Huadong Wu

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CAREER OBJECTIVE

A full time position involving applied research in computer science that will utilize my expertise in intelligent sensing, information fusion, pattern recognition (classification, diagnosis, and prognosis), and preferably my strong engineering research and development experience

SUMMARY OF QUALIFICATIONS

- Expertise in artificial intelligence techniques via research in sensor data fusion, context-aware Human-Computer-Interaction, robotics application, sensor signal processing, and intelligent sensing
- Proficient in software programming, familiar with Windows and Unix OS and various commonly used tools via 8+ years of various research projects and robotics graduate courses
- Skillful in mechanical design and system control via 8+ years of engineering research and development practice, through the full R&D life-cycle of several robotic products

EDUCATION

Robotics Institute, School of Computer Science
Carnegie Mellon University, Pittsburgh, PA 15213

- Ph.D. in Robotics, May 2004
- M.S. in Robotics, August 1998

Ph.D. Dissertation: "Sensor Data Fusion for Context-Aware Computing Using Dempster-Shafer Theory"

Courses Taken:

- Robotics Perception Core Qualifier:
  - Computer Vision
  - Advanced Perception
- Robotics Cognition Core Qualifiers:
  - Fundamental Artificial Intelligence in Robotics & Engineering
  - Sensor Based Robot Motion Planning
- Robotics Manipulation Core Qualifiers:
  - Robotics Manipulation
  - Mechanics of Manipulation
- Robotics Math Foundation Core Qualifiers:
  - Mathematical Foundation for Robotics
  - Introduction to Differential Geometry
- Specialized Qualifier
  - Computer Control Systems Design Lab
  - Digital Signal Processing I
  - Advanced Data Analysis II

Department of Precision Instrument
Shanghai Jiao Tong University, Shanghai, China

- M.S. in Inertial Navigation, February 1987

M.S. Dissertation: "Data Processing of the ESG Drift Tested Using Torque-Feedback Method"

Key Courses Taken:

- Matrix Theory
- Calculus of Variations
- Mathematical Statistics
- Stochastic Process
- Numerical Analysis
- Linear Systems
- System Identification
- Optimal Estimation
- Adaptive Control
- Principles of Gyroscope
- Inertial Elements & Data Processing
- Inertial Navigation
- Application of Microcomputer

Department of Precision Instrument
Shanghai Jiao Tong University, Shanghai, China

- B.S. in Precision Instrument, July 1984

Undergraduate Thesis Project:
"Mechanical Design of Shoulder Joint for Disabled People" (Final Grade: "Excellent")

Key Courses Taken:

- Advanced Mathematics
- Engineering Mathematics
- University Physics
- University Chemistry
- Inorganic Chemistry Experiment
- Theoretical Mechanics
- Theory of Machines
- Machine Drawing
- Precision Machine Design
- Strength of Materials
- Tolerance & Technical Measurements
- Metallic Material & Heat Treatment
- Basic Circuit Theory
- Analogue Electronics
- Digital Electronics

- Digital Electronics Experiments
- Theory of Automatic Control
- Control of Electrical Machinery
- Sensors
- Instrument Fabrication Techniques
- Algorithmic Language
- Principles & Application of Microcomputer
- Basis of Instrument Optics
- Techniques of Optical-Electric Measurement
- Design of Precision Instruments
- Mechanical Quantity Measurement
- Dynamic Measurement & Analyses
- Measurement Errors & Data Processing

RESEARCH

Ph.D. Dissertation:
Sensor Data Fusion for Context-Aware Computing Using Dempster-Shafer Theory

Context-aware computing is to have computers understand human situational "context" information, and sensing context is in the forefront of context-ware computing research. To meet the sensor fusion challenges for context-sensing, wherein the sensor set is highly dynamic in configuration, the sensor output joint probability distribution is typically unavailable, and human subjective speculation is often desired to be added into the information fusion process, this dissertation introduced the Dempster-Shafer Evidence Theory into the context-aware computing research area. The theoretical principle is first practically extended to account for the sensors' different performance factors, and then the reasoning system is further extended to improve its robustness against the sensor drift and environment changing effects. As an add-on module to the existing Context Toolkit System from Georgia Tech, this sensor fusion system architecture is implemented and tested. Case studies with prerecorded experimental data and with artificially generated simulation data both demonstrated the feasibility of this approach and the effectiveness of the sensor fusion algorithms.

