

**ICT Virtual Organization of ASEAN Institutes and NICT  
ASEAN IVO Forum 2016  
Call for Presentations**

**Submission and Registration Form**

**I. Title**—Title of presentation:

**Smart Spaces: Activity Recognition**

**II. Author(s)**—Full name (First name family name):

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**III. Organization(s):**

**Universiti Teknologi Brunei**

**IV. Topic selection:**

**Smart Society: ICT applications for community and environment  
B) Smart City  
Keywords: Smart Homes**

**IV. Abstract:**

*(Describe the purpose, background, objectives, content, plans for connected projects, expected results/outcomes, etc.)*

**Background**

Activity recognition aims to recognize human activities which could be further refined to location estimation, intent recognition, goal recognition and behavior recognition. There are two major approaches for research activities in this area: vision-based and sensor-based approaches. The vision-based approach extract activities through visual information using techniques drawn from computer vision techniques; the sensor-based approach infers activities from physical sensors attached to the subject of interest.

The understandings of these activities can be inferred through data mining, pattern recognition, etc. Depending on the type of data e.g., vision, sound, and spatial

information; appropriate computing techniques can be applied to extract useful information e.g., computer vision, sound analysis, spatial analysis.

## **Objectives**

Activity recognition is a rich and challenging area since it involves many sub-tasks: object tracking, object identification, gesture recognition and activities recognition. It will be too ambitious to attack all these issues at once in an unconstrained environment. Here users' behaviors are attempted in a specific setting, in an open space with one user and with a limit set of activities e.g., stand up, sit down, walking, looking at, etc.

## **Content**

The main components of this research are summarized below:

- A vision-based approach: the region of interest (ROI) is tracked using Camshift algorithm [1,2] and Speeded Up Robust Features (SURF) [3]. Employing Camshift to detect ROI based on global features and employing SURF to identify the class of ROI based on local features incorporates the strength of both techniques. From the tracked ROI, both pixels information and depth information are collected, pre-processed and employed for the pattern recognition task in the later stage (these features form a training data set).
- A sensor-based approach [4]: data can be directly collected from the sensors which are the time series data. This data is then pre-processed and employed for the pattern recognition task in the later stage (these features form a training data set).
- A classification model is then constructed and trained based on the training dataset. There are various plausible approaches and we plan to use artificial neural network [5] in this work.
- Finally, we test and validate the model in a real environment through an empirical setting.

## References

- [1] Bradski, G. Computer vision face tracking for use in a perceptual user interface. Intel Technology Journal Q2, 1998.
- [2] Cheng, Y. Mean shift, mode seeking, and clustering. IEEE Transactions on Patterns Analysis and Machine Intelligence 17(8): 790-799, 1995.
- [3] Bay, H. and Ess, A. and Tuytelaars, T. and Van Gool, L. SURF: Speeded up

robust features. Computer Vision and Image Understanding (CVIU), Vol. 110, No. 3, pp. 346–359, 2008.

[4] Chen, L., Hoey, J., Nugent, C.D., Cook, D.J, and Yu, Z.W. Sensor-Based Activity Recognition. IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews) 42 (6 ):790-808, 2012.

[5] Haykin, S. Neural Networks: A Comprehensive Foundation, 1999.

### **Plans for connected projects**

The ability to correctly understand users' behaviors is fundamental for many applications such as E-healthcare, smart office/home, smart retailer, smart surveillance, etc.

Recognizing users' activities using vision-based and sensor-based techniques is still an open research topic. It is timely and very important since once the users' activities are recognized, they can be applied to various applications. Some scenarios are highlighted here:

- Smart spaces: the spaces that understand your needs e.g., E-health, smart advertisement, smart home, smart shopping mall, etc.
- Intelligent city: features such as security and public bus services are examples of potential downstream applications.

### **Expected results & Outcomes**

This project builds up research capacity and helps bringing researchers with the same interest together. The tangible output of this project is a computing system. It is a program and its merit is on the computing techniques which could be evaluated based on efficiency and accuracy of the computing system.

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- **Accommodation**