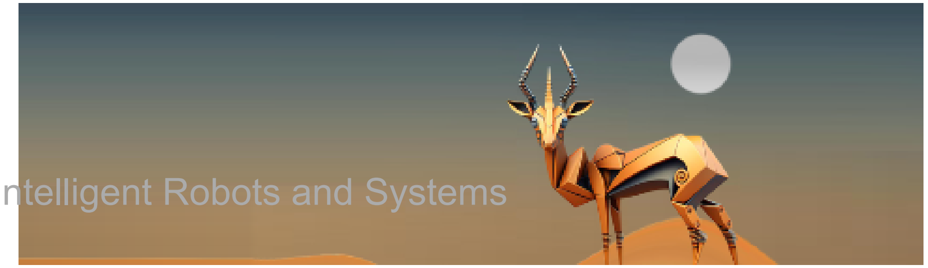
AbuDhabi 2024 iROS

2024 IEEE/RSJ International Conference on Intelligent Robots and Systems
October 13-17, 2024 | Abu Dhabi, UAE



Acceptance Decision and Reviews of Submission 1942 for IROS 2024 (July 8, 2024)

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All deadlines are 23:59:59 Pacific Time. Current time 08:42:51

Kaixin Chai 351781 (Author). Your current session expires in 59:56

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Acceptance Decision and Reviews of Submission 1942 for IROS 2024	
Submission number	1942
Authors or proposers	Kaixin Chai, Long Xu, Qianhao Wang, Chao Xu, Fei Gao*
Title	LF-3PM: a LiDAR-based Framework for Perception-aware Planning with Perturbation-induced Metric
Scroll down to view the publication decision and reviews when and if available	

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Publication Decision for this Submission	
Timestamp	June 30, 2024 01:10:13
Decision	Accepted as Contributed paper
Decisions on attachments The inclusion of attachments in the conference program is subject to the acceptance of the submission itself	Video Attachment: Accepted
Cover message	To: Prof. Fei Gao Re: (1942) LF-3PM: a LiDAR-based Framework for Perception-aware Planning with Perturbation-induced Metric Dear Colleague: It is our pleasure to inform you that your paper has been accepted for publication in the Proceedings of the 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024) as oral pitch and interactive presentation. Congratulations! This year the conference received 3,645 paper submissions from 61 countries/regions: 3,344 as IROS 2024 submission and 301 transferred from the IEEE Journals (TRO, RAL, RAM, TASE). From the very large number of high-quality papers, we selected 1,587 for presentation, which represents an acceptance rate of 47,5%. Each submission was reviewed by at least two reviewers before receiving a summary report from an Associate Editor and a final report from an Editor. Based on these reviews and reports, the Senior Program Committee and the Program Chair made the final decisions. * Presenting your paper in Abu Dhabi Your paper is accepted on the condition of an author presenting it at the conference. At least one author of each paper must be registered for the conference before submitting the final version. Full on-site registrations cover up to two papers; student registrations cover one paper. Please follow the registration instructions on the conference website. All oral presentations will be 15 minutes; please, plan to speak for 12 minutes and allow 3 minutes for questions and answers. All oral pitch presentations will be 3 minutes, with no questions and answers, and the work will be also presented in a 2-hour interactive session based on a poster. We also solicit your presentation video clip in advance of the conference. The details will be announced later. In case

	of any travel difficulties, the video will be played during the session. Please contact the organizers if you wish to arrange a remote presentation instead. * Preparing the final version of your paper Your reviews and editorial feedback are available at http://ras.papercept.net Please carefully read the reviews provided by the Editorial Board and ensure your final version reflects their advice. The final version of your paper must closely match the accepted draft. You may only add or remove material as specifically requested by the reviewers. The preferred paper length is six pages, with up to two additional pages allowed for a fee of 200 USD per page. The final version of your manuscript must be uploaded to PaperPlaza by 31 August 2024 at 23:59 PST. * Planning your travel The IROS 2024 organization is pleased to announce travel grants on a competitive basis for student authors traveling to IROS. The grants will be awarded to applicants that meet all eligibility criteria. Learn how to apply for the travel grant and see full program details by clicking here:http://www.iros2024-abudhabi.org/travel-support. For any travel inquiries, contact the Local Organization Committee by email (localarrangements@iros2024-abudhabi.org) or by filling the online form at http://www.iros2024-abudhabi.org/local_arrangements * Call for Late-Breaking Results Posters You are cordially invited to contribute a Late-Breaking Results poster to IROS 2024. If you have any additional late-breaking results, please consider submitting one-page extended abstract by 15 August 2024. http://iros2024-abudhabi.org/cf-late-breaking We look forward to welcoming you to Abu Dhabi in October. Yours sincerely, Cecilia Laschi, Program Chair Jorge Dias, General Chair Filippo Cavallo, Publication Chair Christian Laugier, Editor-in-Chief IROS 2024 Conference Paper Review Board
Comments to the author	Comments to author (Associate Editor) ===================================== Reviewers have provided detailed and valuable comments, which should be addressed in final version. -- Comments on Video Attachment: The video is well prepared.