Pre-thesis Research: Coin-Tap Test

With coin-tap test, the research in signal processing, sensor fusion, and pattern recognition is to detect disband defects in sandwich material structures (especially emphasizing on applications of aging-aircraft skin inspection). The research discoveries lead to a practical engineering solution in which the tap impact acceleration and the correspondingly emitted sound two-modality information is judiciously combined.

Pre-thesis Research: Odor Sensor for Incontinence

The goal is to invent an "artificial nose" for nursing homes. This research studied the dynamic behavior of several tin oxide based solid state gas sensors under an alternating heating current, explored the high-dimensional feature space of the sensor array's responses.

Pre-thesis Research: Vehicle Sound Recognition & Tracking

Research in signal processing and pattern recognition, the goal is to enable small autonomous robots to find and track typical vehicle types (such as tanks, trucks, helicopters, etc.) in battle field environment. The research creatively transferred an image processing technique in human face recognition research to audio signal processing applications for effectively detecting vehicle sound signatures.

WORK EXPERIENCE

Imaging Research, Department of Radiology, School of Medicine, University of Pittsburgh
4200 Magee-Women's Hospital, 300 Halket Street, Pittsburgh, PA 15212-3180

May 2004 – current

- Medical image processing: to register pathological liver specimen slices with the MRI images taken prior surgical transplant, to recognize pathological signatures of liver tumor in MRI images

Robert Bosch Research and Technology Center North America,
Pittsburgh, PA 15212

Summer internship, May 14, 2001 – August 31, 2001

- Transferred a sensor fusion software package from Linux platform to Windows 2000 platform, improved documentation and studied enhancing it with some context-aware computing features

Motorola Applications Research Labs,
Schaumburg, Illinois 60169

Summer internship, May 16, 2000 – September 16, 2000

- Conducted a thorough literature research on sensing and sensor technology that can be used for human-computer interaction, analyzed gathered information to suggest a sensor technology road map for the Context-aware Computing Research Project in Motorola Research Labs

Robot & Automation Research Institute, Beijing, China

February 1987 – December 1989 Engineer Assistant
January 1990 – August 1993 Engineer
September 1993 – June 1995 Senior Engineer

- R&D of HRGP-1A Painting Robots, February 1987 – June 1995
  Participated in the whole process from design and prototype to improvement and application support, mainly on mechanical design of some of its components/parts, robot control programming, production line application support
- R&D of HRGB-1 Assembly Robot, June 1990 – December 1991
  Participated in its whole prototype process, in charge of the mechanical design of its vertical arm assembly, helped the design of its electrical control system
- R&D of Video-Dynamic-Simulation-Seat, January 1993.1 – June 1995
  Participated the whole prototype process of 2 models, in charge of motion analysis and control programming
- Various other projects mostly involved in mechanical design and system control programming

SKILLS

- Computer Language: Java, C, C++, Basic, SQL, Perl, FORTRAN, Assembly, HTML/XML, etc.
- Operating System: familiar with Microsoft Windows and UNIX through various projects
- Software Tools: MS Office, Sun One Studio, Eclipse, MS Visual Studio, Matlab, Rational Rose, JBuilder, Unix GNU tools, Mathematica, S-plus, Origin, MySQL, Apache, etc.

