Author Guidelines for the British Machine Vision Conference

BMVC 2012 Submission # 666

Abstract

In this work we have proposed a method to determine 2D-3D correspondence between non-coplanar circles from a single image. Our method uses image conics to compute circle plane orientation in camera coordinate system, thus bringing the problem from 2D to 3D domain. This information is used to generate projective invariant descriptors which can be used directly for correspondence matching, given that the 3D information about circles are known. Additionally, the evaluation also covers study stability of the projective invariants and the factors affecting their computation. One of the intended applications is for tracking industrial objects with circles on it.

In our approach we use conic properties of circles to compute projective invariant descriptors. These descriptors are matched with known 3D information to establish correspondences. We also demonstrate stability of the invariants used to generate descriptors, In our approach we compute 3D plane orientation of each circle from its image contour, and compute projective invariants between each pair of circles. We propose a new descriptor

1 Introduction

Correspondence matching between 2D-3D features is one of the key problems in computer vision. If 3D information is available correspondence is vital for either pose estimation or object detection applications. Recent literature suggest extensive work being done in order to establish correspondences using learning based methods [8]. Many researchers have proposed methods using natural features like points, lines and conics.

However, fiducial based systems are also in use due to their reliability and performance.

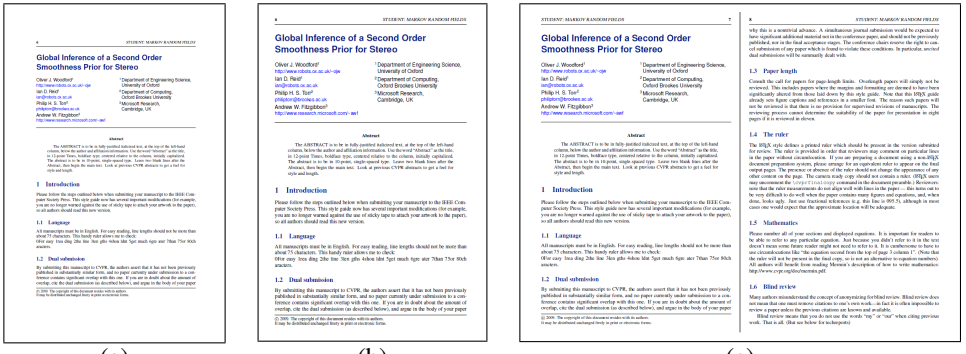
This topic is studied extensively in the vision community, however the solutions proposed are mainly suitable for a particular configuration of object or cameras. In recent literature machine learning techniques are used to learn features from an object. Various Machine Vision, Computer Vision and Augmented reality applications use circles for tracking objects or pose estimation. Use of circles for tracking objects is

Why circle?

What has been done, or is being done?

1.1 Paper length: nine pages plus bibliography

Papers length should not exceed 9 pages in length, *not counting* the bibliography. **Papers which are overlength will not be reviewed**. This includes papers where the margins and



(a) (b) (c)

Figure 1: It is often a good idea for the first figure to attempt to encapsulate the article, complementing the abstract. This figure illustrates the various print and on-screen layouts for which this paper format has been optimized: (a) traditional BMVC print format; (b) on-screen single-column format, or large-print paper; (c) full-screen two column, or 2-up printing.

formatting are deemed to have been significantly altered from those laid down by this style guide. The reason such papers will not be reviewed is that there is no provision for supervised revisions of manuscripts. The reviewing process cannot determine the suitability of the paper for presentation in nine pages if it is reviewed in twelve.

The bibliography should begin immediately after the paper text. It may be of any length, within reason. It should *not* include annotations, figures, or any other paraphernalia intended to subvert the paper length requirement.

1.2 Dual submission

By submitting this manuscript to BMVC, the authors assert that it has not been previously published in substantially similar form, and no paper currently under submission to a conference contains significant overlap with this one. If you are in doubt about the amount of overlap, cite the dual submission (as described below), and argue in the body of your paper why this is a nontrivial advance. A simultaneous journal submission would be expected to have significant additional material not in the conference paper, and should not be previously published, nor in the final acceptance stages. The conference chairs reserve the right to cancel submission of any paper which is found to violate these conditions. In particular, *uncited* dual submissions will be summarily dealt with.