Reviews of this Submission				
Reviewer number	**Review ID**	**Comments to the author**	**Attachment to the review**	**Comment on the Video Attachment**
3	13821	The authors have introduced a LiDAR-based Perception-aware Planning framework named LF-3PM, which aims to evaluate the impact of LiDAR observations on the localization accuracy and stability (LAS) of robots by incorporating a novel perturbation-induced metric. This framework significantly enhances the efficiency of the planning process by logically separating the observation assessment and motion planning phases through the creation of a Static Observation Loss Map (SOLM). A series of experiments, including simulations in various scenarios and tests in real-world settings, have been conducted to validate the effectiveness of the proposed metric and framework. The results demonstrate that the robot can improve its LAS by actively selecting trajectory topologies and orientations that are favorable for localization. There are some questions about this article: 1.In the introduction section where "Fig. 1 shows an example of SOLM" is mentioned, the article posits that the yaw angle does not affect the observations made by a 360-degree LiDAR. Consequently, the SOLM is calculated in R2 space without considering the yaw angle. However, in the experimental section, a Livox Mid-70 LiDAR with a smaller Field of View (FoV) is utilized. This discrepancy raises concerns about the reliability of the algorithm, as there is a divergence between the LiDAR used in experiments and the omnidirectional LiDAR assumed in the theoretical model. It is questioned whether the model constructed in the article is applicable to LiDAR with a limited FoV. 2.The article's experiments are deemed insufficient due to the lack of comparative experiments and the absence of experimental metrics, such as trajectory length, total time, and planning success rate. 3.In the "Problem statement and method intuition" section, below equation (6), it is stated "\mathrm{V}=m^2+m". Where is the symbol \mathrm{V} represented in the text? 4.The first contribution in the article proposes "the proposed perturbation-induced metric is employed to calculate SOLM" and provides a detailed derivation. However, in the "SOLM Calculation" section, how is the evaluation result q updated into the grid at (i, j, k)? Is "q" a specific value or a range? Moreover, how is it reflected in the path planning part? 5. The second contribution in the article mentions "design an efficient LiDAR-based" but does not explore the aspect		Video is clear and intuitive.

		of real-time performance. 6. There are some minor issues in the text, such as in the introduction section where "of cameras and LiDAR:" should be corrected to "of cameras and LiDAR." Additionally, the text frequently refers to "trajectories" and "trajectory"; is the use of singular and plural forms intentional? If not, it would be advisable to maintain consistency.		
9	35371	The paper introduces an innovative approach to enhance LiDAR-based Localization Accuracy and Stability (LAS) through Perception-aware Planning. The framework addresses the unique challenges of LiDAR-based perception, offering a novel metric for evaluating LiDAR observation loss and a strategic trajectory generation method. The framework is thoroughly explained, and extensive experiments demonstrate its effectiveness across various scenarios. 1. The framework addresses a significant gap in the existing research by focusing on LiDAR-based perception, it lacks comparative analysis with vision-based frameworks or other LiDAR-based approaches, limiting the understanding of its advantages. 2. The proposed metric for evaluating LiDAR observation loss relies on the assumption that localization algorithms address a least squares problem, potentially restricting its applicability to certain algorithms. However, the comprehensive analysis provided in the paper offers valuable insights into the challenges of LiDAR-based perception and motion planning, laying a solid foundation for further research. 3. Extensive experiments demonstrate the framework's effectiveness in improving LAS across various scenarios, and the availability of the source code promotes transparency and facilitates future developments in the field. Despite these strengths, there is room for further experimentation to explore the framework's performance in a broader range of scenarios and to investigate its scalability and robustness in complex real-world environments.		The video is informative.
10	39939	The submitted work proposes a solution for perception-aware planning to increase autonomous robots' localization accuracy and stability (LAS). In contrast to earlier work, the proposed method focuses explicitly on geometric localization, e.g., coming from LiDAR-based odometry estimation. The main contribution of the presented work is the introduction of a new LiDAR scan perturbation-induced metric to evaluate LiDAR observations w.r.t. to their information content regarding localization. Moreover, in the second step, this metric is used to generate an offline map called SOLM efficiently, gridded over the SE(2) space, which can then be used for the shortest path computation		The video is difficult to watch, as it is recorded at around double speed, requiring the reviewer to continuously pause it. Otherwise, it is useful for better understanding.

and motion planning.
The proposed approach and motion planning framework are evaluated in simulated and real-world experiments, showcasing the benefit of geometry-aware planning.

