2009 Korus-Tech / SKKU-ICE Summer School on

Cognitive Robotics, Vision and Human Robot Interaction for Consumer Robots

August 10-11, 2009

2nd Research Complex building B, Room# 83140
Sungkyunkwan University, Suwon, Korea

Organized by

Intelligent Systems Research Center, SKKU

Co-Organized by

Robotics & Intelligent Machines @ Georgia Tech

Yujin Robot, Inc.

Bona-Vision, Inc.

Sponsored by

Korus Tech Program, Ministry of Knowledge Economy

BK21-SKKU Center for Advanced IT HRD

School of Information & Communication Engineering, SKKU

Gyeonggi Province, Office of Investment Committee

SKKU BrainCity Research Institute

• Introduction

First of all, I would like to welcome each of you to the 2009 Korus Tech / SKKU-ICE summer school on Cognitive Robotics, Vision and Human Robot Interaction for Consumer Robots. This summer school is intended to offer professionals and students an opportunity to learn emerging critical technologies on cognitive robotics, vision and human robot interaction that are essential for development of the next generation of robotic services through consumer robots.

This summer school is a part of the Korus Tech program of Ministry of Knowledge Economy in Korea, which aims at strengthening competitiveness of technologies and advancing industrial structure by yielding synergy effect from University-Industry-Institutes cooperation between Korea and U.S. From this perspective, we invite diverse lecturers from universities, industry, and institutes both in Korea and U.S. to have them share the state-of-the-art technologies in cognitive robot research. The program is mainly comprised of two parts: 1) Cognitive robotics, Vision and Human Robot Interaction Technologies and 2) Development of Home Service Robots as consumer products. The contents in this program will provide the current and prospective robot researchers with technical details about how the future robot technologies emerge.

• Special Thanks

It is my pleasure to express my special thanks to those providing valuable contributions to the success of this summer school, including the Korus Tech program under the Ministry of Knowledge Economy, the SKKU-BK21 program at the Center for the Advanced IT-HRD, the School of Information & Communication Engineering, and BrainCity Research Institute at SKKU, and the Gyeonggi Province.

Sukhan Lee, Dr.
Professor and Director
The Intelligent Systems Research Center
Sungkyunkwan University

• Schedule
– Part I : Cognitive Robotics, Vision and HRI Technologies (2009/08/10)

Time	Title	Lecturer
09:00-10:30	Visual Recognition of Human Activity and Behavior	Prof. Bobick
10:30-12:00	Visual SLAM / Human Augmented Mapping	Prof. Christensen
12:00-13:00	Lunch	
13:00-14:30	Cognitive Visual Manipulation	Prof. Sukhan Lee
14:30-15:00	Break	
15:00-17:00	Gesture Recognition	Prof. Seong-Whan Lee

– Part II : Development of the Home Service Robot (2009/08/11)

Time	Title	Lecturer
09:00-10:30	Construction of Cognitive Robots – Experience from Cosy	Prof. Christensen
10:30-12:00	Cognitive Agent System for CCR (Cognitive Consumer Robot)	Dr. Shinn, Bonavision
12:00-13:00	Lunch	
13:00-14:30	Long-term Study of User Experience with Roombas	Prof. Christensen
14:30-15:00	Break	
15:00-17:00	Service Development Environment from the Cognitive Perspective	Mr. H. Jung, Yujin Robot

- ## Course Description

  - ### Visual Recognition of Human Activity and Behavior
    Prof. Aaron Bobick, Georgia Tech

    Over the last decade or so, the computer vision task of Action Recognition - semantically labeling a sequence of video data as containing a particular action - has grown to become as fundamental as that of classic static object recognition. We have developed a variety of techniques for the representation and recognition of action, most specifically focusing on human behavior. I will present examples of our work in each of these areas covering domains ranging from the low-level recognition of aerobics moves and gestures, to both structural and statistical models of visual surveillance, to the semantic labeling of football plays.