1.3 Anonymity and blind review

BMVC operates a double-blind review process. Your review submission **must not identify you as the author**. This means, in particular, that the author list should be replaced by the words "BMVC *YYYY* Submission # *NNN*", where the italics are to indicate the year and the submission number. The provided LaTeX command `\bmvcreviewcopy` does this automatically. In addition, acknowledgements should not be included in the review copy.

Many authors misunderstand the concept of anonymizing for blind review. Blind review **does not mean that one must remove citations to one's own work**—in fact it is often impossible to review a paper unless the previous citations are known and available.

Blind review means that you do not use the words "my" or "our" when citing previous work. That is all. (But see below for techreports)

Saying "this builds on the work of Lucy Smith [1]" does not say that you are Lucy Smith, it says that you are building on her work. If you are Smith and Jones, do not say "as we show in [7]", say "as Smith and Jones show in [7]" and at the end of the paper, include reference 7 as you would any other cited work.

An example of a bad paper:

> An analysis of the frobnicatable foo filter.
>
> In this paper we present a performance analysis of our previous paper [1], and show it to be inferior to all previously known methods. Why the previous paper was accepted without this analysis is beyond me.
>
> [1] Removed for blind review

An example of an excellent paper:

> An analysis of the frobnicatable foo filter.
>
> In this paper we present a performance analysis of the paper of Smith *et al*. [1], and show it to be inferior to all previously known methods. Why the previous paper was accepted without this analysis is beyond me.
>
> [1] Smith, L and Jones, C. "The frobnicatable foo filter, a fundamental contribution to human knowledge". Nature 381(12), 1-213.

If you are making a submission to another conference at the same time, which covers similar or overlapping material, you will almost certainly need to refer to that submission in order to explain the differences, just as you would if you or others had previously published related work. In such cases, include the anonymized parallel submission [4] as additional material and cite it as

> [1] Authors. "The frobnicatable foo filter", ECCV 2006 Submission ID 324, Supplied as additional material `eccv06.pdf`.

Finally, you may feel you need to tell the reader that more details can be found elsewhere, and refer them to a technical report. For conference submissions, the paper must stand on its own, and not *require* the reviewer to go to a techreport for further details. Thus, you may say in the body of the paper "further details may be found in [5]". Then submit the techreport as additional material. Again, you may not assume the reviewers will read this material.

Sometimes your paper is about a problem which you tested using a tool which is widely known to be restricted to a single institution. For example, let's say it's 1969, you have solved a key problem on the Apollo lander, and you believe that the ICLL'70 audience would like to hear about your solution. The work is a development of your celebrated 1968 paper entitled "Zero-g frobnication: How being the only people in the world with access to the Apollo lander source code makes us a wow at parties", by Zeus *et al*.

You can handle this paper like any other. Don't write "We show how to improve our previous work [Anonymous, 1968]. This time we tested the algorithm on a lunar lander [name of lander removed for blind review]". That would be silly, and would immediately identify the authors. Instead write the following:

> We describe a system for zero-g frobnication. This system is new because it handles the following cases: A, B. Previous systems [Zeus et al. 1968] didn't handle case B properly. Ours handles it by including a foo term in the bar integral.
>
> ...
>
> The proposed system was integrated with the Apollo lunar lander, and went all the way to the moon, don't you know. It displayed the following behaviours which show how well we solved cases A and B: ...

As you can see, the above text follows standard scientific convention, reads better than the first version, and does not explicitly name you as the authors. A reviewer might think it likely that the new paper was written by Zeus *et al*., but cannot make any decision based on that guess. He or she would have to be sure that no other authors could have been contracted to solve problem B.

FAQ: Are acknowledgements OK? No. Leave them for the final copy.