Overall, the paper is well-written and easy to follow. The introduction is convincing, and splitting it into two separate metric computation and planning modules seems reasonable. The computation of the static SOLM map, while limiting some real-world applications such as navigation in dynamic environments, is a reasonable choice to allow for fast and global planning considering potential localization loss. Moreover, the introduced math of Sec. 3 is sound and allows for intuitive interpretation, also thanks to the remark that q(min) essentially corresponds to the famous work of Zhang et al.
Yet, some parts would benefit from improved clarity.

Detailed comments are as follows.

Major Technical Comments

1.1) The handling of manifolds SE(3) and SE(2) could be a bit clearer. In particular, the pose x is described as an element of the vector space R^n, which is not true for general manifolds. Moreover, the SOLM map seems to be only represented in SE(2), while the full LiDAR localization system in the experiments (Fast-LIO) is operating in full 3D (SE(3)). This requires some clarification. Also, it would be great to understand how the 3D grid map with x,y, and yaw would look for the more complicated case, e.g., SE(3).

1.2) The choice for V_\delta as a linear transformation could be discussed more thoroughly. Why is this choice sufficient?

1.3) In the experiments, MDE is used as a GT. Why MDE cannot be used during map generation should be mentioned explicitly, and why should the given metric be used instead?

1.4) The real-world robot experiments in Sec. 5.D is impressive, as the difference between the proposed method and the baseline is pretty big. However, it is unclear to the reviewer why the difference is so big, as the environment looks relatively simple with apparent geometric features. What could be the exact reason for that? Is it the small FoV of the Livox Mid70 that leads to only seeing flat walls at times?

Minor Technical Comments

2.1) The code, while mentioned to be available online, is not yet publicly available. This is okay for now but should be made available upon acceptance of the paper.

2.2.) The title paper does not adequately unveil the exact content of the paper. In particular, "perturbation-induced" could mean a lot, and it is unclear whether this addresses a metric describing the expected quality of LiDAR localization. The reviewer recommends slightly revising the title to make the work searchable more quickly in the future.

2.3) The argument that the "efficiency of simulating a visual observation is much higher" could be explained better. In particular, one could think that photo-realistic rendering is more expensive than simple raytracing in a CAD environment.

2.4) The computed SOLM maps are stored in grayscale image formats. The motivation for this should be made more clear. Is it solely for saving disk space by using image compression techniques?

2.5) Sec. 3 A introduces the robot pose as if it were a full part of a vector space. This should be revised.

2.6) It could be a bit more precise on what the observations h(x) could be early on in the paper. Instead of referring forward in time to Equ. 25, it would be more helpful to give a quick example or at least mention "point-to-plane" explicitly.

2.7) The submitted work only mentions how the LiDAR scan could be obtained using a "ray-casting-based scan simulator with GPU acceleration." Still, it does not explain how this work is being done.

2.8) Fig. 3 could be made readable more easily by clearly indicating that the top only corresponds to the map generation, while the bottom only corresponds to the planning.

Structural Comments

3.1) The term "Localization accuracy and stability (LAS)" does seem to be too familiar. Has this wording been used before by other works? If not, it should be more apparent that the authors introduced this wording. If yes, a reference is needed.

3.2) The captions of figures and tables could be used to provide more information. This usually makes reading/flying over the paper much more accessible.

3.3) If space is needed, the footnotes on page 6 are likely unnecessary.

Language and Formatting Comments

4.1) Introduction, "yet relative researches based on LiDAR..." --> related research

4.2) Introduction: "we need a new evaluating metric" --> evaluation

4.3) Introduction: Fig. 1(c), Fig. 1 (b), Fig. 1(a) do not fit into the remaining sentence.

4.4) Gaussian-Newton --> Gauss-Newton

4.5) Sec. 4.A: "we can discrete the SE(2)" --> discretize

4.6) Sec. 5.B: "localize itself stable and robust" --> grammar

Cancel