Fundamentals of Computer Vision

Project 3

Tracking Objects in Videos

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Q1.1)

We know the Affine warp

$$\mathbf{W}(\mathbf{p}) = \begin{bmatrix} 1+p_1 & p_3 & p_5 \\ p_2 & 1+p_4 & p_6 \\ 0 & 0 & 1 \end{bmatrix}$$

So the Jacobian warp matrix J ($\frac{\partial W}{\partial P}$)

$$Let \quad W([x,y];P) = [W_x, W_y]$$

$$\frac{\partial W}{\partial P} = \begin{bmatrix} \frac{\partial W_x}{\partial P_1} & \frac{\partial W_x}{\partial P_2} & \frac{\partial W_x}{\partial P_3} & \cdots & \frac{\partial W_x}{\partial P_n} \\ \frac{\partial W_y}{\partial P_1} & \frac{\partial W_y}{\partial P_2} & \frac{\partial W_y}{\partial P_3} & \cdots & \frac{\partial W_y}{\partial P_n} \end{bmatrix}$$

For affine warping, n = 6 and so

$$\frac{\partial W}{\partial P} = \frac{\partial \begin{bmatrix} x + xP_1 + yP_3 + P_5 \\ xP_2 + y + yP_4 + P_6 \end{bmatrix}}{\partial P}$$

$$= \begin{bmatrix} x & 0 & y & 0 & 1 & 0 \\ 0 & x & 0 & y & 0 & 1 \end{bmatrix}$$

Q2.4)

Both Lucas kanade and Mattew Baker was not able to track the car till the end of video, the tracker got breakdown when the car changed its lane, the tracker was working fine only till the car was in the starting lane. On compared between kanade and Mattew tracking the car, Mattew tracking was better comparatively, in kanade tracking the tracking frame was not stable in tracking the object, it some times went slightly away from the object (car) but in Mattew the car was always within the frame before the tracker got breakdown.

The reason for this method not tacking the car till the end is because of the assumptions made in the algorithm, that is, it was assumed the motion of the object we tracking is less than 1 pixel, in this video since the car was moving to the other lane which was a huge motion the algorithm failed to detect the car.

One way of recovering from this problem is reduce the resolution of the image.