  - ### Visual SLAM / Human Augmented Mapping
    Prof. Henrik Christensen, Georgia Tech

    Simultaneous Localization and Mapping (SLAM) is by now a well formed problem, from a theoretical point of view. A number of solutions have been presented using in particular laser range data. More recently doing SLAM purely based on visual information has emerged as an alternative. In this presentation the basic SLAM problem is introduced and examples of doing visual SLAM will be presented including opportunities and challenges.

  - ### Cognitive Visual Manipulation
    Prof. Sukhan Lee, Sungkyunkwan University

    Unlike human, for robot to demonstrate such capability in our natural environment seems still not to be within our grasp in spite of over 30 years of rather remarkable progress in the technology of computer vision and robotic manipulation. The key to the problem lies in how robotic visual manipulation can deliver the required dependability in performance under a large variation of working environment as well as of situation. Recently, there has emerged, so called, "cognitive visual manipulation" as an approach to the solution of dependability in robotic visual manipulation in a natural and cluttered environment. This lecture aims at introducing fundamental technologies that are the foundation for engineering cognitive visual manipulation in 3D environments. A number of application details will be shown by demonstrating experimental results in order to help understand the lecture.

  - ### Gesture Recognition
    Prof. Seong-Whan Lee, Korea University

    Recently, virtual interface have begun to emerge in human life space. In order for natural interactions with the virtual interface, automatic gesture recognition is required. Especially, vision-based gesture recognition provides intuitive and natural interface without wearing on any special devices. In this lecture, vision-based human gesture recognition methods will be introduced dividing them into three types: pointing gesture, command gesture and whole body gesture. Various methods and recent progresses in the human gesture recognition are given, and then applications and demos are shown to help understanding.

– **Construction of Cognitive Robots – Experience from Cosy**
  Prof. Henrik Christensen, Georgia Tech

  Over the last 5 years a project funded by the European Commission - Cognitive Systems for Cognitive Assistance - CoSy has studied the problem of cognitive robot design. The research has included both theoretical research across the areas mentioned above and empirical studies using two demonstrator scenarios - "the explorer – spatial mapping/exploration" and "the Playmate - object manipulation/grasping and spatial reasoning".
  The CoSy project made significant progress on the general problem of design of cognitive robot systems. In this presentation the basic problems address, key theoretical results and major demonstrations will be presented. Some of the major insights are presented and issues for future research are also discussed

– **Cognitive Agent System for CCR (Cognitive Consumer Robot)**
  Dr. Richard H. Shinn, Bonavision

  We will first review a variety of cognitive agent architectures and systems currently available. From a cognitive perspective, we will then identify the requirements for our cognitive consumer robot. We will finally introduce a cognitive agent architecture for our robot and justify why it is a good architecture.

– **Long-term Study of User Experience with Roombas**
  Prof. Henrik Christensen, Georgia Tech

  To better understand these issues 30 Roomba systems have been deployed over a period of 6 months in a number of US households. The distribution of users is across single/married, ages, income, children, pets, etc to make sure that there is a broad coverage of the possible users. During the study six visits to the home took place to document the full process. The study covered people awareness of technology, their view of robotics, changes in cleaning routines, etc. The study also documented their bonding with the appliance to understand if they named it, if they decorated / personalized the unit etc.

  In this presentation we will outline the study, document the variability across the users, and discuss some of the main lessons that can be learned from the study in terms of physical design, social embedding, behavior, training and interfaces.

– **Service Development Environment from the Cognitive Perspective**
  Mr. HyunChul Jung, Yujin Robot

  Robot Contents Organizing Software (ROCOS) is a robot contents development environment for contents developers and users besides the robot developers. It features straightforward development of robot services that are applicable to heterogeneous robots. To this end, 1) we adopt an approach to make a model using drag-and-drop instead of the programming languages or script-based procedure, 2) we introduce an intuitive method based on events, and 3) we provide specialized methods for multi-media robot contents.

