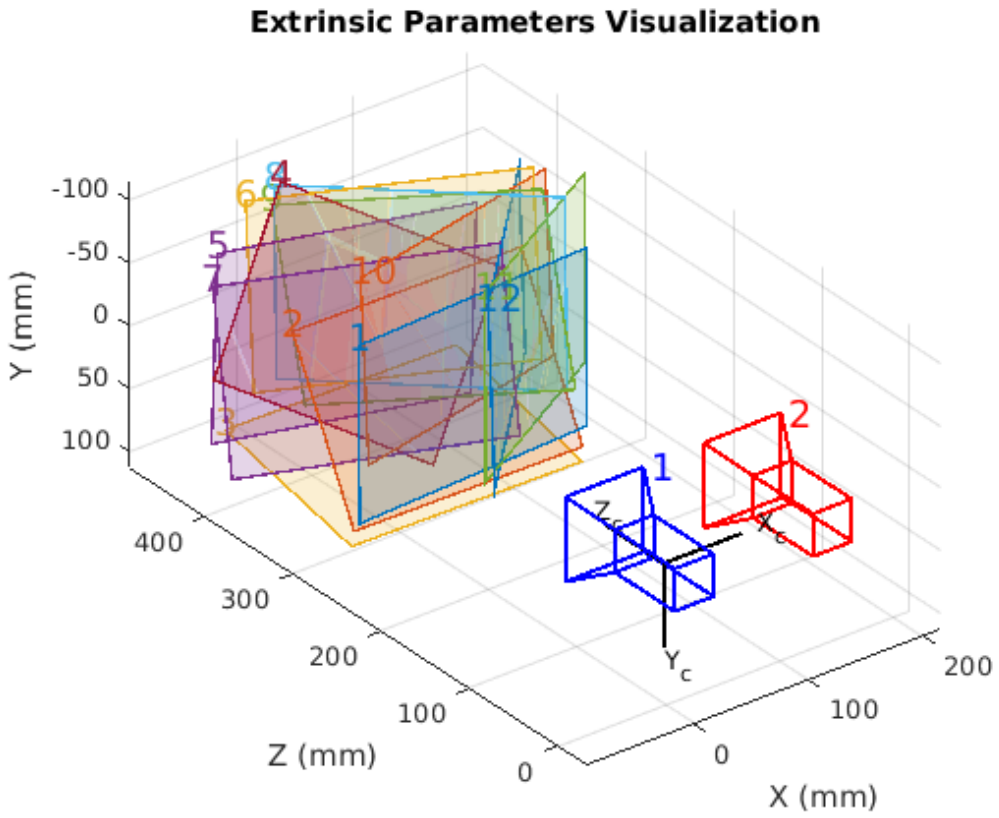
Table of Contents


```
clear
clc
close all
```

Initializing the parameters

Load the stereoParameters object.

```
load('handshakeStereoParams.mat');

% Visualize camera extrinsics.
showExtrinsics(stereoParams);
```

