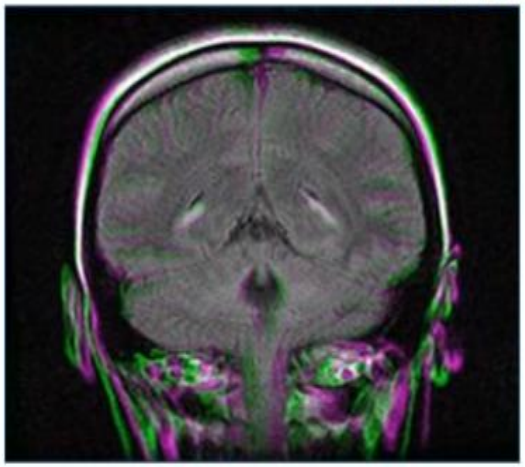
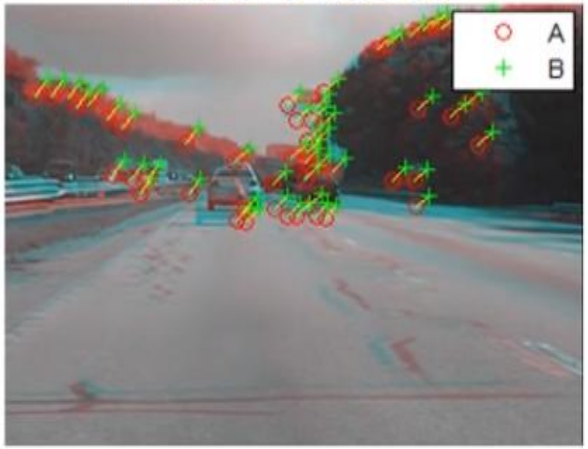
Automatic Image Registration

Intensity-based



Feature-based



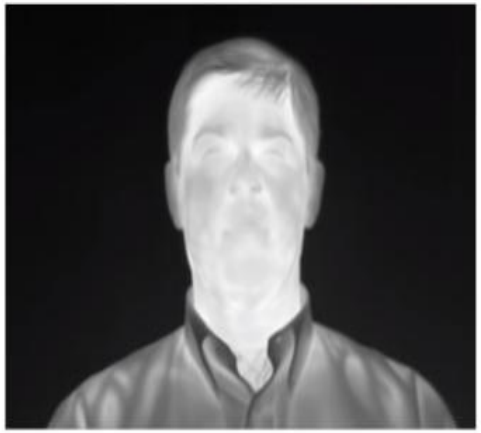
Two new registration types supported:

- Intensity-based (Image Processing Toolbox)
- Feature-based (Computer Vision System Toolbox)

Demo: Image Registration

Webcam image

Thermal IR image



Goal: Register the image pair to detect the eyes and measure body temperature

ThermalScreening.m

```
%% Read in the image pair
Fixed = imread('IR_image.png');
Moving = imread('Webcam_image.png');
Moving = rgb2gray(Moving);

%% View the 2 images
imshow(Moving);
% Use imtool to view the IR image
imtool(Fixed);

%% View the images side by side in a montage
imshowpair(Fixed,Moving,'montage');

%% Configure parameters in imregconfig
[optimizer,metric] = imregconfig('Multimodal');

%% Default registration
registered = imregister(Moving,Fixed,'translation',optimizer,metric);
figure;
imshowpair(registered,Fixed);
title('falsecolor');

%% Change visualization in imshowpair
figure;
imshowpair(registered,Fixed,'blend');

%% Change transformType in imregister
registered = imregister(Moving, Fixed,'affine',optimizer,metric);
figure;
imshowpair(registered,Fixed);
title('Intermediate Registration');

```

falsecolor

```
33      %% Modifications to optimizer/metric and transform type
34 -    optimizer.GrowthFactor = 1.16974;
35 -    optimizer.Epsilon = 0.75401;
36 -    metric.NumberOfSpatialSamples = 500;
37 -    metric.NumberOfHistogramBins = 90;
38 -    optimizer.InitialRadius = 0.00675;
39 -    optimizer.MaximumIterations = 100;
40
41      %% Final registration
42 -    registered = imregister(Moving, Fixed,'Similarity',optimizer,metric);
43 -    figure;
44 -    imshowpair(registered,Fixed);title('Final Registration');
45
46      %% Detect the eyes in the RGB image
47 -    eyesDet = vision.CascadeObjectDetector('EyePairSmall');
48 -    bbox = step(eyesDet, Moving);
49 -    drawBox = vision.ShapeInserter('BorderColor','Black');
50 -    image = step(drawBox, registered, int32(bbox));
51 -    hold on; rectangle('Position',bbox,'EdgeColor',[1 1 0]);
52 -    subsIR = int32(bbox(:,1:2)+bbox(:,3:4)/2);
53
54      %% Compute temperature near the eyes
55 -    value = mean2(imcrop(registered,bbox));
56 -    foreheadTemperature = value/10 - 272; % In Celcius
57 -    foreheadTemperature =  (foreheadTemperature*9/5) + 32; % Convert to Fare
58
```

