Ms. Ref. No.: CAG-D-14-00303
Title: Computational Rim Illumination of Dynamic Subjects using Aerial Robots
Computers & Graphics

Dear Manohar,

Reviewers have now commented on your paper. You will see that they are advising that you revise your manuscript. While reviewers and associate editor alike are seemingly pleased with the technical content, they question the discussion and technical detail of some of the extensions. Furthermore, all reviewers complain about typos and grammar errors which can easily be caught and fixed by careful proofreading with the help of a Native English Speaker. Please check the many comments by reviewers and the attached PDF file with marking corrections. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers’ comments are appended below.

If you decide to revise the work, please submit a list of changes or a rebuttal against each point which is being raised when you submit the revised manuscript. Your revised paper is due by Jan 16, 2015.

To submit a revision, please go to http://ees.elsevier.com/cag/ and login as an Author.
Your username is: ******
If you need to retrieve password details, please go to: http://ees.elsevier.com/cag/automail_query.asp

On your Main Menu page is a folder entitled "Submissions Needing Revision". You will find your submission record there.

For further assistance, please visit our customer support site at http://help.elsevier.com/app/answers/list/p/7923. Here you can search for solutions on a range of topics, find answers to frequently asked questions and learn more about EES via interactive tutorials. You will also find our 24/7 support contact details should you need any further assistance from one of our customer support representatives.

Please note that this journal offers a new, free service called AudioSlides: brief, webcast-style presentations that are shown next to published articles on ScienceDirect (see also http://www.elsevier.com/audioslides). If your paper is accepted for publication, you will automatically receive an invitation to create an AudioSlides presentation.

PLEASE NOTE: Computers & Graphics would like to enrich online articles by displaying interactive figures that help the reader to visualize and explore your research results. For this purpose, we would like to invite you to upload figures in the MATLAB .FIG file format as supplementary material to our online submission system. Elsevier will generate interactive figures from these files and include them with the online article on SciVerseScienceDirect. If you wish, you can submit .FIG files along with your revised submission.

Yours sincerely,

Joaquim Jorge, PhD
Editor-in-Chief
Computers & Graphics

Reviewers' comments:

The reviewers have suggested several changes. In particular, you should seek to address the perceived lack of detail and unclear explanations in the new sections, especially about the outdoor scene experiment.
Definitely heed Reviewer #1's advice to avoid using references (such as "[6]") as words.

----
Reviewer #1:

This paper presents a technique for controlling rim lighting in photographs using aerial robots that carry lights or flashes. In the indoor scenario, the photographer defines the desired average width of the rims, and the aerial robot automatically flies towards the right location using an iterative optimization scheme. The position of the robot is determined using a lidar mounted on the robot as well as a motion capture system.

New in this version (compared to the Expressive paper) are initial experiments in an unconstrained outdoor environment (Section 6.6), rim lighting compositing (Section 6.5), and experiments to verify the monotonicity between rim width and angle of the robot relative to the subject (Section 6.4).

The experimental validation of monotonicity in Section 6.4 is useful to support that assumption. However, Figure 14 does not add up. First, the top view shows that the robot moves 135 degrees from Q1 to Q2, but the axes in the plots only cover 45 degrees from 90 to 135 degrees. With this sketched setup, I would also assume that the front face of the cube in that figure is never actually lit by the point light, as it comes from the side or behind, so the rim width should be a constant zero, unlike the first graph. The rim width data is also best plotted as a line chart with markers, not with sticks. And why does the rim width appear to be negative outside 90 to 135 degrees? Please clarify and fix these issues.

Author Response: The sketch is incorrect. The Light position Q1 and Q2 should be at a different positions with reference to the object. The x-axis markings are also incorrect. The corrections are made in the figure.

Section 6.5 describes an interesting technique, but does not give enough detail. Please explain this part in more detail.

Author Response: Algorithm description is added to the text in Section 6.5.

The outdoor experiments in Section 6.6 are the next logical step for a more practical use of the proposed technique. However, as far as I can see, the outdoor experiment was limited to manually controlling the aerial robot without any use of location information or the lighting control system that is the core of the paper. In my opinion, this is not a technical contribution. The ergonomic studies mentioned in the abstract and contribution 3 are also overstated.

Author Response: Undertoned the claim in contributions.

