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Summary: Our materials have not arrive yet. We looked into other systems or algorithms which are currently being used to achieve similar outcomes as Constellation is proposed to have. We also explore the advantages and disadvantages of using a support vector machine vs a neural network to classify the features from our images

1 Comparable Systems

1.1 Structure-From-Motion Pipeline

1.1.1 Epipolar Geometry and Essential Matrices

- We have two views of a scene, taken from different viewpoints
- We see an image point p in one image, which is the projection of a 3D point
- Given p_0 in the first image, where can the corresponding point p_1 in the second image be?
- the vector from Camera0 to p0 ($\vec{C_0 p_0}$) is coplanar with $\vec{C_0 C_1}$ and $\vec{C_1 p_1}$, which can be expressed mathematically if you take the cross product of two of them, in this case $\vec{C_0 C_1}$ and $\vec{C_1 p_1}$, which should be perpendicular to the third vector, the dot product of the third vector with that should equal 0 ($\vec{C_0 p_0} \cdot (\vec{C_0 C_1} \times \vec{C_1 p_1}) = 0$), because p0 lies in that same plane
- We are going to think of p0 not as a point, but now as a 3D direction vector ($\begin{pmatrix} x_0 \\ y_0 \\ 1 \end{pmatrix}$) - x0 and y0 are projected points on the image plane, and it's a normalized image with focal length=1
- If I want to express p1 in camera0 coordinates I need to rotate it by the rotation matrix between C1 and C0
  - ${}^{C_0}_{C_1}Rp_1$
- use that equation for lots of known points to determine the 3d direction vectors of each of the points, as shown in this lecture

1.1.2 Observations

- Results can be unstable, due to poor numerical conditioning
  - A little bit of image noise can cause a large error in the resulting essential matrix
- We can improve the results by:

1.2 Stereo Vision