TASK: VISUAL ODOMETRY

PART 1

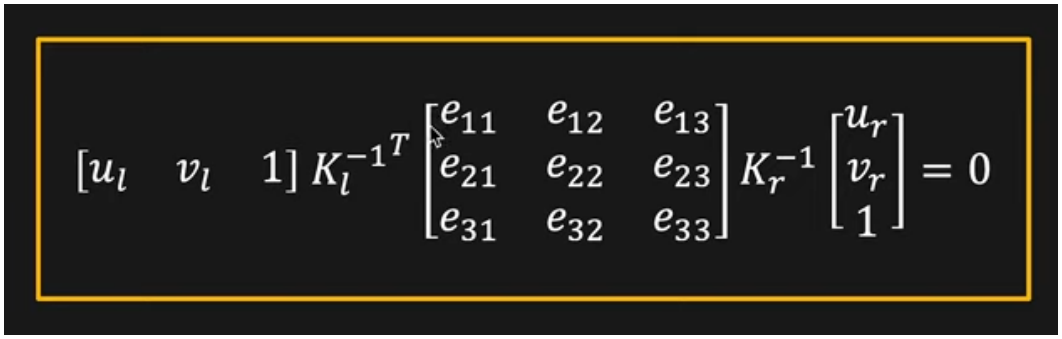
The task involves determining the relative motion between two consecutive camera frames (or images) by using epipolar geometry and calculating the **Essential Matrix (E)**. Visual odometry is crucial in computer vision and robotics to track the movement of a camera in a 3D environment. Here's a breakdown of the task:

1. **Identify Corresponding Points**:

- Given two images (I1 and I2), the task involves detecting and matching corresponding points between them. These points can be obtained using feature matching algorithms (like SIFT, SURF, or ORB).

2. **Compute the Essential Matrix**:

- Using the point correspondences, candidates must compute the Essential Matrix E. The computation of E involves solving the equation below.



$$[u_l \quad v_l \quad 1]\, K_l^{-1^T} \begin{bmatrix} e_{11} & e_{12} & e_{13} \\ e_{21} & e_{22} & e_{23} \\ e_{31} & e_{32} & e_{33} \end{bmatrix} K_r^{-1} \begin{bmatrix} u_r \\ v_r \\ 1 \end{bmatrix} = 0$$

(Image source + reference material: Epipolar Geometry | Uncalibrated Stereo)

3. **Decompose the Essential Matrix**:

- Once the Essential Matrix is computed, the next step is to decompose it to extract the **rotation (R)** and **translation (t)** between the two camera views. This can be achieved using Singular Value Decomposition (SVD).

4. **Interpret the Results and compare with ground truth**:

Interpret what the rotation and translation matrices signify in terms of camera motion between the two images. Also, compare your result with the ground truth.

IMPORTANT NOTES:

- **We are not looking for correct results. We are looking to see your understanding of these concepts and implementation. So don't worry if your result does not match with the ground-truth.**
- **IMAGE DATA : You may use the KITTI dataset for your algorithm. You are also free to use any other dataset you wish to, but it should have the ground truth available so that you can compare your results with the ground truth.**
- **You may refer to: https://www.youtube.com/watch?v=6kpBqfgSPRc**

PART 2

Look into what other methods you can use for Visual Odometry and create a presentation with 1-2 slides.

SUBMISSION:

- Submit a zip file using this form https://forms.gle/CoQHMJWgYeyU2PGh9
- Required files:
    1) For part 1: code in your preferred programming language
    2) For part 2: a presentation file with 1-2 slides

EVALUATION

- Based on the submissions, a shortlisting will be done for the interview.
- If you get shortlisted, a part of the interview would consist of discussing your submission along with the understanding of the concepts used in the task such as:
    - How feature detection techniques such as SIFT, SURF, ORB, Harris corner detector work
    - Camera calibration, intrinsic and extrinsic matrices
    - Essential Matrix
    - Outlier removal techniques such as RANSAC