

2) Consider two images frame Captured at time t and $t + \delta t$ respectively.

Let a point $p(x, y)$ in image 1 displaced to $p(x + \delta x, y + \delta y)$ in image 2

Assuming the intensities of point p does not change in both the images

$$I(x + \delta x, y + \delta y, t + \delta t) = I(x, y, t) \rightarrow (1)$$

From Taylor Series expansion, we can rewrite this as

$$I(x + \delta x, y + \delta y, t + \delta t) = I(x, y, t) + \frac{\partial I}{\partial x} \delta x$$

$$+ \frac{\partial I}{\partial y} \delta y + \frac{\partial I}{\partial t} \delta t$$

$$I(x + \delta x, y + \delta y, t + \delta t) = I(x, y, t) + I_x \delta x + I_y \delta y + I_t \delta t \rightarrow (2)$$

Subtract (1) from (2)

$$I_x \delta x + I_y \delta y + I_t \delta t = 0$$

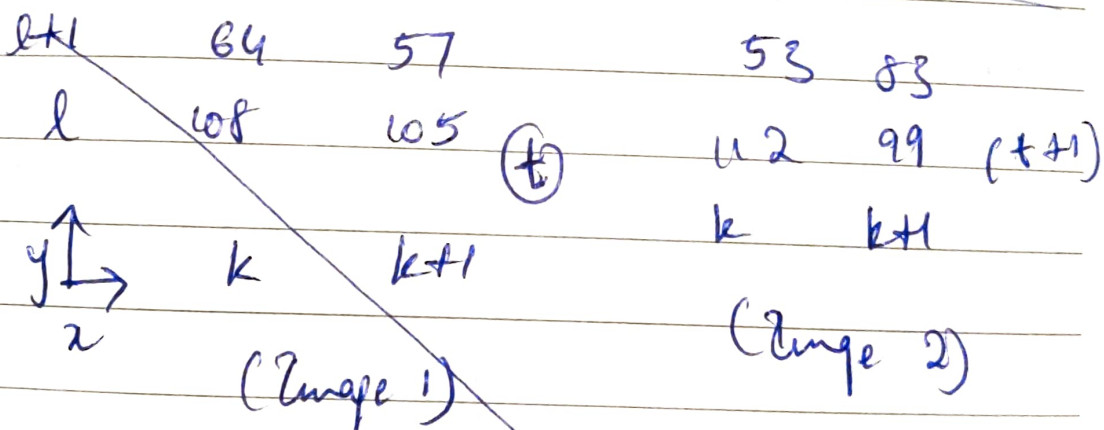
divide by Δt & take limit as $\Delta t \rightarrow 0$

Equation

$$I_x u + I_y v + I_t = 0$$

(u, v) : Optical flow

Considering two consecutive image frames and 2×2 block of pixels from each image



$$I_x = \frac{57 + 105 + 83 + 99}{4} - \frac{64 + 108 + 53 + 112}{4}$$

$$= 86 - 84.25 = 1.75$$

$$I_1 = \frac{64+57+53+83}{4} - \frac{108+105+112+99}{4}$$

$$= 76 - 84.5 = -11.5$$

$$I_2 = \frac{53+83+112+99}{4} - \frac{64+57+108+105}{4}$$

$$= 86.75 - 83.5 = 3.25$$

$l+1$ 54 45
 l 100 98

(f)

48 80
 108 90 (t+1)
 k $k+1$
 (Range 2)

$y \uparrow$
 $z \rightarrow$ k $k+1$
 (Range 1)

$$I_2 = \frac{54+98+90+80}{4} - \frac{56+100+48+108}{4}$$

$$= 80.5 - 77.5 = 3$$

$$\bar{y} = \frac{54+45+48+80}{4} - \frac{100+98+108+90}{4}$$

$$= 56.75 - 99$$

$$= -42.25$$

$$\bar{d} = \frac{54+45+108+98}{4} - \frac{48+80+90+108}{4}$$

$$= 81.5 - 74.25 = 7.25$$