In the Name of God

Machine Learning and Vision Lab

8th Lab

Pre report

Prof. Mohammadzade

Sajjad Hashembeiki

98107077

Dec 20th 2023

- Bonus

$$Assume\ x = \begin{bmatrix} u \\ v \end{bmatrix}, we\ want\ to\ minimize\ \|Ax - b\|_2^2\ ,thus\ we\ have:$$

$$\|Ax - b\|_2^2 = (Ax - b)^T(Ax - b) = x^TA^TAx - x^TA^Tb - b^TAx + b^Tb$$

$$\rightarrow \frac{\partial}{\partial x} = \frac{x^TA^TAx}{\partial x} - \frac{2b^TAx}{\partial x} = (A^TA + A^TA)x - 2A^Tb = 0$$

$$\rightarrow x = \begin{bmatrix} u \\ v \end{bmatrix} = (A^TA)^{-1}A^Tb$$

1-

 As you know in pyramid an image is successively down-sampled to create a series of images at different resolutions, forming a pyramid structure. Each level of the pyramid represents the same scene but at different scales.

 The pyramid-based approach is often implemented using techniques like the Lucas-Kanade method with pyramids or the Farneback method, which uses a polynomial expansion of the image and calculates optical flow at multiple scales. Optical flow with pyramid is a technique that leverages multi-resolution representations to estimate motion in images, providing scale-invariant, efficient, and robust results.