Intermediate Registration

Final Registration

ThermalScreening.m

```
51 -    hold on; rectangle('Position',bbox,'EdgeColor',[1 1 0]);
52 -    subsIR = int32(bbox(:,1:2)+bbox(:,3:4)/2);
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54      %% Compute temperature near the eyes
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56 -    foreheadTemperature = value/10 - 272; % In Celcius
57 -    foreheadTemperature =  (foreheadTemperature*9/5) + 32; % Convert to Fare
58
59      %% Embed temperature on IR image and display
60 -    ti = vision.TextInserter('Color',[255 0 0]);
61 -    ti.Location = int32(bbox(:,1:2)+bbox(:,3:4)/2);
62 -    ti.Text = sprintf('%3d F', int8(foreheadTemperature));
63 -    contAdj = vision.ContrastAdjuster('CustomProductInputDataType',numericty
64 -    imageContrastAdjusted = step(contAdj, Fixed);
65 -    textAdded = step(ti, imageContrastAdjusted);
66 -    text(320, 180,'98 \circ F ','Color',[1 1 0])
67      % finalImage = step(drawBox, textAdded, int32(bbox));
68      % imshow(finalImage);
69
70
```
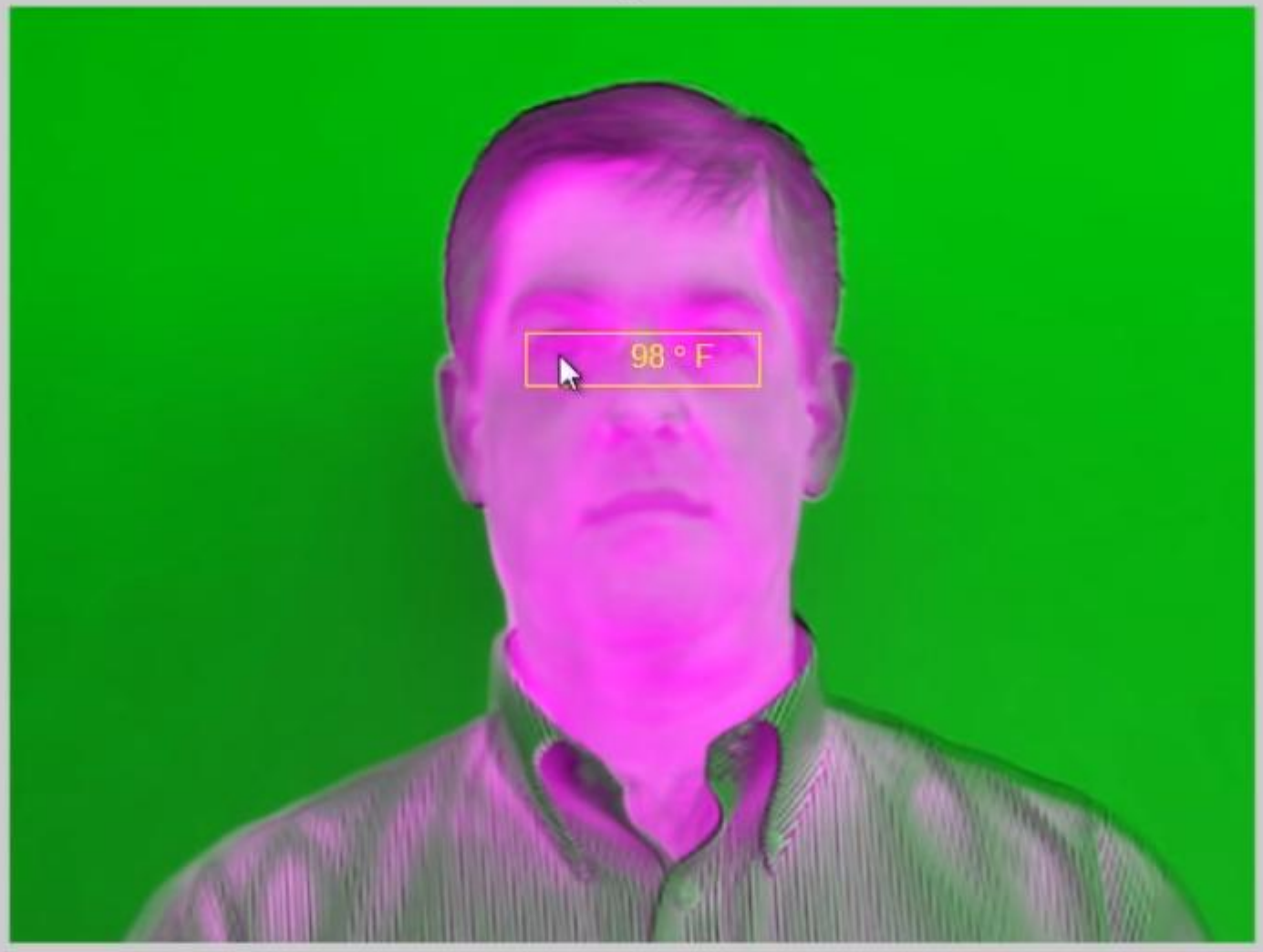

Final Registration



Demo Summary: Image Registration

- Acquire images into MATLAB
- Visualize images
- Automatic image registration
- Feature detection using Viola-Jones detector
- Text annotation on the image

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THANKS