:2) = cnt{f}(:,1:2);
    cnts(r:r+nr-1,3) = f;
    r=r+nr;
end
%delete any missing rows
cnts(isnan(cnts(:,1)),:) = [];
```

```
%% Track Particles
% Link particle locations into tracks
maxdsp = 3; %maximum centroid displacement in pixels
param.mem = 4; %number of frames to remember a centroid if it gets lost
param.dim = 2; %number of cols to pad output with
param.good = 0.8*nF; %minimum number of frames a track must have data for
param.quiet = true; %don't talk to us

tracks = track2array(trackPTV(cnts,maxdsp,param)); %calc tracks
[nF,~,nID] = size(tracks); %tracks(:,:,:) = <nF x 2 x nID>
```