Soon-Yong Park

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OBJECTIVE

A teaching and research position in *Computer Vision* and *Image Processing*

EDUCATION

- September 1999 ~ May 2003: PhD, Department of Electrical and Computer Engineering, The State University of New York at Stony Brook, Stony Brook, NY
  Advisor: Prof. Murali Subbarao
- March 1991 ~ February 1993: MS, Department of Electronics Engineering, Kyungpook National University, Daegu, Korea
- March 1987 ~ February 1991: BE, Department of Electronics Engineering, Kyungpook National University, Daegu, Korea

WORK EXPERIENCES

- June 2003 ~ present: Postdoctoral Research Associate, Computer Vision Lab, Department of Electrical and Computer Engineering, State University of New York at Stony Brook
- January 2004 ~ present: Lecturer, Department of Electrical and Computer Engineering, State University of New York at Stony Brook
- September 2000 ~ May 2003: Research/Teaching Assistant, Computer Vision Lab., Department of Electrical and Computer Engineering, State University of New York at Stony Brook
- September 1999 ~ August 2000: Research Fellow, Department of Electrical and Computer Engineering, Research Foundation of the State University of New York at Stony Brook (Supported by Symbol Technology Inc.)
- March 1993 ~ August 1999: Senior Research Engineer, Advanced Robotics Lab, Korea Atomic Energy Research Institute (KAERI), Daejon, Korea 305-600

RESEARCH INTERESTS

- 3D Sensing and Modeling (Sponsor: Olympus Corporation, Japan)
  - Photo-realistic 3D model reconstruction using multiple range images of real objects
  - Stereo camera calibration and stereo image rectification
  - Object segmentation using color image analysis techniques
  - Registration of multiple geometric and photometric images using point-to-plane techniques
  - Estimation of 3D pose and registration of multiple data sets
  - An accurate and fast point-to-plane registration refinement technique: A new registration technique based on an Contractive Projection Point (CPP) technique
  - Volumetric integration and mesh reconstruction from multiple range images
  - Pose estimation between two 3D models of an object using Base Tangent Plane (BTP) constraints
  - Object motion tracking using the CPP-based registration technique
  - Image-based 3D modeling: voxel coloring and space carving
  - Photo-realistic human face and body modeling

- Automatic Focusing of Color Digital Camera (Sponsor: Olympus Corporation, Japan)
  - Automatic focusing of SLR (Single Lens Reflection) digital camera using the Depth-from-Defocus technique
  - Automatic focusing of a zoom digital camera
  - Measuring of image blur using a spatial domain image analysis technique
  - Integration of Depth-from-Stereo and Depth-from-Focus using digital cameras

- Stereoscopic Imaging: Development of Stereoscopic Imaging and Tele-presence Systems (Sponsor: Korean Government Long-term Research Project)
  - Development of polarized stereoscopic monitors for tele-presence
  - Development of parallel-verging stereoscopic cameras with vergence and focus control
  - Development of polarized stereoscopic monitors using TFT-LCDs (Sponsor: Samsung Electronics)
  - Development of a binocular target tracking system with cepstrum-based vergence control technique
  - Stereo target tracking system using color image correlation and cepstrum-based matching
  - Automatic vergence and focus control of a parallel-verging stereo camera

TEACHING EXPERIENCES

As an Instructor

- Spring 2004: ESE124, Computer Techniques for Electronic Design, SUNY at Stony Brook

As a Teaching Assistant

- Fall 2000: ESE333, Real-Time Operating System, SUNY at Stony Brook
- Spring 2001: ESE344, Software Techniques for Engineers, SUNY at Stony Brook
- Fall 2001: ESE358, Computer Vision, SUNY at Stony Brook
- Spring 2002: ESE344, Software Techniques for Engineers, SUNY at Stony Brook
- Fall 2002: ESE358, Computer Vision, SUNY at Stony Brook
- Spring 2003: ESE344, Software Techniques for Engineers, SUNY at Stony Brook

RESEARCH GRANTS

- Title: Photo-realistic 3D Model Generation System using Digital Stereo Cameras, Research Assistant, Sponsor: Olympus Corporation, Project Dates: 11/00 ~ 10/03
- Title: Depth-from-Defocus Technique for Automatic Focusing of Digital Camera, Research Associate, Sponsor: Olympus Corporation, Project Dates: 11/03 ~ 10/05
- Title: Clinically-Accurate Low-cost 3D Vision System for Positioning and 3D Surface Imaging of Patients, co-PI, Sponsor: Center for Biotechnology, SUNY at Stony Brook, proposal submitted
- Title: Improvement in Detection of Radiological Threats, Research Associate, Sponsor: DTRA, A white paper submitted to DTRA

PUBLICATIONS (Recent)

- **Journal papers**
  1. Soon-Yong Park and Murali Subbarao, “Automatic 3D Reconstruction based on Novel Pose Estimation and Integration Techniques,” *Image and Vision Computing*, Vol. 22, No. 8, pp. 623-635, Aug. 2004.
  2. Soon-Yong Park and Murali Subbarao, “An Accurate and Fast Point-to-Plane Registration Technique,” *Pattern Recognition Letter*, 24 (16), pp. 2967-2976, Dec 2003.
  3. Soon-Yong Park, Namho Lee, and Seungho Kim, “Stereoscopic Imaging Camera with Simultaneous Vergence and Focus Control,” Accepted to be published in *Optical Engineering*, May. 2004.

