GCV Assignment5: Non-rigid Structure from Motion

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Q1: Prove $rank(AB) \leq \min\{rank(A), rank(B)\}$, for any matrices A and B.

Show that $rank(AB) \leq \min\{rank(A), rank(B)\}$. It can be proved as follows:

Each column of AB is a combination of the columns of A, which implies that $\mathcal{R}(AB) \subseteq \mathcal{R}(A)$. Hence, $dim(\mathcal{R}(AB)) \leq dim(\mathcal{R}(A))$, or equivalently, $rank(AB) \leq rank(A)$. Each row of AB is a combination of the rows of $B \rightarrow rowspace(AB) \subseteq rowspace(B)$, but the dimension of rowspace = dimension of column space = rank, so that $rank(AB) \leq rank(B)$. Therefore, $rank(AB) \leq \min\{rank(A), rank(B)\}$

Q2: Show the average reconstruction error per frame and over all the frame. Give your analysis of the results, for example, performance, error distribution and visualization.

The mean error is 0.014074723559774682. The error distribution is shown as Fig1.

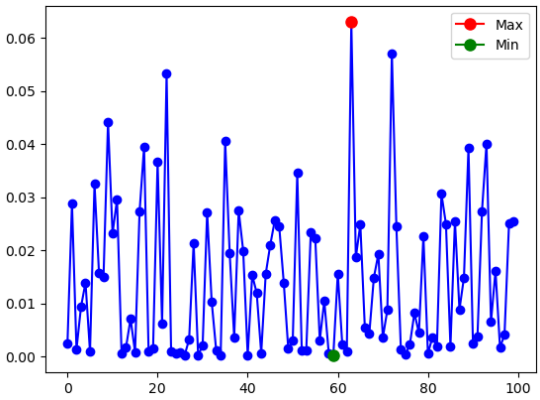

Figure 1: The error distribution.

The performance of best and worst are shown as below. We can see in the best figure, all points are well aligned. However, the worst case is in a

mess. The performance of it is not stable the standard deviation of error is 0.00020545619171280497.

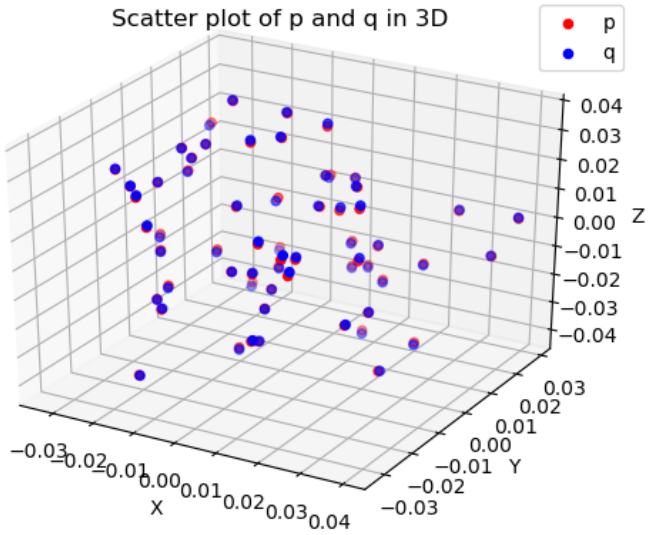

Figure 2: The best case.

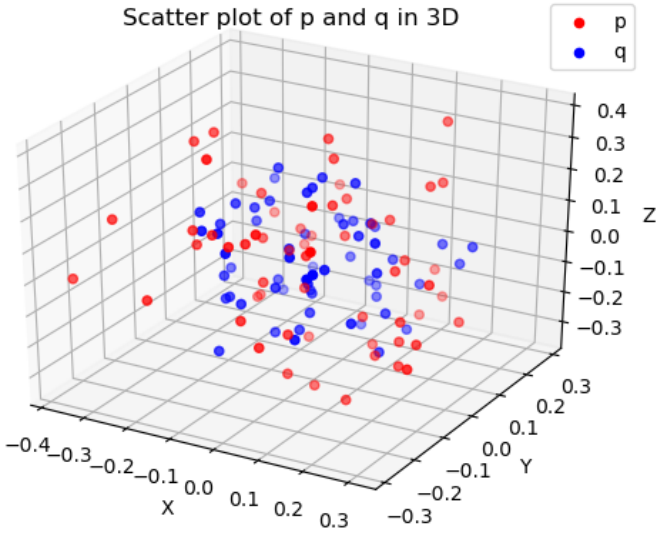

Figure 3: The worst case.