A Review of "Review of Handcrafted and Learned Techniques for Feature Matching in Autonomous Driving"

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Abstract—With the development of autonomous driving, much attention is attracted into the domain of visual feature learning. One key part of the visual feature learning is the feature matching. Therefore, much research work is done in this area. This paper gives a brief summary of the paper "Review of Handcrafted and Learned Techniques for Feature Matching in Autonomous Driving", highlights the exceptional part of the paper and discusses the possibilities for an improvement on the paper.

Index Terms—Feature Matching, Autonomous Driving

I. INTRODUCTION

As the feature matching highly depends on how the feature is located and how it is described, the paper includes all three phases (detection, description, matching) and introduces several different methods on each of these phases. The reviewed paper has first introduced handcrafted methods and learning based methods in feature detection, feature description, and feature matching respectively. Then a comparison of different methods in these three phases is presented. Many recent advances are included.

II. EXCEPTIONAL PART

It is noticeable that the general structure of the reviewed paper is very clear. First a brief introduction is given, after which follows the feature detection, description and matching sections. Each section is divided into exactly two parts, one for handcrafted methods and another for learning based methods. Than follows the introduction of some deep learning methods which handle three steps jointly, the application in autonomous driving and the comparison as well as the conclusion.

Secondly, the number of methods reviewed for both handcrafted and learning based methods in detection, description and matching is large. Although the explanation of some methods are not very clear, the number of mentioned methods is very impressive. Therefore, it gives the reader a good overview of the whole domain.

III. SUGGESTIONS

Though the paper has exceptional parts, there is space for further improvements. The suggestions will be discussed in terms of grammars, formats, references, figures&equations, logic, and consistency.

A. Grammars

It's noticeable that there are many grammar and spelling errors in the paper (around 40), which negatively influences the readability of the paper.

B. Formats

Some format problems should be avoided. For example, after some sentence there is no period symbol ".". In the expression "64 × 64" there is no "×" symbol. The word "image" is typed as "im ages". There is often no space given between a word and the following left parenthesis "(". Some words are written beginning with an uppercase at the middle of a sentence, for example the "Autonomous Driving" in section VII-B, etc. In section IV-B, the word "methods" in the "title "B. Matching in Learned methods" should begin with an uppercase.

Besides, the full names of the abbreviations "SVM", "SURF", "FAST", "SIFT" are not given in the text.

The format problem makes some parts look weired, if it could be improved, the paper will look much better.

C. References

Firstly, many figures and tables are not referenced.

Secondly, some paragraphs which are actually referencing statements from other papers don't offer any reference (e.g. Introduction section, and the last paragraph of section II-A). Besides, the references section has some errors. A list of not correctly referenced resources is showed in section V.

Thirdly, the word "we" is used several times when referencing other's work. This should ideally be avoided. Especially in line 10 of the section V: "In practice, we found it is impossible to train the whole architecture.", the usage of "we" is actually wrong because the author of the review paper didn't do experiments. Besides, this sentence also doesn't give a correct summary of the original work. The original sentence is: "In practice, we found it impossible to train the full architecture from scratch, because the individual components try

to optimize for different objectives." This means the training is not possible from scratch but not totally impossible. The following part of the paper gives a method of how it could be trained.

D. Figures&Equations

It is good that all figures are mentioned in the text, but they are unfortunately not readable, because they are too small. Putting unreadable figures in the papers is same as not putting them in the paper because they don't help the reader to understand the texts.

Besides, in the equation 1 of the paper, the operator "star" and "circle" is not explained, which could lead the reader to be confused.

E. Logic

Although the general structure of the paper is clear, there isn't a good story line to combine all sections. For example, if there could be a small paragraph in the end of the introduction section which introduces the general structure of the paper, it would give the reader a clear overview of what is going to be seen in the following.

In the following feature detection, description and matching sections, there are neither introductory words at the beginning of the section, nor summary words at the end of the section. If there are some words in these parts, the connection between sections would be much smoother.

In section III-B, the authors suddenly begin to talk about different loss functions with a highlighted loss function name in the beginning of the paragraph without any hints in previous paragraphs. This could make the reader quite confused. If some description can be offered (e.g. "In the following part, how different loss functions could help with feature description is presented") before starting this part, the logic will be more convincing.

F. Consistency

An important inconsistency is that the terms SIFT, SURF and FAST are classified as detector in section II: feature detection but are discussed as descriptors in section VII: comparison. As reviewing different detectors and descriptors is the focus of this paper, they should be classified consistently.

Besides, it is not easy to find where the statements in the conclusion section are based on because of the large number of methods mentioned in the reviewed paper. It could be improved as "from the comparison in section VII, we can see that...".

Ideally, some more words could be written on the explicit comparison of handcrafted methods and learning based methods as a part of the conclusion. Because this is the key value of this paper and the aim of the conclusion part. Researchers typically want to know when which type of methods are better in their own research projects after reviewing many different methods.

IV. CONCLUSION

The reviewed paper reviews a huge number of different methods in feature detection, description and matching. The general structure of the paper is clear and the explanation is generally understandable. However, there are many grammar and format errors, which decreases the readability of the paper. The references, figures and equations can be handled better to make the paper scientifically more convincing. Besides, there is still a large space for improvements in terms of "story telling" to let the paper more compactly connected. As for the consistency, especially the SIFT, SURF, and FAST should be classified more carefully and consistently in the paper.

V. CHECK LIST

- Check if the references are given correctly:

1. There should be two " symbols for the title: [22] J. Rabin, Approches robustes pour la comparaison dimages et la reconnaissance dobjets. PhD thesis, Telecom ParisTech, 2009.

2. No author and publisher is given: [51] Learning local feature descriptors using convex optimisation,.

3. Here the abbreviation of the conference "Bmvc" is used, but for other references the full name of the conferences are used: [52] V. Balntas, E. Riba, D. Ponsa, and K. Mikolajczyk, Learning local feature descriptors with triplets and shallow convolutional neural networks., in Bmvc, vol. 1, p. 3, 2016.

- Check if all the necessary statements are referenced: This part is already discussed above.

- Check whether enough evidence is there to come to the conclusions: Yes.

- Check all the figures are in line with the text: Yes.

- Check whether figures are readable and explained enough: Not readable, and figures are explained briefly but enough.

- Check the structure of the paper: General structure is good, but there is no connection paragraphs between sections.

- Check the title and the aim of the paper are coherent with the body: Yes.