NII国際インターンシッププログラム報告書
NII International Internship Program Report

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Affiliation:　　Czech Technical University in Prague	**Degree:**　　　　Master

2. Name of Supervisor:　professor Akihiro Sugimoto

3. Duration of Internship:
　From: **March 07, 2017** to **August 26, 2017**　（ **5.5** months)

4. Outline of Internship Program:

(1) Research Topic and Outlines

The aim of the research is (i) image segmentation, (ii) object detection and (iii) extraction atomic patterns. All the steps are presented on Drosophila ovaries as a part of a larger international project regarding data mining of gene information from fluorescent microscopy images of Drosophila (fruit fly). For the first part - image segmentation - we desire to segment a structure inside ovaries which typically contain only texture information and also there is a high similarity between some tissue. Compare to standard approaches, we adopted GraphCut regularisation to enforce regularisations [submitted to a journal]. Typically each image contains multiple eggs that can touch each other but never overlap. Having the structure segmentation we perform an object (egg) detection to extract individual eggs from images for further analyses. We experiment with a few state-of-the-art methods but none of them was able to handle it properly, so we developed own region growing method to separate individual eggs [submitted to a journal]. We skip the image registration - registering individual eggs together, because it was already made and/or we can use some other common method. The last step is extracting repetitive patterns from gene activation - Binary Pattern Dictionary Learning (BPDL). We extend our previous work to handle also probabilistic images and we observed that incorporation internal pattern deformation would improve the results on real images [it will be submitted to a journal].

(2) Procession of your research
March - implementing Region Growing method and writing two journal submissions to JEI
April - experimenting Region Growing method and writing two journal submissions to JEI
May - extension of BPDL to allow pattern extraction on probabilistic input images
June - reserch about image deformation (demons) as an extension of BPDL;
Jully - re-submitting conference paper about Drosophila egg detection; rewriting journal submission
August - rewriting journal submission and submitting major revision JEI

(3) Result or Achievement
We made two journal submissions (SPIE Journal of Electronic Imaging) - one base on previous work and coned on an implementation of region growing methods implemented during the internship. We have been working on an extension of BPDL methods by probabilistic images, incorporation image deformation and presenting on real images, which we did not finish but we are going to finish it soon and publish in a journal.

(4) Presentation
During the internship I did not have any presentation, but probably I will have a presentation in my home institution about my internship in NII.

(5) Feedback about NII International Internship Program
Spending half year at NII has been a great experience, the work environment is very warm and everyone has been very welcoming to us interns. The NII International Internship program has given me the opportunity to build many professional and personal connections among fellow researchers, which is an essential part of the research. Most noticeable among all, it is the great pleasure that has been to be able to work with Prof. Akihiro Sugimoto - all discussions have been very productive and have always helped me get the right perspective. Last but not least, I have been able to get in touch with the fascinating Japanese culture and history. For all these, I would like to thank NII for the opportunity and the aforementioned Prof. Sugimoto his help. The only drawback I can see that the NII presentation to

【Note】 *Before the completion of your internship, please submit an NII International Internship Program Report to your supervisor by email.

the public completely missed English so we foreigners could not fully see the larger scale of NII research.