- System Control: experiences in PID control, frequency analysis, robot & automation, etc.
- Mechanical Engineering: 8+ years of experiences in machine, equipment, and parts' design

TEACHING

- Teaching Assistant, Spring Semester of 2000
  16-722 Sensing and Sensors, taught by Prof. Mel Siegel
- Teaching Assistant, Spring Semester of 1999
  15-229 Multimedia Information Processing, taught by Prof. Robert Thibadeau, Prof. Roger Dannenberg, and Prof. Raj Reddy
- Teaching Assistant, Fall Semester of 1985 (1985.9 - 1986.1)
  Theory of Automatic Control (Shanghai Jiao Tong University, Shanghai, China)

PUBLICATIONS

- "Confidence Fusion", Mel Siegel, Huadong Wu, the Proceedings of ROSE'2004 (2004 IEEE Workshop on Robotic Sensing), May 24-25, 2004, Graz, Austria
- "Sensor Fusion Using Dempster-Shafer Theory II: Static Weighting and Kalman Filter-like Dynamic Weighting," Huadong Wu, Mel Siegel and Sevim Ablay (Motorola), the Proceedings of IMTC'2003 (IEEE annual Instrumentation and Measurement Technology Conference, Vail, CO USA, May 20-22, 2003)
- "Objective Evaluation of Subjective Decisions," Mel Siegel, Huadong Wu, the Proceedings of SCIMA'2003 (International Workshop on Soft Computing Techniques in Instrumentation, Measurement and Related Applications, Brigham Young University, Provo, Utah, USA, May 17, 2003)
- "Sensor Fusion Using Dempster-Shafer Theory," Huadong Wu, Mel Siegel, Rainer Stiefelhagen, and Jie Yang, the Proceedings of IMTC'2002 (Anchorage, AK, USA, May 21-23, 2002)
- "Sensor Fusion for Context-Understanding," Huadong Wu, Mel Siegel, Sevim Ablay (Motorola), the Proceedings of IMTC'2002 (Anchorage, AK, USA, 21-23 May 2002)
- "Odor-Based Incontinence Sensor," Huadong Wu, Mel Siegel, the Proceedings of IMTC'2000 (Baltimore, MD USA, May 1-4, 2000), selected in the IEEE Transactions on Instrumentation and Measurement Special Edition
- "Sensor Fusion Approach to Automating the 'Coin Tap Test'," Huadong Wu, Mel Siegel, ASNT'1999, (American Society of Non-destructive Test Annual Conference, Phoenix, Arizona, Oct. 11-15, 1999)
- "Correlation of Accelerometer and Microphone Data in Coin Tap Test," Huadong Wu, Mel Siegel, the Proceedings of IMTC'1999, selected in the IEEE Transactions on Instrumentation and Measurement, Vol. 49, No. 3, June 2000, page 493 - 497, (ISSN 0018-9456)
- "Vehicle Sound Signature Recognition by Frequency Principle Component Analysis," Huadong Wu, Mel Siegel and Pradeep Khosla, the Proceedings of IMTC'1998, selected in the IEEE Transaction on Instrumentation and Measurement Vol. 48, No. 5, October 1999, page 1005 - 1009, (ISSN 0018-9456)
- "Error Analysis of HRGP-1A Painting Robot," Huadong Wu, the Proceedings of the second National Symposium on Robotics, Beijing, China, Oct. 1991
- "System Analysis of the T3-746 Industry Robot," Huadong Wu, the Proceedings of the Symposium on Robotics, Chinese Society of Astronautics, Harbin, Oct. 1990

HONORS

- Graduate Fellowship since from the Robotics Institute, School of Computer Science, Carnegie Mellon University, September 1995 – August 2003
- Recipient of Motorola University Partnership in Research (UPR) Grant, 2001 - 2003

- Three papers selected in IEEE Transactions Special Issues of Instrumentation and Measurement
- The paper "Error Analysis of HRGP-1A Painting Robot" won the second prize in the 1990 Young Scholars' Thesis Competition in the Ministry of Space and Aeronautics Industry, China
- Technical Report "Robot Tracking System for Rocket Fueling Process" won the third prize in the 4th Young Scholars' Science & Technology Conference of China Academy of Launch Vehicle Technology, Beijing, 1994