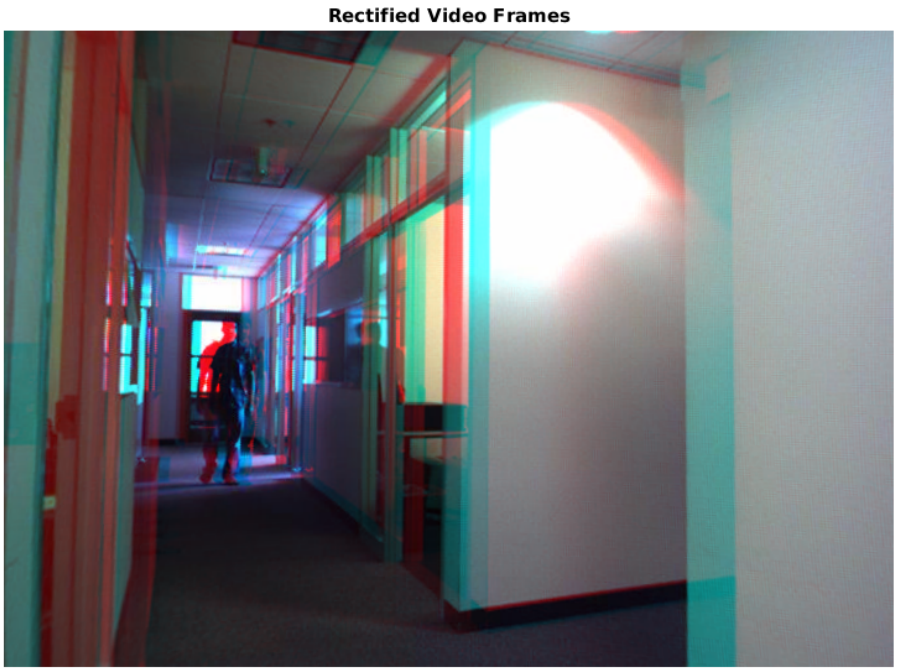


Creating video player

```
videoFileLeft = 'handshake_left.avi';
videoFileRight = 'handshake_right.avi';

readerLeft =
 vision.VideoFileReader(videoFileLeft, 'VideoOutputDataType', 'uint8');
readerRight =
 vision.VideoFileReader(videoFileRight, 'VideoOutputDataType', 'uint8');
player = vision.DeployableVideoPlayer('Location', [20, 400]);
```

Rectifying the video frames

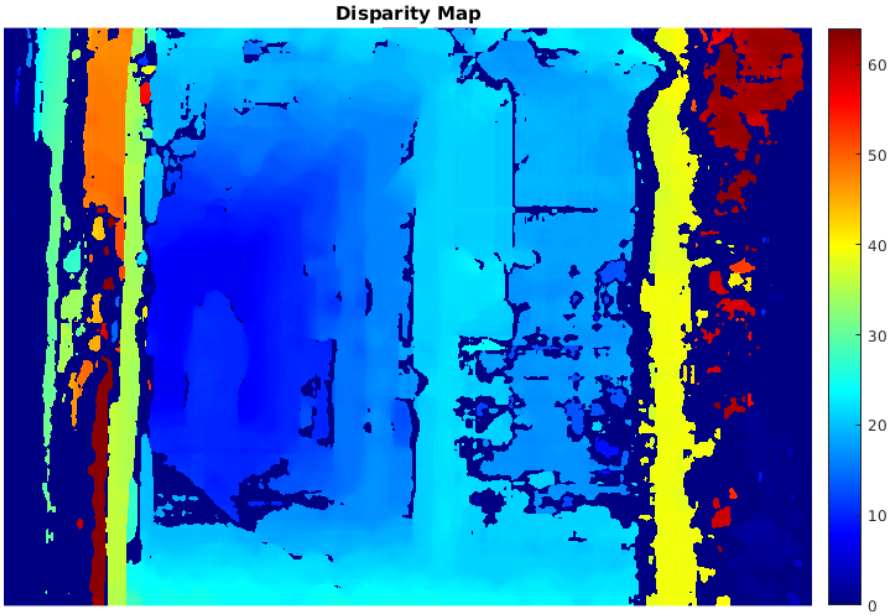
```
frameLeft = readerLeft.step();
frameRight = readerRight.step();

[frameLeftRect, frameRightRect] = ...
    rectifyStereoImages(frameLeft, frameRight, stereoParams);

figure;
imshow(stereoAnaglyph(frameLeftRect, frameRightRect));
title('Rectified Video Frames');
```



