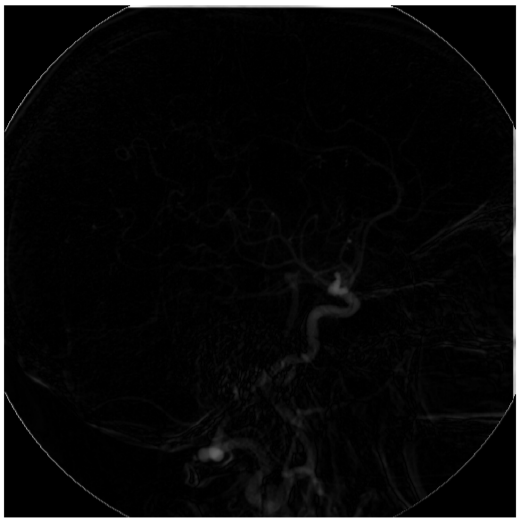
```
% 1. Initial Setup
clc; clear;
live = imread('live_new.tif');    % Reference image (with contrast)
mask = imread('mask_new.tif');    % Floating image (no contrast)
[m, n] = size(live);

% Convert to double for numerical operations
live = double(live);
mask = double(mask);

% Calculate initial subtraction (before registration)D:\drive\OneDrive - Case
Western Reserve University\FILE\2025spring\EBME461 Image\GroupProject\HW04
diff_before = live - mask;

% Setup optimization parameters
param = struct();
param.scaling = 1;  % Start with no scaling
```

cost function

```
function cost = registrationcost(params, fixedImage, movingImage)
    persistent frames;
    if isempty(frames)
        frames = struct('cdata', {}, 'colormap', {});
    end

    % Extract translation parameters
    tx = params(1);
    ty = params(2);

    % Translate the moving image
    translatedImage = imtranslate(movingImage, [tx, ty]);
    row_i= ceil(abs(ty)+1);
    col_i= ceil(abs(tx)+1);

    % Compute the difference image
    differenceImage = abs(fixedImage - translatedImage);

    % Compute the sum of squared errors
    cost = sum(differenceImage(row_i:end,col_i:end).^2,"all");

    % Capture the difference image as a frame
    figure(100);
    imshow(uint8(differenceImage));
    drawnow;
    frame = getframe(gcf);
```

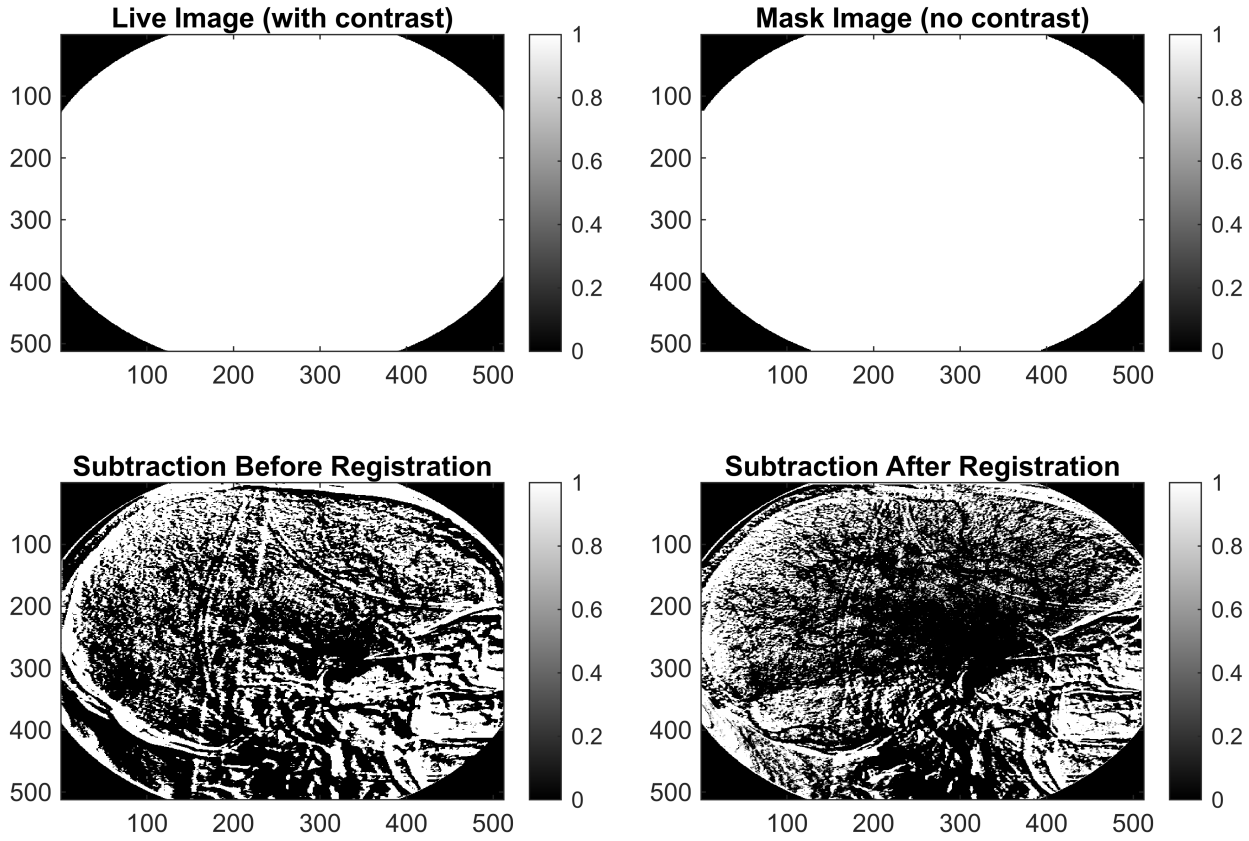
```
    % Store the frame
    frames(end+1) = frame;

    % Assign the updated frames to the base workspace
    assignin('base', 'frames', frames);
end
```

```
% Setup cost function
costF= @(t) registrationcost(t, live, mask);

% Create the output function with additional parameters
outfun = @(x, optimVals, state) regOutFun(x, optimVals, state, live, mask, param);

