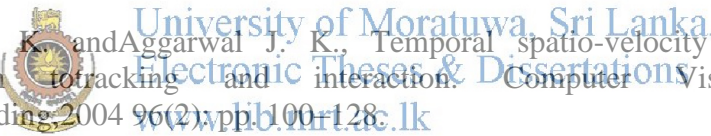


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**Program 1: Kalman Initialization**

```
// Kalman initialization
CvKalman* InitializeKalman(CvKalman* kalman)
{
    const float A[] = {1,0,1,0,
                       0,1,0,1,
                       0,0,1,0,
                       0,0,0,1};
    kalman = cvCreateKalman( 4, 2, 0 );
    memcpy( kalman->transition_matrix->data.fl, A, sizeof(A)); //A
    cvSetIdentity( kalman->measurement_matrix, cvScalarAll(1) ); //H
    cvSetIdentity( kalman->process_noise_cov, cvScalarAll(1e-5)
); //Q w;
    cvSetIdentity( kalman->measurement_noise_cov, cvScalarAll(1e-1)
); //R v
    cvSetIdentity( kalman->error_cov_post, cvScalarAll(1)); //P
    return kalman;
}
```

**Program 2: Get Current State and Measurement State**

```
void GetCurrentState( CvKalman* kalman, CvPoint point1, CvPoint
point2)
{
    float input[4] = {point2.x, point2.y, point2.x-point1.x,
point2.y-point1.y}; //current state
    memcpy( kalman->state_post->data.fl, input, sizeof(input));
}

CvMat* GetMeasurement(CvMat* mat, CvPoint point1, CvPoint point2)
{
    float input[4] = {point2.x, point2.y, point2.x-point1.x,
point2.y-point1.y};
    memcpy( mat->data.fl, input, sizeof(input));
    return mat;
}
```

**Program 3: Select Object**

```
if( select_object )
{
    selection.x = MIN(x,origin.x);
    selection.y = MIN(y,origin.y);
    selection.width = selection.x + CV_IABS(x - origin.x);
    selection.height = selection.y + CV_IABS(y - origin.y);

    selection.x = MAX( selection.x, 0 );
    selection.y = MAX( selection.y, 0 );
    selection.width = MIN( selection.width, image->width );
    selection.height = MIN( selection.height, image->height );
    selection.width -= selection.x;
    selection.height -= selection.y;
}
```

```

switch( event )
{
    case CV_EVENT_LBUTTONDOWN:
        origin = cvPoint(x,y);
        selection = cvRect(x,y,0,0);
        select_object = 1;
        break;
    case CV_EVENT_LBUTTONUP:
        select_object = 0;
        if( selection.width > 0 && selection.height > 0 )
            track_object = -1;
        origin_box=selection;
}

```

#### Program 4: Camshift and Kalman Filter

```

//Predict the target frame position (x, y, vx, vy),
prediction = cvKalmanPredict( kalman, 0 );
predictpoint = calc_point(prediction->data.fl);
//Predict the rectangular box
track_window = cvRect(predictpoint.x -
track_window.width/2, predictpoint.y - track_window.height/2,
track_window.width, track_window.height);
track_window=my_ChangeRect( cvRect(0,0,frame->width,frame-
>height),track_window);
//Only calculate the projection of the target around
search_window = cvRect(track_window.x - region,
track_window.y - region, track_window.width + 2*region,
track_window.height + 2*region);
//Correction search window, to within the range of image
search_window=my_ChangeRect( cvRect(0,0,frame-
>width,frame->height),search_window);
cvSetImageROI( hue, search_window );
cvSetImageROI( mask, search_window );
cvSetImageROI( backproject, search_window );
cvCalcBackProject( &hue, backproject, hist );
cvAnd( backproject, mask, backproject, 0 );
//Because the set_1ROI, so updates track_window
track_window = cvRect(region, region, track_window.width,
track_window.height);
//Calling CAMSHIFT algorithm module
cvCamShift( backproject, track_window, cvTermCriteria(
CV_TERMCRIT_EPS | CV_TERMCRIT_ITER, 2, 1 ), &track_comp);
//cvMeanShift( backproject, track_window, cvTermCriteria(
CV_TERMCRIT_EPS | CV_TERMCRIT_ITER, 10, 1 ),&track_comp);

// The actual coordinates of the centroid
measurepoint = cvPoint(track_window.x + track_window.width/2,
track_window.y + track_window.height/2 );

realposition->data.fl[0]=measurepoint.x;
realposition->data.fl[1]=measurepoint.y;
realposition->data.fl[2]=measurepoint.x - lastpoint.x;
realposition->data.fl[3]=measurepoint.y - lastpoint.y;
lastpoint = measurepoint;//keep the current real position

//Calculate the actual measurement is the current x, y

```

```
cvMatMulAdd( kalman->measurement_matrix/*2x4*/,  
realposition/*4x1*/,/*measurementstate*/ 0, measurement );  
cvKalmanCorrect( kalman, measurement );  
  
cvKalmanCorrect( kalman, measurement );
```



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