Computing the disparity

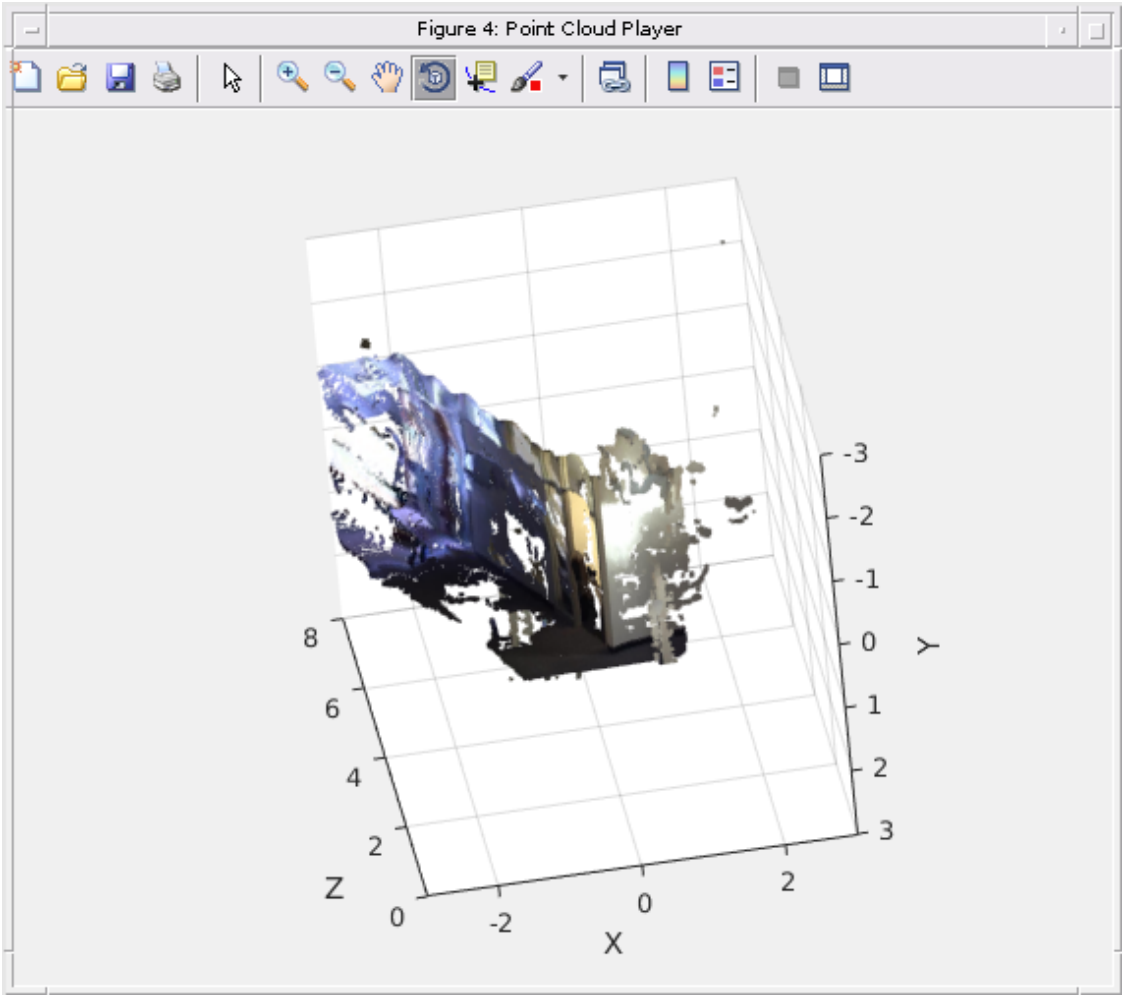
Disparity(distance between the individual left and right pixels) is proportionalto distance of corresponding world from the camera

```
frameLeftGray  = rgb2gray(frameLeftRect);
frameRightGray = rgb2gray(frameRightRect);

disparityMap = disparity(frameLeftGray, frameRightGray);
figure;
imshow(disparityMap, [0, 64]);
title('Disparity Map');
colormap jet
colorbar
```



Reconstructing the 3D scene

```
points3D = reconstructScene(disparityMap, stereoParams);

% Convert to meters and create a pointCloud object
points3D = points3D ./ 1000;
ptCloud = pointCloud(points3D, 'Color', frameLeftRect);

% Create a streaming point cloud viewer
player3D = pcplayer([-3, 3], [-3, 3], [0, 8], 'VerticalAxis', 'y', ...
    'VerticalAxisDir', 'down');

% Visualize the point cloud
view(player3D, ptCloud);
```



