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3 April 2021

## Report on PhD Thesis: Martin Musil

The PhD thesis of Martin Musil addresses the topic of High Dynamic Range (HDR) video. In particular, the thesis sets out to make three major contributions to the field:

1. Creating HDR video which is free from ghosting artefacts
2. Implementing the new algorithms on embedded devices
3. Achieving real-time performance with full HD resolution.

A central theme of this thesis is to target the results for a real application, identifying number plates on cars in difficult lighting conditions.

The thesis is divided into 5 chapters.

**Chapter 1** introduces the topic of HDR imaging and discusses the limitations of traditional imaging. The motivation for the work, the requirement for HDR and embedded solutions in surveillance, are discussed. The need to address the challenging problem of acquiring HDR video rather than the well understood problem of static HDR images is also presented.

**Chapter 2** presents a detailed review of previous literature relating to HDR acquisition, tone mapping, deghosting algorithms, and in particular those that might be applicable for implementing on embedded systems.

An overview of hardware that may be appropriate for implementing the deghosting algorithm is given in **Chapter 3** together with details of embedded platforms for HDR acquisition and a review of previous work of deghosting carried out on embedded platforms.

**Chapter 4** is the core of the thesis. In this Chapter the novel algorithm developed in this research is described, implemented and compared with other techniques for doing deghosting. Chapter 4 also contains a description of possible applications of the new algorithm. In addition, a short section is given in Chapter 4 about possible future research.

**Chapter 5** is a one-page conclusion of the work. This includes a summary of what was achieved.

### Limitations

The structure of the thesis could be improved. Chapter 5 could be extended and I would like to have seen some of the key results restated in the Conclusion and their importance full re-emphasised. The section on Future Work could also have been expanded and this section should be included in Chapter 5.

### Strengths

A significant amount of research has been undertaken. The candidate fully understands the field and his research not only makes an original contribution to the field, but it could also have significant commercial impact as well. There is more than enough novel work here to qualify for PhD. The thesis is well written, and the candidate's contributions already published in leading journal.

### Questions for the PhD defence

There are a number of questions that arise from this thesis which would be helpful to have answered when the candidate defends his thesis. These include:

1. In the examples given, and for the chosen security application, the camera is in a fixed position. Would the results be any different, or would extra work be required if the camera itself was moving, for example if it was mounted on a car as part of an autonomous vehicle detection system?
2. HDR video results in a lot of data. How would you include compression into your pipeline to ensure that the data could be forward to e.g. a remote processing unit in real time?
3. A feature of many videos is motion blur. How would your deghosting algorithm be able to cope with or maintain such motion blur?

### Summary

In summary, this thesis is a significant body of original work. The candidate has clearly shown a very good knowledge of the field and used this knowledge to identify where significant improvements could be made in the deghosting of HDR video, and in particular on an embedded system. The candidate has then set about introducing his method and clearly demonstrating the benefits his approach can bring.

The candidate's thesis is certainly worthy of the award of a PhD, and the candidate should be particularly commended on successfully tackling such a challenging topic.

Yours sincerely

Professor Alan Chalmers