- ## Short Bios for lectures

  - ### Prof. Aaron Bobick

    Professor and Chair, School of Interactive Computing
    GVU Center
    Robotics and Intelligent Machines Center
    Office of the Dean
    Georgia Institute of Technology, Atlanta, GA

    Dr. Bobick is the chair of School of Interactive Computing at Georgia Tech. The School is a leader in computing research in all areas that involve computers interacting with the outside world, ranging from Human Computer Interaction to Robotics.   Dr. Bobick's research is in computer vision where he is one of the pioneers in activity and behavior recognition from video imagery.

  - ### Prof. Henrik Christensen

    Director, Robotics and Intelligent Machines Center
    KUKA Chair of Robotics, Distinguished Professor
    School of Interactive Computing
    Georgia Institute of Technology, Atlanta, GA

    Henrik I Christensen is the director of Georgia Tech's new Robotics Program and the KUKA Chair of Robotics. Christensen's main research interests include human centered robotics, sensory/data fusion, and systems integration.
    A fundamental assumption remains that all work must be evaluated; therefore a solid theoretical model, a credible scenario, and thorough testing and verification are required. Christensen has contributed over 250 publications within robotics, vision, and artificial intelligence, including ten books. He has served on the board of the most prestigious robotics journals, and is currently serving on the editorial board of six journals across robotics, vision and AI. Christensen is the founding chairman of the EU network of excellence in robotics - EURON (1999-2006), and is a science advisor to government agencies across three continents, as well as several international companies.

  - ### Mr. HyunChul Jung

    Staff Engineer, Yujin Robot

    Mr. Jung's main job areas are developing environment for robot service. It features development environment for robot services that are applicable to heterogeneous robots by contents developers and users besides the robot developers. Without contents, maybe robot is an empty can. He hopes that robot will be new-coming media delivery system used by even non-expert users.

- ## Prof. Sukhan Lee

  Director of the Intelligent Systems Research Center
  Professor, School of Information & Communication Engineering
  Sungkyunkwan University, Suwon, Korea

  His research areas are intelligent systems and MEMS/NEMS. Research in intelligent systems includes real-time vision-based recognition, modeling, and understanding of the 3D environment, visual servo, robotic motion planning, reconfigurable and embedded systems-on-chip for robotic software and hardware engines, 3D cameras, robot manipulation and navigation, and intelligent vehicles. Research in MEMS/NEMS includes devices for jetting micro and NANO droplets, electro-wetting, NANO fountain pens, and micro and NANO transducers.

- ## Prof. Seong-Whan Lee

  Hyundai-Kia Motor Chair Professor
  Department of Computer Science and Engineering
  Center for Artificial Vision Research
  Korea University, Seoul, Korea

  From February 1989 to February 1995, he was an Assistant Professor in the Department of Computer Science at Chungbuk National University, Cheongju, Korea. In March 1995, he joined the faculty of the Division of Computer and Communications Engineering at Korea University, Seoul, Korea, and now he is the full professor. Prof. Lee is also the director of Center for Artificial Vision Research (CAVR). In 2001, he also stayed at the Department of Brain and Cognitive Sciences, MIT as a visiting professor. In 2009, he was appointed as the Hyundai-Kia Motor Chair Professor.

- ## Dr. Richard H. Shinn

  Chairman/CEO, Bonavision, Inc.

  CEO/Founder, CROSSCERT: Korea Electronic Certification Authority
  President, Korea Intelligent Information Systems Society, 2000-2001
  CEO, Dongbu Informative System, Inc., 1996-1997
  Managing Director, Tongyang SHL (Currently, Tongyang Systems), 1993-1996
  Senior member of technical staff, GTE Labs, Boston, MA, U.S.A., 1989-1991
  Engineer, Bell Telephone Mfg. Co. (Currently, Alcatel), 1978-1979

• Location and Map

The 2nd Research Complex Room #83140
Sungkyunkwan University, Natural Science Campus
300 Cheoncheon-dong, Jangan-gu, Suwon
Gyeonggi-do, 440-746, Korea

• Direction

There are several ways to get to the Natural Science Campus of the Sungkyunkwan University using public transportation. Detail information (including driving direction) can be found at the following link:
http://isrc.skku.ac.kr/aboutus/location_direction_map.php

• Contact Information

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