4. Soon-Yong Park and Murali Subbarao, “A Stereo-based Computer Vision System for Multi-view 3D Model Generation,” finished the first revision, *Machine Vision and Applications*, Mar, 2004.
5. Soon-Yong Park and Murali Subbarao, “A Pose Estimation Technique based on Base Tangent Plane Constraints,” submitted to *Computer Graphics Forum*, Dec. 2003.
6. Soon-Yong Park and Murali Subbarao, “A Range Image Refinement Technique for Multi-view 3D Model Reconstruction,” submitted to *Computer Vision and Image Understanding*, May 2003.
7. Soon-Yong Park, Yong-bum Lee and Sung-Il Chien, "Linear Relation for Vergence Control of Parallel Stereo Camera," *IEE Electronics Letter (J.)*, Vol.34, No.3, Feb.1998.
8. Soon-Yong Park, Yong-bum Lee and Sung-Il Chien, "Disparity Compensation for Vergence Control of Active Stereo Camera," *Journal of The Institute of Electronics Engineering of Korea*, vol.34 no.9, pp.67-76, Sep. 1997. (in Korean)

□ **Conference papers**

1. Soon-Yong Park and Murali Subbarao, “A Range Image Refinement Technique for Multi-view 3D Model Reconstruction”, *The 4th International Conference on 3-D Digital Imaging and Modeling*, Oct. 2003.
2. Soon-Yong Park and Murali Subbarao, “A Point-to-Tangent plane Technique for Multi-view Registration,” *The 4th International Conference on 3-D Digital Imaging and Modeling*, Oct. 2003.
3. Soon-Yong Park and Murali Subbarao, “Pose Estimation and Integration for Complete 3D Model Reconstruction, “ *IEEE Workshop on Application of Computer Vision (WACV2002)*, pp.143-147, Dec. 2002.
4. Soon-Yong Park and Murali Subbarao, “Pose Estimation of Two-pose 3D Models using the Base Tangent Plane and Stability Constraints”, *7th International Workshop on Vision, Modeling, and Visualization (VMV2002)*, Nov. 2002.
5. Soon-Yong Park and Murali Subbarao, “Automatic 3D Model Reconstruction Using Voxel Coding and Pose Integration,” Proceedings of *IEEE International Conference on Image Processing (ICIP2002)*, pp. 533-536, Sept. 2002.
6. Soon-Yong Park and Murali Subbarao, "A New Technique for Registration and Integration of Partial 3D Models," *Proceedings of SPIE*, Vol. 4567, Oct. 2001.
7. Huei-Yung Lin, Murali Subbarao, and Soon-Yong Park, "Complete 3D Model Reconstruction from Multiple Views," *Proceedings of SPIE*, Vol. 4567, Oct. 2001.
8. Soon-Yong Park, Nam-Ho Lee and Yong-bum Lee, "Simple Method for Automatic Vergence Control of the Parallel Stereo Camera, " *SPIE 10th International Conference on Electronics Imaging*, Jan. 1998.
9. Soon-Yong Park, Yong-Bum Lee and Jong-Min Lee,"3-D Model Reconstruction from Three Orthogonal Views Based on Merging Technique of RP Codes", *IEEE Conf. on System, Man and Cybernetic*", Oct. 1995

INVITED TALKS

1. A Complete 3D Model Generation System based on Stereo-Vision Techniques. Olympus Optical Co., Advanced Core Technology Group, Japan, Sep. 2003.
2. A Multi-view Modeling Technique for Complete 3D Model Reconstruction: CAVE Lab, Columbia University, New York, Dec. 2002.
3. Stereoscopic Vision Systems for Complete and Photorealistic 3D Model Reconstruction, Intelligent Systems Lab, Rensselaer Polytechnic Institute, New York, Mar. 2003.
4. 3D Model Generation from a Stereo Digital Camera, Olympus Optical Co., Advanced Core Technology Group, Japan, Jan. 2000.

DEMONSTRATION

1. Photo-realistic 3D Model Generation System, CEWIT (Center of Excellence at Wireless and Information Technology) Conference, New York, Nov. 2003.