Detecting the people in the left image

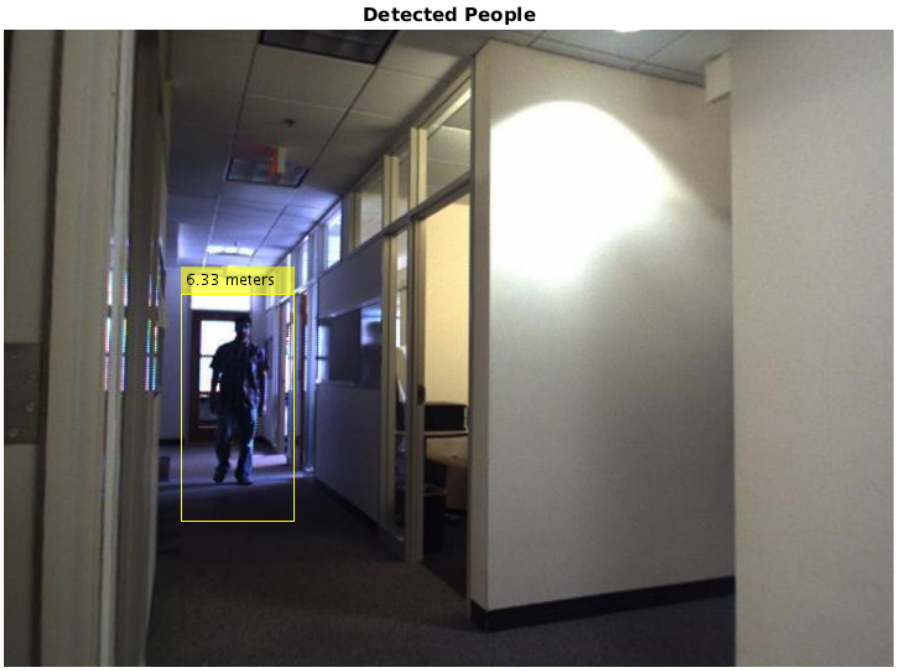
Create the people detector object. Limit the minimum object size for speed.

```
peopleDetector = vision.PeopleDetector('MinSize', [166 83]);

% Detect people.
bboxes = peopleDetector.step(frameLeftGray);
```

Determine The Distance of Each Person to the Camera

```
%Find the 3-D world coordinates of the centroid of each detected
 person and compute the distance from the centroid to the camera in
 meters.

% Find the centroids of detected people.
centroids = [round(bboxes(:, 1) + bboxes(:, 3) / 2), ...
    round(bboxes(:, 2) + bboxes(:, 4) / 2)];
```

```
% Find the 3-D world coordinates of the centroids.
centroidsIdx = sub2ind(size(disparityMap), centroids(:, 2),
 centroids(:, 1));
X = points3D(:, :, 1);
Y = points3D(:, :, 2);
Z = points3D(:, :, 3);
centroids3D = [X(centroidsIdx)'; Y(centroidsIdx)'; Z(centroidsIdx)'];

% Find the distances from the camera in meters.
dists = sqrt(sum(centroids3D .^ 2));

% Display the detected people and their distances.
labels = cell(1, numel(dists));
for i = 1:numel(dists)
    labels{i} = sprintf('%0.2f meters', dists(i));
end
figure;
imshow(insertObjectAnnotation(frameLeftRect, 'rectangle', bboxes,
 labels));
title('Detected People');
```

