NII 国際インターンシッププログラム報告書

NII International Internship Program Report

1. Name: Vojir Tomas 　　　　Family　　　　　　First　　　　　　Middle	
Affiliation: 　Czech Technical University in Prague	Degree: 　　Master
2. Name of Supervisor: Prof. Akihiro Sugimoto	
3. Duration of Internship: 　　From:　　Sept. 12, 2011　　　to　Dec. 10, 2011　　　　　（　3　months)	

4. Outline of Internship Program:

Research Topic and Outline

Multi-Modal Tracking-Learning-Detection

My work was focused on the problem of long-term object tracking in video sequences. The tracked object is arbitrary and defined by its position in the first frame. The goal is to keep tracking this object in a video even if it changes its shape (e.g. articulated objects such as a figure skater), gets fully or partially occluded or disappears from the scene and comes back later. This task is crutial for many real life applications. Recently, a novel approach for long-term tracking, called Tracking-Learning-Detection (TLD) [1], was proposed. This metod consists of object tracking, detecting and learning object's visual appearance. These three components are integrated in one functional system. However, the system can deal with only one tracker and one object representation. In cases where the tracker cannot cope with the object pose transformation (e.g. out-of-plain rotation, separate movement of articulated parts, ...) or where the object representation by the learned model is not sufficient, the TLD algorithm fails.

During the internship period I proposed a new system of multiple modalities in tracking and learning parts of the TLD framework to handle new types of objects (e.g. deformable, articulated, ...). There are two ways how the new system can be seen: (i) With multiple trackers and object representations the algorithm becomes more robust and can handle new types of objects and object pose transformations. (ii) The new TLD framework can choose automatically the best tracker and object representation from the pool of available trackers and models on-the-fly during video sequence processing.

Experiments with two different modalities (both for tracking and learning parts of the TLD algorithm) outperformed (or performed equivalently) the original TLD in all sequences but one and showed the strength in tracking new types of the objects. I also provided a generalization for employing more than two modalities.

[1] Z. Kalal, J. Matas, and K. Mikolajczyk, "P-N Learning: Bootstrapping Binary Classifiers by Structural Constraints", *Conference on Computer Vision and Pattern Recognition*, 2010.

Procession of the research
- **September –** Studied the TLD algorithm behaviour on new sequences and related state-of-the-art.
- **October –** Studied and implemented new modalities (frame-to-frame tracker, object representation) that can be used in the TLD algorithm.
- **November –** Integrated new modalities into the TLD algorithm and experimented with different types of interaction between individual modalities.
- **December –** Sumarized results and worked on an idea of the interaction generalization for more than two modalities .

【Note】 * Please send by email to the International Affairs and Education Support Team (kaigai@nii.ac.jp) within a month after finishing your internship program.
* Please submit your report with below five contents.
(1) Research Topic and Outlines   (2) Procession of your research   (3) Result or Achievement
(4) Presentation if you had any opportunity   (5) Feedback about NII International Internship Program

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Results
- Advancing the state-of-the-art results, which will be sumarized in a paper to be submitted to one of the following conference: ECCV 2012, ICPR 2012, BMVC 2012 or ACCV 2012.
- Invaluable experience with working in stimulating international environment with friendly colleagues and professors.

Feedback
NII provides a very exciting environment together with kind people, that are willing to help you with any problem. It's a good place for studying and research.

I am very thankful for the opportunity of participating in the NII internship program. It gave me a chance to experience a life in Japan, Japanese culture and opportunity to get to know new people.

Most of all, I would like to thank to professor A. Sugimoto for his kindness and many research advices during my internship.

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