Assignment - 3

Q2] A: Part 1

Derive the motion tracking eqn from the fundamental principles

Optical Flow is based on assumption that apparent velocity of the movement of brightness patterns in an image.

Let us assume brightness of an object in a image remains constant. Between two frames. Let $I(x, y, t)$ be brightness at point (x, y) at time t.

$$\therefore I(x, y, t) = I(x + \Delta x, y + \Delta y, t + \Delta t)$$

Lets expand RHS using taylor expansion.

$$I(x + \Delta x, y + \Delta y, t + \Delta t) \approx I(x, y, t) + I_x \Delta x + I_y \Delta y + I_t \Delta t$$

where $\Delta x, \Delta y, \Delta t$ are small
I_x, I_y, I_t are partial derivates of I w.r.t x, y, t

$$\therefore \quad 0 = I_x \Delta x + I_y \Delta y + I_t \Delta t$$ ... since we assume brightness constancy

This is nothing but optical flow equation

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

where $u = \frac{\Delta x}{\Delta t}$, $v = \frac{\Delta y}{\Delta t}$ are components of velocity of the pixel motion.