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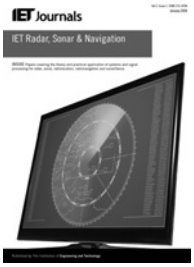

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Comment on 'Huber-based unscented filtering and its application to vision-based relative navigation'

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1 Introduction

In a recent paper published in IET Radar, Sonar, and Navigation, Wang *et al.* [1] develop a robust sigma-point Kalman filter using Huber's generalised maximum likelihood estimation technique. The key step in this development is to recast the sigma-point Kalman filter update step into the form of a linear regression problem. In Wang *et al.* [1], the particular type of sigma-point Kalman filter investigated is the unscented Kalman filter (UKF) [2]. Another example of a sigma-point Kalman filter is the divided difference filter (DDF) [3].

The wording and development of [1] seems to be taken directly from two papers authored by Karlgaard [4] and Karlgaard and Schaub [5]. Some discussion in the second to last paragraph in the Introduction of [1] matches with passages from [4, 5] and Section 2.2 of [1] is almost directly taken from [4]. The mathematical symbols are different in places but the overall flow and wording of the section is nearly identical to that in [4]. Reference [4] is included in their references but it was not cited in Section 2.2 as the basis for their formulation, and Section 2.2 is almost word for word from that paper, starting with (14).

It is evident that the authors of [1] have read the 2007 paper on the Huber-Based Divided Difference Filter [5], although it was not cited. For example, (12) in their paper is something that appears in [5] in the first paragraph on Section II.C. on page 887. Essentially, Wang *et al.* use the exact same approach used with the DDF in [5] in order to recast the unscented filter into a linear regression problem, and from there apply the Huber estimator to solve the problem. Some wording from the introduction of [5] also appears in [1] describing some past applications of the Huber-based filtering approaches.

It should also be pointed out that there seems to be a typographical error in third paragraph of Section 5 of [1] and in the labels in Figs. 2–6. Here, the parameter μ is referred to as the 'perturbing parameter', yet this variable has already been introduced in (18) as the tuning parameter in Huber's mixed ℓ_1/ℓ_2 norm function. If the authors did in fact mean to refer to the Huber function tuning parameter then the discussion in this paragraph is incorrect: the UF and HUF should agree when $\mu = \infty$ not when $\mu = 0$ as indicated in Section 5. Evidently the μ described in the third paragraph in Section 5 is meant to be the ϵ parameter introduced in (56) for the Gaussian mixture model since it is also identified as such in Table 2. Assuming this is the case, then this discussion brings up the point that Wang *et al.* did not indicate what value of the Huber tuning parameter μ that was used in their simulations, nor do they provide any guidelines for how to choose this parameter in general. Such guidelines are provided in [6].

2 References

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