1.4 Citations

When citing a multi-author paper, you may save space by using "*et alia*", shortened to "*et al*." (not "*et. al.*" as "*et*" is a complete word.) The provided `\etal` macro is a useful *aide memoire* in this regard. However, use it only when there are three or more authors. Thus, the following is correct: " Frobnication has been trendy lately. It was introduced by Alpher [1], and subsequently developed by Alpher and Fotheringham-Smythe [2], and Alpher *et al*. [3]."

This is incorrect: "... subsequently developed by Alpher *et al*. [2] ..." because reference [2] has just two authors. If you use the `\etal` macro, then you need not worry about double periods when used at the end of a sentence as in Alpher *et al*.

We use `natbib`, so citations in random order are nicely sorted: [1, 2, 4, 5]. However, we don't use the compress option, as we want each reference to have its own hyperlink and popup window.

1.5 Footnotes

Please use footnotes[1] sparingly. Indeed, try to avoid footnotes altogether and include necessary peripheral observations in the text (within parentheses, if you prefer, as in this sentence). If you wish to use a footnote, place it at the bottom of the column on the page on which it is referenced. Use Times 8-point type, single-spaced.

1.6 The ruler

The LaTeX style defines a printed ruler which should be present in the version submitted for review. The ruler is provided in order that reviewers may comment on particular lines in the paper without circumlocution. If you are preparing a document using a non-LaTeX document preparation system, please arrange for an equivalent ruler to appear on the final output pages. The presence or absence of the ruler should not change the appearance of any other content on the page. The camera ready copy should not contain a ruler. (LaTeX users may remove the `[review]` option from the `\documentclass` statement.) Reviewers: note that the ruler measurements do not align well with lines in the paper — this turns out to be very

[1] This is what a footnote looks like. It often distracts the reader from the main flow of the argument.

Figure 2: Example of a short caption, which should be centered.

Method	Frobnability
Theirs	Frumpy
Yours	Frobbly
Ours	Makes one's heart Frob

Table 1: Results. Ours is better.

difficult to do well when the paper contains many figures and equations, and, when done, looks ugly. Just use fractional references (e.g. this line is 210.5), although in most cases one would expect that the approximate location (210 in the previous example) will be adequate.

1.7 Mathematics

Please number all of your sections and displayed equations. It is important for readers to be able to refer to any particular equation. Just because you didn't refer to it in the text doesn't mean some future reader might not need to refer to it. It is cumbersome to have to use circumlocutions like "the equation second from the top of page 3 column 1". (Note that the ruler will not be present in the final copy, so is not an alternative to equation numbers). All authors will benefit from reading Mermin's description [7] of how to write mathematics.

1.8 References

List and number all bibliographical references in 9-point Times, single-spaced, at the end of your paper. When referenced in the text, enclose the citation number in square brackets, for example [4]. Where appropriate, include the name(s) of editors of referenced books.

1.9 Color

Color is valuable, and will be visible to readers of the electronic copy. However ensure that, when printed on a monochrome printer, no important information is lost by the conversion to grayscale.

References

[1] A. Alpher. Frobnication. *Journal of Foo*, 12(1):234–778, 2002.

[2] A. Alpher and J. P. N. Fotheringham-Smythe. Frobnication revisited. *Journal of Foo*, 13 (1):234–778, 2003.

[3] A. Alpher, J. P. N. Fotheringham-Smythe, and G. Gamow. Can a machine frobnicate? *Journal of Foo*, 14(1):234–778, 2004.

[4] Authors. The frobnicatable foo filter, 2006. ECCV06 submission ID 324. Supplied as additional material `eccv06.pdf`.

[5] Authors. Frobnication tutorial, 2006. Supplied as additional material `tr.pdf`.

[6] R. I. Hartley and A. Zisserman. *Multiple View Geometry in Computer Vision*. Cambridge University Press, ISBN: 0521623049, 2000.

[7] N. David Mermin. What's wrong with these equations? *Physics Today*, October 1989. http://www.cvpr.org/doc/mermin.pdf.