SOFTWARE and HARDWARE SKILLS

1. Programming Languages: C/C++, Visual C++, Matlab
2. Image/Vision Libraries: MFC (Microsoft Foundation Class), OpenGL, OpenCV (Intel Computer Vision Library), MIL (Matrox Image Library), FreeImage (Freeware for Image Processing), VectorLib (Vector Library from CMU), FLTK, LaPack,
3. Software Tools: AutoCAD, Origin, MS Office, Latex, OpenOffice
4. Operating Systems: Unix, Linux, MS Windows
5. Image/Vision/Robot System Interfaces: Frame grabbers (Matrox, Data Translation, Datacube), Point Grey Stereo Camera, IEE1394 cameras, Digital camera SDK (Olympus), A/D and D/A boards (Data Translation), Servo motion controllers, and GPIB board, 3D Scanning System, Stereoscopic Imaging

PATENTS (Korean)

1. Vergence control method of a parallel-type stereoscopic camera, Korean patent #1002567770000, 2/24/2000
2. Polarizing stereoscopic monitor using a color-LCD and two twisted-nematic LCDs, Korean patent # 2001803830000, 2/17/2000
3. Automatic vergence control of a stereo-vision camera, Korean patent #2001804390000, 2/7/2000.
4. Polarizing stereoscopic monitor using TFT-LCD, Korean patent #102508080000, 1/7/2000
5. Method of depth measure using a stereoscopic camera with vergence control, Korean patent #1001700160000, 10/14/1998
6. System for storing and retrieving stereo pictures, Korean patent #1001517600000, 6/23/1998

GRANTS

1. September 1999 ~ May 2000: Graduate Student Research Fellowship, Research Foundation of the State University of New York at Stony Brook (Sponsored by Symbol Technology Co.)
2. March 1991 ~ February 1993: Graduate Student Scholarship, Kyungpook National University, Korea
3. March 1987 ~ February 1991: Undergraduate Student Scholarship, Kyungpook National University, Korea

ACTIVITES

1. September 1999 ~ present: IEEE member
2. September 1999 ~ present: SPIE member

RESEARCH SUMMARY (Soon-Yong Park)

1. PhD Thesis: Stereo Vision and Range Image Techniques for Generating 3D Computer Models of Real Objects

One topic of research interest today in three-dimensional (3D) model reconstruction is the generation of a complete and photorealistic 3D model from multiple views of an object. My PhD thesis addresses the problem of generating 3D computer models of real-world objects. It presents stereo vision systems and computer vision techniques for complete 3D model reconstruction through a sequence of steps: (1) Multi-view range image acquisition (2) Registration and integration of multi-view range images (3) Pose estimation of 3D models (4) Integration of two-pose 3D models and (5) Photorealistic texture mapping. The thesis presents two stereo vision systems to obtain multi-view range images and photometric textures of an object. Range images obtained from multiple views of an object are registered to a common coordinate system through the calibrations of the vision systems. In order to refine the registration of multi-view range images, we introduce a novel registration refinement technique.

For many real objects, using a single pose yields only a partial 3D model because some surfaces of the object remain hidden from a range sensor due to occlusions or concavities. In order to obtain a complete and closed 3D model, we generate two 3D models of the object, register and integrate the 3D models into a single 3D model. By placing the object in different suitable poses and sensing the visible surfaces, we reconstruct two partial 3D models. We then merge the partial 3D models by novel pose registration and integration techniques. A pose estimation technique between two 3D models is presented to determine coarse registration parameters. The pose estimation technique finds a stable tangent plane (STP) on a 3D model which can be transformed to the base tangent plane (BTP) of the other model and vice versa. After pose estimation, the two pose models are integrated to obtain a complete 3D model through a volumetric pose integration technique. The integration technique merges two iso-surfaces of the corresponding partial 3D models. Texture mapping finally generates photorealistic 3D models of real-world objects.

2. Research Activities at KAERI: Development of Stereoscopic Imaging and Tele-presence Systems for Tele-operation of Remotely Operated Robotic Vehicles

I have been involved in long-term research projects to develop stereoscopic imaging systems. The purpose of the projects was mainly to develop tele-operation systems of remotely operated robotic vehicles, which are supposed to be operated in hazardous nuclear facilities. I have developed polarizing stereoscopic monitors using CRT or LCD monitors. The stereoscopic monitors provide tele-presence to human operators for efficient operation. I was also the main person of a research project to develop stereoscopic cameras. The developed cameras have a parallel-verging stereo configuration and a simultaneous vergence and focus control function. This is because the camera's lens is detached from the body and moved in parallel and perpendicular directions with the CCD plane to control both focus and vergence. The parallel-verging stereo camera with a simultaneous vergence and focus control system gives a linear control property between the focusing and the vergence. Using this property of the camera, I control the focus and the vergence simultaneously using focus measure of the lens system. I was also involved in developing a binocular active-vision system for automatic tracking of a moving object in real-time, an active stereo tracking system to track a moving object in work space, a stereo BOOM and Molly system for tele-presence, and a tele-inspection system using a high-definition infra-red camera.