The related work section needs rewriting to not use references like "[6]" as words, or even worse to start sentences with such references. In general, it reads much better to refer to the authors by name (e.g. "Debevec et al. [7]"). I remarked on this in my previous review and I find it disappointing that my advice was ignored. Please also add a suitable reference for template matching, as well as those for PatchMatch and NRDC.

Author Response: Added short description, and added references.

The layout of figures should be improved. Figure 3 should appear on the previous page, before Figures 4 and 5. The layout of Figures 8 to 14 is also suboptimal, leaving a lot of empty space on page 10.

Author Response: Tried the best, but the latex does not permit this.

I don't fully understand Equation 2. "dv" appears to be the discrete derivative of some grayscale image in either x or y direction, so it is a scalar. However, as "L_v" is a vector, what does dv.L_v mean? Maybe the intended meaning of dv is the direction of the derivative? Please clarify.

Author Response: Clarified this in the text near Equation 2.
The paper would have benefited from proof reading prior to submission as it is full of small, avoidable mistakes:
- abstract: achieve he necessary motion => achieve the necessary motion
- l97: computer graphics => computer graphics
- l105: light => lights
- l125: a => the [?] [or just delete]
- l216: delete “the proper”
- l219: quadrotor => quadrotors
- l226: Out => Our
- l228: array cameras => array of cameras
- l269: gradient => gradients
- l345: demand => demands
- l406: means quadrotor => means the quadrotor
- l410: it => the [?
- l414: quadrotor settle => quadrotor to settle
- l437: an [delete]
- l492: a [delete]
- l501: when quadrotor => when the quadrotor
- l564: and => to
- l571: in monotonic => in a monotonic
- l604: in-consistent => inconsistent
- l639: it's => its
- l641: (drone) [delete]
- l644: used DJI => used a DJI
- l656: solve right => solve the right
- l660: lighting => flash
- l663: shows robot => shows the robot
- l668: clarify whole sentence "In our cases [...] 10 minutes."
- l689: it's => its
- l714: though satisfies => though it satisfies
- l716: chance photographer => chance the photographer
- l725: save significant => save a significant

**Author Response:** Fixed all this. Thank you.

I think the authors performed the minimal amount of work to extend their Expressive paper. I really like the original Expressive paper, but the outdoor extension is ad hoc and the rim lighting compositing too vague. In summary, I think this is still a good paper and should be accepted with corrections, but I also believe it could have been better.

Additional comments:
- remove extra periods after inline headings on lines 99, 132, 156, 723, 729, 732, 737, 744, 753
- l183: fix "ishacked2001automatics"
- remove hyphens from references to figures, sections, tables etc.
- ensure references are capitalized correctly (e.g. line 529)
- Section 6.1: "Hz" is preferable to "fps"; add space (\;) between number and unit; no italic for units (fps/Hz, mm)
- Section 6.3: use \degree from the "gensymb" package instead of "deg"
- Figure 16: clarify what the inset shows; it's not "the photographer's perspective"
- check correct capitalization of references, e.g. "The Navigation and Control technology inside the {AR.Drone} micro {UAV}" [I also mentioned this in my previous review. Please fix it.]

**Author Response:** Fixed all this. Thank you.
Reviewer #2:

This is an extension of the Expressive-submission by the same authors. The paper differs from the submission mainly in four topics:

- extended discussion of the robot control scheme
- numerical simulation of one of the underlying assumptions of rim-width control
- image compositing of multiple pictures
- outdoor experiments

While the first two additions are welcome and provide the reader with valuable information about the control strategies and some insight into the validity of monotonicity of rim-illumination, the next two additions (while highly interesting) leave something to be desired.

First, as for the image compositing, interesting results (such as how to deal with slightly moving subjects) are only hinted at - could the authors provide some examples? What kinds of correspondence algorithms were used? How is this integrated into the workflow of the photographer that is highlighted before?

Author Response: Provided the description of the algorithm. Added references. Complete description would be hard without running into at least a page or two. The authors propose to keep this for a separate publication.

Second, as for outdoor experiments, it is not clear what kind of optimization / control was actually done by the computer. Since the original control loop cannot be used (as important input sensors are missing), it is not clear how the final illumination is actually achieved. There is some manual intervention at the beginning, with some parameters fixed by the photographer, but what happens after that is not clear. There are two options: either the author provide some more detail about the methods used (preferred), or the authors move this section into an outlook in the final part of the manuscript.

