

Annex 6: Habilitation thesis reader's report

Masaryk University

Faculty MU Faculty of Informatics

Field of Habilitation Informatics

Applicant RNDr. Petr Matula, Ph.D.

Affiliation Masaryk University, Faculty of Informatics

Habilitation Thesis Automated Image Analysis in Fluorescence Microscopy

Reader Professor Karen Egiazarian

Affiliation Tampere University of Technology, Finland

Report Text (as large as the reader deems necessary)

I have read Dr. Petr Matula's habilitation's thesis and here is my evaluation of the work.

Addressing a coherent, unified problem area

The thesis covers a closely-related range of topics in the area of image analysis in fluorescence microscopy, contributing to the following fields: confocal microscopy, micro-axial tomography and image analysis in siRNA screening.

Construction of the thesis

This thesis is a result of the work that the author has carried out at the Center of Biomedical Analysis, Masaryk University, Czech Republic, and at the German Cancer Research Center. The thesis is well organized. The thesis consists of two parts: Commentary and the collection of papers co-authored by Dr. Matula, namely, 14 peer-reviewed journal articles and 4 peer-reviewed conference papers.

The reader is guided to the themes of the thesis and the motivation is given and the research problem is described. The problems are challenging and the introduction clearly awakes the interest towards the thesis.

Commentary consists of Introduction covering motivation, history and state-of-the-art.

Thesis covers author's work in the area of automated image analysis in fluorescence microscopy starting from 2000 till now. The main results are summarized in three chapters dedicated to the following areas: confocal microscopy, micro-axial tomography and image analysis in siRNA screening.

In the area of confocal microscopy Dr. Matula's work was devoted to the following four topics: chromatic aberration correction, automation of confocal microscopy, image registration and tracking and spot segmentation and quantification. His main contributions are mainly concern the last two of them.

In the area of micro-axial tomography, author of the thesis has been working on Automation and Resolution Improvement problems.

Finally, in the area of image analysis in siRNA screening the following two topics were covered: quantification of viral infection and Golgi assembly and disassembly.

Scientific novelty

In the habilitation thesis one of the principal areas of scientific novelty is the development of an automated system for image cytometry providing an efficient tool for high-resolution cytometry.

Another important contribution of the thesis is on the automation of micro-axial tomography, developing both registration method to precisely align tilted 3D images, as well as resolution improvement by image fusion in spatial or frequency domains.

Clear presentation of new findings, research methods, measurements etc.

The new findings are very clearly presented and the research methods explained in comprehensive detail.

Candidate's contribution

Dr. Matula has appeared as a first author in 5 publications with contribution of 70 %, while in other 13 publications his contribution varies from 10% to 30%.

Language

The quality of the language is good. I am satisfied with the quality of the language.

Good scientific practice and ethically sustainable principles

The dissertation follows good scientific practice and the research appears to comply with the international guidelines for habilitation theses.

Summarising all above, I'm pleased to recommend the acceptance of this habilitation thesis.

Reader's questions to answer to defend the habilitation thesis (number of questions is upon reader's consideration)

1. Image analysis algorithms in your HRCM-x systems are rather simple, involving very basic technique based on histogram analysis and thresholding. In the new versions of the system are you going to use more advanced tools, e.g. those based on sparse representations, etc.?
2. For image resampling you have been utilizing spline based methods. Have you been using any optimization technique to find the best solution as a combination of splines of various degrees?

Conclusion

Petr Matula's habilitation thesis of *Automated Image Analysis in Fluorescence Microscopy* **does** meet the standard requirements for a habilitation thesis in the field of Informatics.

In Tampere on September 12, 2012

Karen Egiazarian.....(signature)