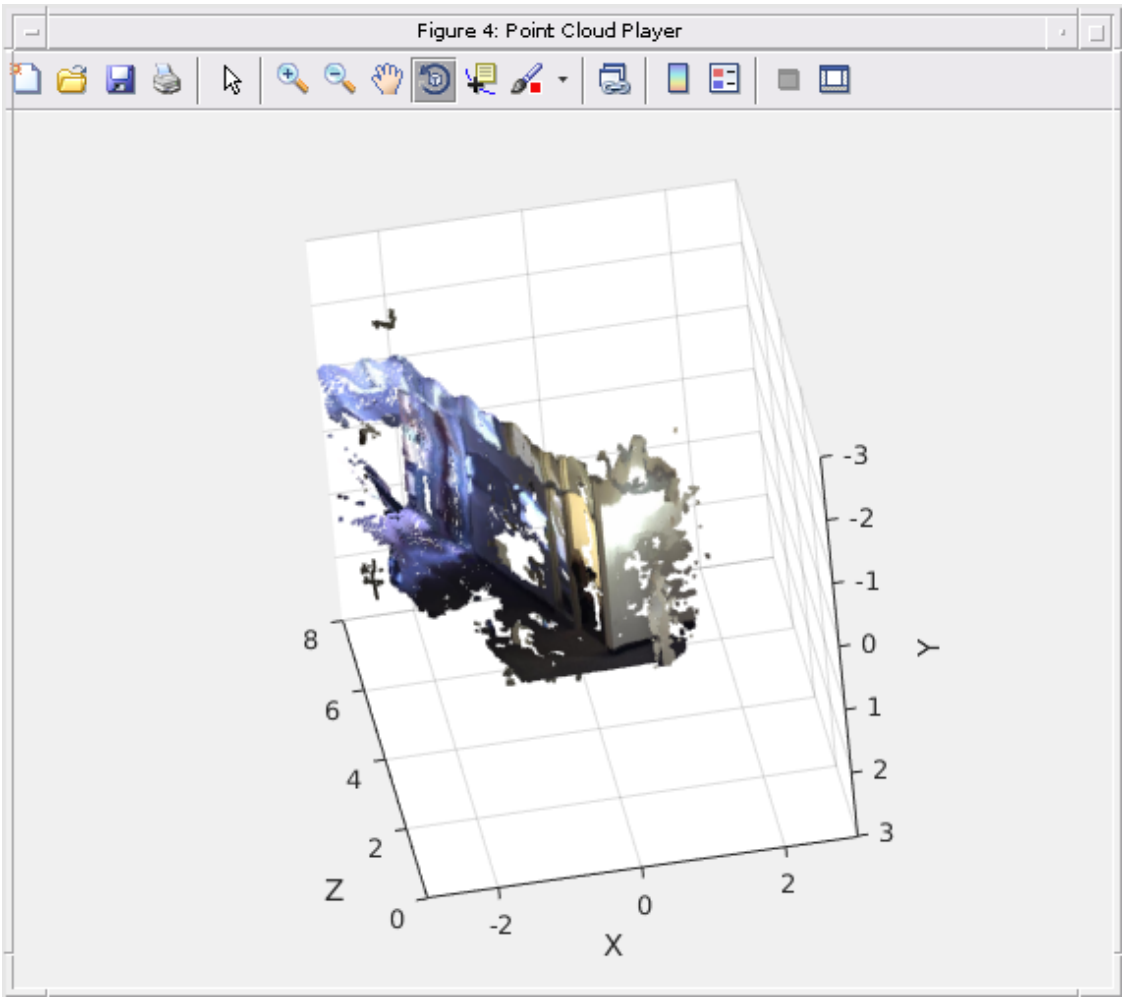


Process the rest of the video

```
while ~isDone(readerLeft) && ~isDone(readerRight)
    % Read the frames.
    frameLeft = readerLeft.step();
    frameRight = readerRight.step();
```

```
    % Rectify the frames.
    [frameLeftRect, frameRightRect] = ...
        rectifyStereoImages(frameLeft, frameRight, stereoParams);

    % Convert to grayscale.
    frameLeftGray  = rgb2gray(frameLeftRect);
    frameRightGray = rgb2gray(frameRightRect);

    % Compute disparity.
    disparityMap = disparity(frameLeftGray, frameRightGray);

    % Reconstruct 3-D scene.
    points3D = reconstructScene(disparityMap, stereoParams);
    points3D = points3D ./ 1000;
    ptCloud = pointCloud(points3D, 'Color', frameLeftRect);
    view(player3D, ptCloud);

    % Detect people.
    bboxes = peopleDetector.step(frameLeftGray);

    if ~isempty(bboxes)
        % Find the centroids of detected people.
        centroids = [round(bboxes(:, 1) + bboxes(:, 3) / 2), ...
            round(bboxes(:, 2) + bboxes(:, 4) / 2)];

        % Find the 3-D world coordinates of the centroids.
        centroidsIdx = sub2ind(size(disparityMap), centroids(:, 2),
centroids(:, 1));
        X = points3D(:, :, 1);
        Y = points3D(:, :, 2);
        Z = points3D(:, :, 3);
        centroids3D = [X(centroidsIdx), Y(centroidsIdx),
Z(centroidsIdx)];

        % Find the distances from the camera in meters.
        dists = sqrt(sum(centroids3D .^ 2, 2));

        % Display the detect people and their distances.
        labels = cell(1, numel(dists));
        for i = 1:numel(dists)
            labels{i} = sprintf('%0.2f meters', dists(i));
        end
        dispFrame = insertObjectAnnotation(frameLeftRect, 'rectangle',
bboxes,...
            labels);
    else
        dispFrame = frameLeftRect;
    end

    % Display the frame.
    step(player, dispFrame);
end

% Clean up.
```

```
reset(readerLeft);
reset(readerRight);
release(player);
```



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