Author Response: This is similar to what Reviewer 1 hinted. The claim in the introduction has been toned down to highlight that the outdoor setup is _not_ a fully automatic system. Yet, there is a lot to learn from outdoor system such as the design tradeoffs and ergonomic issues. We believe that understanding such issues are important for future work in robotic lighting (and hence the readers might benefit).
Reviewer #3:

This paper presents a system for using a quad copter to assist in lighting design. In particular, this work focuses on a single copter and attempt to achieve a rim lighting effect on the subject. Having reviewed this paper for Expressive, I will keep my comments a bit shorter.

My feeling is that this paper/system is more of a "first in class" paper having benefits and drawbacks. Being first, I feel that the paper is very limited in its coverage. The system described covers a narrow range of effects, it only works with a single copter (most photographic lighting designers use multiple lights i.e. 2-3), there's only a single subject, the copter only optimizes in a 2D plane and does not optimize its height, and the method optimizes for rim lighting whereas other goals might be considered. With all the limitations (plus more not listed) I'm not convinced that this current system is useful in a real-world sense. At the same time, this paper "being first in class" opens up a great new area of exploration and I think this is why this paper is intriguing.

With that said, I think the new expanded form of this work has merit. Still, there are numerous areas for improvement. As mentioned below, the synthetic tests for monotonicity are just not that interesting since they do not represent the class of shapes (i.e. the human form) for which the paper appears to be targeting. More interesting challenging configurations could be explored with non-vertically cylindrical subjects (i.e., few vertical edges) which may be more tricky to handle.

Author Response: See figure below.

It's not clear whether this system has had user feedback from professional photographers as to whether it truly meets their needs. Does the rim lighting effect achieved by the copter match what a pro photographer would get with an assistance? I think there could be something interesting to be learned by engaging with professional studio photographers/directors. It's not clear whether the authors of this paper have really solicited feedback on their method (i.e., done any user case studies or validation to show their work produces practical results).

Author Response: We did have feedback from a few photographers, which of course were positive. However, we could not perform a systematic user-study using statistical approaches. Even designing such an experiment in order to obtain meaningful insights is hard. In future, we will consider doing so.

In summary, I like this paper as it presents a new area to explore. The application sits as the intersection of robotics, graphics, vision, and aesthetics. Exploration into the use of quad copters is both timely and exciting. If I had a wish for this paper it would be for it to handle things more deeply. Depth scanners can acquire the geometry of the subjects, cameras can be localized, multiple drones can be used caring controllable light sources to achieve a broader range of effects similar to the light stage, but in a more portable on location manner. Can the location of the camera be controlled simultaneous to the lighting? This paper is only a small step in an exciting space.

163 "and optimize the robot's position is also novel."
228 "By using an array of cameras.."
285 The authors using the notation for the eigenvalues with two subscripts: $\Lambda_{1,1}$, $\Lambda_{2,2}$.. for a 2x2 matrix there are two eigenvalues. Personally I found this notation a bit strange and awkward.

Author Response: Fixed all this. Thank you!
You run synthetic tests to validate your results, showing monotonicity of the rim width. I feel that the chose shapes are poor and not indicative of real world test subjects. The shapes do not cover the variety of material or geometry. As such I feel that they results in figure 14 are a bit meaningless other than to shot that you have a "reasonable" rim width measure. I would like to see such stats run over a much wider range of objects and shapes with varying material. In particular, the human form in different poses would be interesting. Portrait photography is important so having some synthetic scene with hair (which has complex material and light scattering) is important since hair does something very interesting when back lit. Somehow I just feel that the cube and teapot are just poor examples.

**Author Response:**

As the reviewer suggested, we indeed perform the experiments with human 3d models and arbitrary shapes/ materials as shown below. In all these experiments, we observed approximate monotonic behavior.

We did not present these results in the paper because it hard to comprehend the plot and the lighting. Simple geometry such as a rectangular cube and teapot may help the reader easily grasp the idea.

Formatting with all of the images on page 10 could be improved.
Author Response: Fixed.

Reviewer #4:

This is an extended version of an expressive conference paper; the basic idea is novel (light with a robot) and reasonably well-described.

The authors added a study on monotinicity of the rim light and the outdoor setup. The added material is border-line sufficient. My main complaint with it is presentation - both sections are just sort of long, run-on paragraphs where I’m not entirely sure what the motivation for the new study was (particularly for the outdoor lighting). What was the study meant to show and did it achieve that?

There’s also innumerable grammar problems and a few unclear statements - see attached pdf.

Author Response: Fixed. Thank you!