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Peer Review

Review of: "NeRF-VIO: Map-Based Visual-Inertial Odometry with Initialization Leveraging Neural Radiance Fields"

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This paper proposes an original Visual-Inertial Odometry (VIO) method that leverages a Neural Radiance Field (NeRF) as a prior 3D map to estimate the initial pose and mitigate drift—a well-known challenge in odometry systems. The proposed approach is based on a Multi-State Constraint Kalman Filter (MSCKF), where the measurement update is computed from the photometric error between the captured image and the image rendered from the NeRF model.

This method is original, but its positioning within the state of the art warrants more clarification. Its performance needs to be compared to other methods in the state of the art. The downside is that the proposed method is only compared to a single state-of-the-art method, **MSCKF**, that does not use a prior 3D map. The conclusion “ we demonstrate that our NeRF-VIO outperforms all baselines in terms of both accuracy and efficiency “ remains open to significant debate. To substantiate it, a comparative analysis between the proposed method and state-of-the-art approaches is necessary. This conclusion requires comparing the performance of the proposed method with that of state-of-the-art methods such as Loc-NERF and NERF_VINS. Moreover, NERF_VINS has already been evaluated on the same dataset used in this study, so this comparison seems to be possible.

This article lacks sufficient rigor. Several key terms, such as ‘one-line travelling’, ‘spatial constraint’, ‘current sliding window’, and ‘robot states’, are either confusing or insufficiently defined. The overview of the proposed method is not clearly presented, and Figure 1 lacks clarity, making it difficult to follow. Moreover, Figure 2 appears redundant and adds confusion rather than insight. Some equations are also poorly defined—for instance, in Equation (21), several terms are not explicitly explained. The experimental results section requires greater technical depth and scientific precision. For example, it should be clarified that Table X refers to a dataset in Tables I, II, and III.

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Declarations

Potential competing interests: No potential competing interests to declare.