Summary of the administrative activities in this quarter:
- We attended the presentation of Dr. Andrew Chien, Intel Research Director, at Academic Sinica. Andrew presented a lot of interesting research work done at Intel research Labs and talked about future Intel research vision and directions, including participation, data richness, bio-computing, and physicality. Together these four areas “ensemble” to two main themes: ESP (everyday sensing and perception) and cloud computing. Upon hearing the talk, we are excited to say that our research activity is very much aligned with these Intel research directions! We have a lot of ongoing research in participatory & everyday sensing, robotics, etc.
- We were told that Intel research maintains a list of what they consider as quality or excellent publications. We will consider this list as our publication strategy.

Summary of the research activities this quarter:
- **Shopping behavior detection (mobile & everyday sensing, participatory sensing).** We are continuing our efforts in shopping detection. Note that this project is about using available sensors on a mobile phone (i.e., accelerometer, WiFi, and digital compass) to sense and reconstruct a user’s in-store movement trajectory and further infer user’s shopping habits. We are currently talking to experts in the consumer behaviors area. For example, we would like to test the relationship between the amount of time spent shopping and the amount of money spent shopping.

- **Urban-sensing cloud (participation sensing).** We are building a platform where it is possible for a large number of phone-carrying users to participate and help in collecting a large amount (i.e., certain population percentage) of data. In other words, millions of mobile phones carried by everyday users become mobile sensor nodes participating in this huge urban-sensing data collection cloud.

- **PipeProbe sensor node.** We are continuing to develop a mobile sensor node (called PipeProbe) that can determine 3D spatial topology of hidden water pipelines in buildings and homes. PipeProbe works by dropping a tiny wireless sensor capsule into the source of the water pipelines. As the PipeProbe capsule traverses the pipelines, it gathers and transmits sensor readings for reconstructing the 3D spatial topology of water pipelines. This is a part of green computing initiatives in which PipeProbe enables a cheap and non-intrusive way of monitoring the water distribution infrastructure without knocking down walls or stripping floor coverings. The video of this work can be viewed at video: http://www.youtube.com/watch?v=0Sj3qI2VUuk.

- **Energy-awareness (Appliance Recognition).** We are continued to do electricity monitoring and load investigation for measuring appliances power consumption states. Objectives of this project are to make energy-efficiency schemes, provide energy-saving advices, and perform the further appliance controls. Power consumption data are collected by attaching circuit-level smart power meters to the electric panel, and machine learning methods are implemented for analyzing states of appliances. Experimental results show the overall accuracy is above 81.42%.

- **Smart Power.** Smart Power project is a project to make efficient energy usage, and is now focusing on the improvement of energy efficiency of central air-conditioners, which usually use most energy in a building. We have collected temperature and humidity with sensors in our department for a half year. We analyzed the data and realized some problems, such as the unusually low temperature in a not-being-used room, or the un-comfort in a crowded room with full-speed air-conditioner. Finding the reasons of the problems and solving them are what we
are going to do next.

- **Commonsense Knowledge Collection (PTT Game).** Games with A Purpose have successfully harvested information from web users. However, designing games that encourage sustainable and quality data contribution remains a great challenge. Given that many online communities have enjoyed active participation from a loyal following, we explore how human computation games may benefit from rich interactions inherent in a community. We experimented by implementing two games for Chinese commonsense data collection on the leading social community platforms: the Rapport Game on Facebook and the Virtual Pet Game on PTT. We have collected over 1,000,000 commonsense sentences with from both games and more than 80% assertions are rated as useful by online users.

- **Bridging Commonsense Knowledge Bases.** While significant progress has been made in building large common sense knowledge bases, they are intrinsically incomplete and inconsistent. We try to answer queries based on knowledge collected from multiple sources without a common ontology. New assertions are found by computing graph similarity with principle component analysis to draw analogies across multiple knowledge bases. Experiments are designed to find new assertions for a Chinese commonsense knowledge base using the OMCS ConceptNet and similarly for WordNet. The assertions are voted by online users to verify that 75.77% / 77.59% for Chinese ConceptNet / WordNet respectively are good, despite the low overlap in coverage among the knowledge bases.

- **RoboCup 2010 Standard Platform League.** Our team, NTU Robot PAL, made the quarterfinal in 2009 RoboCup SPL among the best robotics research teams around the world. This year our team is pre-qualified to participate in RoboCop 2010 and we are improving the performance of robot localization and implementing a new approach to accomplish localization and tracking simultaneously using onboard cameras and microphones. In addition, new motion control engines and gaming strategies are being developed and tested.

- **3D Face alignment using a 3D (RGBD) camera.** Perceiving human faces is one of the most important functions for human computer (robot) interaction. Previously we have proposed a 3D active appearance model (AAM) to solve the problem of facial landmark aligning in 2D images. We are currently improving the system in which a 3D (RGBD) camera is used for more precisely aligning faces and reconstructing 3D face models. The video of the work of 3D AAM for aligning faces using a RGB camera can be viewed at video: http://www.youtube.com/nturobotpal#p/u/3/tfSMnK_CTXc

- **Simultaneous localization, mapping and tracking using a single camera.** Localization, mapping and tracking serve as the basis for scene understanding. It has been demonstrated that laser scanner-based simultaneous localization, mapping and moving object tracking can be accomplished in dynamic environments. We are current working on a more challenging setup in which only a single camera is used for accomplish the task. The video of this work can be viewed at video: http://www.youtube.com/nturobotpal#p/u/1/S1AYD9LUXMg.

- **Context-Aware Personal Diet Suggestion System.** Keeping a healthy and balanced diet has long been a critical issue for a person (especially an elderly) wanting to stay fit and energetic in her/his daily life. We can always turn to a dietitian (or a nutritionist) for professional diet suggestions if necessary. However, we cannot access to a dietitian all the time, which renders daily nutrition control very challenging. Therefore, it is desirable for each individual to receive handy and informative diet suggestions whenever necessary. In this work, we propose a Context-aware Personal Diet Suggestion System (CPDSS) of which goal is to maximize an aggregated health-related utility function and provides useful diet suggestions according to some contextual information (especially the activity level of a person). In order to increase the practicality of the proposed system, we have integrated the CPDSS with an everyday appliance—a smart refrigerator—so that we can readily access the suggestions about one's diet,
receive instant context-aware reminders while preparing foods, and keep long-term diet history to extract more useful patterns for caregivers to provide suggestions for health improvement.