

Let's consider the motion of object is captured from frame 1 to frame 2.

Now consider 2 different illuminations  $I_1$  &  $I_2$

Perform the following :-

① For the first frame (in the time frame before any motion), capture the image/scene with illumination  $I_1$  and the switch to  $I_2$  and capture the scene again.

② For the second frame, capture the scene with illumination  $I_2$  and switch to  $I_1$  and capture the scene again.

∴ So now we have 2 images per frame.

Now we can have 2 constraint equations

$$\begin{aligned} I_{1x}u + I_{1y}v + I_{1t} &= 0 & \text{--- [with illumination } I_1] \\ I_{2x}u + I_{2y}v + I_{2t} &= 0 & \text{--- [with illumination } I_2] \end{aligned}$$

$(u, v)$  for a given  $(x, y)$ , remain same for both illuminations, since we can change illumination at a speed much faster than object motion.

Given 2 equations and 2 unknowns, we can find unique  $(u, v)$ .