% Set optimization options
options = optimset( 'TolFun',1e-3, 'TolX',1e-3);


% Run optimization
t_i= [0,0];
[t_optimal, fval]= fminsearch(costF, t_i, options);
```



```
% Apply optimal translation to create registered image
translated = imtranslate(mask, [t_optimal(1), t_optimal(2)], 'OutputView', 'same');

% Calculate final subtraction
diff_after = live - translated;

% Display results
```

```
figure('Position', [100 100 1200 800]);
tiledlayout(2,2)

% Original live image
nexttile
imagesc(live)
colormap('gray')
title('Live Image (with contrast)')
colorbar

% Original mask image
nexttile
imagesc(mask)
title('Mask Image (no contrast)')
colormap('gray')
colorbar

% Subtraction before registration
nexttile
imagesc(diff_before)
title('Subtraction Before Registration')
colormap('gray')
colorbar

% Subtraction after registration
nexttile
imagesc(diff_after)
title('Subtraction After Registration')
colormap('gray')
colorbar
```




```
% Print optimization results
fprintf('\nOptimization Results:\n');
```

```
Optimization Results:
```

```
fprintf('Optimal translation parameters:\n');
```

```
Optimal translation parameters:
```

```
fprintf('X translation: %.4f pixels\n', t_optimal(1));
```

```
X translation: -2.7493 pixels
```

```
fprintf('Y translation: %.4f pixels\n', t_optimal(2));
```

```
Y translation: 2.3540 pixels
```

```
fprintf('Final cost value: %.4f\n', fval);
```

```
Final cost value: 119796838.5850
```

```
fprintf('Number of iterations: %d\n', output.iterations);
```

```
Unable to resolve the name 'output.iterations'.
```

```
fprintf('Exit flag: %d\n', exitflag);
```

```
% Save results
save('dsa_registration_results.mat', 't_optimal', 'fval', 'output');
```