Methods S1. Adaptive Local z-Projection Macro (MATLAB), Related to Star methods

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%Matlab macro building a local projection of two channels using one channel
as %reference
% Can be used to locally follow the curvature of tissue and project only a
% limited number of planes for the second channel.
% Ideally reference channel has to be E-cad::GFP or any signal that is
% restricted in a single plane.
% Each z-stack has to be saved in a folder called 'zstacks' with the
% following structure : "C0_time.tif" and "C1_time.tif" with time being the
% frame number
%

clear all
close all
folder='zstacks';

%Main variables-------------------------------------------------------------

zmax=40      % Number of z plane;
tmax=100;    % Number of time;
t0=1;        % Number of time;
METH=1;      % Choice for the method of local projection: 0=MEAN , 1=STDdev
dxy=40;      % Size of the analysis window/2
xystep=20;   % Sampling frequency (step size for shifting the window)
dz=3;        % Number of z planes that will be projected for the second
channel
dz0=6;       % Shift of the central position of the projection for the second
channel compared to the reference channel
gg=50        % Size of the smooth window that will be used to smooth the z
profile
zcad=1;      % Range of max projection for the reference channel (here E-cad)
% ------------------------------------------------------

%%
name_ref= uigetfile( ['*.tif'], 'Open the first TIFF Zstack of the Reference
channel' ) ;
name_ca= uigetfile( ['*.tif'], 'Open the first TIFF Zstack of the cic
channel' ) ;
%%
mkdir local_zprojection
tic
% Loop for all the time (from t0 to tmax)
for t=t0:1:tmax


    name=[name_ref(1:size(name_ref,2)-7), '_t', num2str(t),'.TIF']
    name_CIC=[name_ca(1:size(name_ca,2)-7), '_t', num2str(t),'.TIF']
    I0=imread(name,1);
    mean_z=zeros(1,zmax);
    STANDARD_z=zeros(1,zmax);
    sum_all=zeros(size(I0));sum_all=double(sum_all);
    for z=1:zmax
        I0=imread(name,z);
        mean_z(z)=mean(I0(:));
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        STANDARD_z(z)=std2(I0(:));
        sum_all=sum_all+double(I0);
    end
    sum_all=sum_all/zmax;
    zcenter=find(mean_z==max(mean_z(:)));

%%
    sx=size(I0,1);
    sy=size(I0,2);
    tic
    XYZ=zeros(zmax, sx,sy);
    X=[];Y=X;
    z1=1;
    z2=zmax;
    for z=z1:z2

        I0=imread(name,z);
        i=0;
        for x=[1:xystep:sx sx] %take care if final 1:xystep:sx is not equal
to sx
            i=i+1;
            j=0;
            for y=[1:xystep:sy sy]
                j=j+1;
                X(i,j)=x;
                Y(i,j)=y;
                rect=[y-dxy x-dxy 2*dxy 2*dxy ];
                Icut=imcrop(I0, rect);
                if METH==0  %Calculate the mean intensity in the analysis
window
                    XYZ(z,i,j)=mean(Icut(:));
                elseif METH==1 %Calculate the standard deviation of intensity
in the analysis window
                    XYZ(z,i,j)=std2(Icut(:));
                end
            end
        end
    end
    imax=i;
    jmax=j;
    toc
    pos_z=[];
    for i=1:imax
        for j=1:jmax
            if isnan(max(XYZ(z1:z2,i,j)))
                pos_z(i,j)=0;
            else
                pos_z(i,j)=min(find(XYZ(:,i,j)==max(XYZ(z1:z2,i,j))));%min to
remove singleton
            end
        end
    end
    x=X(:,1)';
    y=Y(1,:);
    [xq,yq]=meshgrid(1:sy,1:sx);
    NEW_pos_z=interp2(y,x,pos_z,xq, yq);
```

```
%% Filter the z profile  (gg is the size of the gaussian filter window)
    h=fspecial('gaussian',gg,gg);
    TEST=imfilter(NEW_pos_z,h);
    NEW_pos_z2=round(TEST);
    I0=imread(name,1);
    TEMP=zeros(size(I0));
    I0Z=zeros(zmax,size(I0,1),size(I0,2));
    for z=1:zmax
        z;
        I0Z(z,:,:)=imread(name,z);
    end
% Local projection of the reference channel based on the local position
% defined above
    for x=1:size(I0,1)
        for y=1:size(I0,2)
            z0=round(NEW_pos_z2(x,y));
            z1=max(z0-zcad,1);
            z2=min(z0+zcad,zmax);
            TEMP(x,y)=max(I0Z(z1:z2,x,y));
        end
    end
    I_CAD=TEMP;

% Local projection on the second channel based on the local plane of
reference (New_pos_z2 matric)
    I0=imread(name_CIC,1);
    TEMP=zeros(size(I0));
    I0Z=zeros(zmax,size(I0,1),size(I0,2));
    for z=1:zmax
        z;
        I0Z(z,:,:)=imread(name_CIC,z);
    end

    for x=1:size(I0,1)
        for y=1:size(I0,2)
            z0=round(NEW_pos_z2(x,y))+dz0;
            z1=max(z0-dz,1);
            z2=max(z0+dz,1);
            z2=min(z2,zmax);
            TEMP(x,y)=max(I0Z(z1:z2,x,y));
        end
    end
    I_CIC=TEMP;
    if t==1
        imwrite(uint16(I_CAD),['local_zprojection\cad_localproject.tif'])
        imwrite(uint16(I_CIC),['local_zprojection\yfp_localproject.tif'])
    else

imwrite(uint16(I_CAD),['local_zprojection\cad_localproject.tif'],'WriteMode',
'Append')

imwrite(uint16(I_CIC),['local_zprojection\yfp_localproject.tif'],'WriteMode',
'Append')
    end
toc
```

```
%%
end
toc
```