Hairong Jiang

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OBJECTIVE

A self-motivated researcher with hands-on experiences and system/algorithm design background actively seeking for a full-time position at system/software level in field of **Robotic Control/Vision, Computer Vision, Gesture/Pattern Recognition, Statistical Machine Learning, Image Processing, and Human Robot/Computer Interaction**

EDUCATION

Ph.D., Industrial Engineering, Purdue University, West Lafayette IN, USA　　　　　　　　**Aug 2015**
Dissertation: *"Effective and Interactive Interpretation of Gestures by Individuals with Mobility Impairments"*　　CGPA 3.85/4.0

M.S., Electrical Engineering *(with Honors)*, Harbin Institute of Technology, Shenzhen, China　　　**Dec 2010**
Thesis: *"Controller Parameters Tuning for Wire Bonders Based on Data-Driven Method"*　　CGPA 3.73/4.00, Rank: 1/58

B. S., Electrical Engineering, Harbin Institute of Technology, Harbin, China　　　　　　**Aug 2008**
Thesis: *"Linear Motor Driven Control System Design"*　　CGPA 3.71/4.00, Rank: 3/109

RELATED COURSES

CS: Computer Vision, Statistical Machine Learning, Digital Image Processing, Data Mining, Data Structure and Algorithms

Robotics/Control: Advanced Robotics & Machine Vision, Introduction to Robotic Manipulation, Robotic Control, Principles of Automatic Control, Fundamental Theory of Modern Control System, System Modeling and Simulation, Motion Control Systems

Math/Statistics: Dynamic Programming, Integer Programming, Convex Optimization, Bayesian Decision Theory, Statistical Methods

TECHNICAL SKILLS

- Programming Languages: C/C++ (expertise), MATLAB (expertise), C# (familiar), R (familiar)
- IDE: QNX, Linux, embedded system, Git, Microsoft Visual Studio, Qt, Robot Operation System (ROS)
- API: OpenCV, OpenNI, Kinect SDK, MFC, LIBSVM, Boost, Point Cloud Library (PCL)
- Robotics: FANUC *LR Mate 200iB*, TurtleBot Mobile Robot, JACO Robotic Arm, Novint Falcon, ROBODOC acetabulum robot

WORKING & TEACHING EXPERIENCES

Robotic Software Engineer, THINK Surgical, Fremont, CA　　　　　　　　　Oct 2015-present
- Designed and implemented algorithms for automatic robot calibration verification and automatic testing on pose finding for an acetabulum surgical robot
- Redesigned and debugged visualization module for bone and cutting process for an acetabulum surgical robot

Teaching Assistant, School of Industrial Engineering, Purdue University　　　Fall 2013, Spring 2015
IE 474　*Industrial Control Systems*

System Engineer, Parallax Precision CO. LTD, China　　　　　　　Aug 2009-Dec 2010
- Designed motion control systems for Wire Bonding Machines (WBMs)
- Investigated algorithms for multi-loop precision position and force control for WBMs.
- Developed algorithms to optimize WBMs' motion trajectories and reduce vibration

ROBOTICS & COMPUTER VISION PROJECTS

Ph.D. Researcher, Intelligent System and Assistive Technologies Laboratory, Purdue University　　Jan. 2011-Aug. 2015

Integrated gesture recognition based interface for people with upper extremity mobility impairments (C++, OpenCV, Boost, and ROS)
- Proposed a 3D particle filter framework based on color and depth information for robust face and hand tracking. Incorporated an interaction model utilizing spatial and motion information to tackle the "false merge" and "false labeling" problem through hands' interaction and occlusion. Obtained an optimized parameters set using neighborhood search and achieved a tracking accuracy of 98.81%
- Encoded acquired trajectories using Dynamic Time Warping and obtained 95.9% on dynamic hand gesture recognition using extended CONDENSATION algorithm. Applied the proposed gesture-based interface to multi-robot control and collaboration

Effective and Interactive Interpretation of Gestures by Individuals with Quadriplegia (MATLAB, C++, Kinect SDK)
- Investigated effective features (Laban space, kinematic, and geometric) to interpret gesture trajectories and train a regression tree model. Generated matched gesture trajectories using Gaussian Mixture Regression
- Built 4-DOF human arm model, computed forward/inverse kinematics, and Jacobian matrices. Analyzed real-time video data to extract and annotate human body skeleton using Microsoft Kinect sensor and applied uncontrolled manifold theory to analyze users' performance

Ph.D. Researcher, Institute of Accessible Science, Purdue University　　　Jan. 2011-Dec. 2013

Multimodal vision-based wheelchair-mounted robotic arm system (C++, OpenCV, PCL, and LIBSVM)
- Developed a novel multimodal vision-based robotic system containing two Kinect sensors, a wheelchair mounted commercial robotic arm allowing users with motor impairments to use natural interaction (recognized gesture and speech commands in real time) reliably
- Investigate 2D/3D object recognition algorithms to detect and recognize daily living objects

3D joystick for robotic arm control (C++ and C#)
- Developed an innovative 3D joystick to enable independent and efficient operation of a robotic arm
- Compared different input modalities and evaluated the system using the Fitts's law measurement.

Email: jhrpurdue@gmail.com　　　　　　　　　　　　　　　　　　　*Hairong Jiang*

M.S. Researcher, Harbin Institute of Technology   Aug. 2008-Jul. 2009

Data-drive based controller parameters tuning for wire bonders
- Investigated data-driven methods to tune parameters for wire bonding systems.
- Applied the methodologies to optimize the manufacture process. Implemented the interface using MFC.

Linear motor driven control system design
- Developed a multi-loop high-speed and high-precision positioning system driven by linear motors for semiconductor packaging.

Other Projects

Surgical Instruments Classification
- Built background model using Gaussian Mixture Model, represented surgical instruments using HOG features and SVM for classification.

Human Action Detection based on Hidden Markov Models
- Built Hidden Markov Model for each human action and then used them for recognition.

One Shot Learning Gesture Recognition from RGBD Images
-Solve the ChaLearn one shot learning problem using extended motion histogram image and maximum correlation coefficient

Micro Gesture Recognition for Individuals with Severe Motor Impairments
- Applied Eulerian Video Magnification framework to detect micro hand motion and dynamic time warping for gesture recognition.

Learning of statistical skin color model
-Build histogram and Gaussian mixture models for skin color and classified skin color based on Bayes rule

Denso VM 6083 Robotic Arm Modeling and Simulation (MATLAB, SolidWorks, Addams)
- Created a 3D model of Denso robotic arm using Solidworks and solved the inverse kinematic problem and computed the Jacobian
- Sketched the reachable workspace and found the singularities of the mechanism and derived the dynamic equations of motion

PATENTS

1. Bradley S. Duerstock, Juan P. Wachs, and **Hairong Jiang** "Gesture Translation for Persons with Mobility Impairments" Pending

2. Wei Cheng, Xinlu Yu, Jianjun Min, and, **Hairong Jiang** "A Four-loop Precision Position/Force Hybrid Control Approach for Golden Wire Bonders" CN101969034 A, September 3, 2010

SELECTED PUBLICATIONS

1. **H. Jiang**, B. S. Duerstock, and J. P. Wachs, "User-Centered and Analytic-Based Approaches to Generate Usable Gestures for Individuals With Quadriplegia", *IEEE Transactions on Human-Machine Systems (THMS)*, 99: 1-7, 2015
2. **H. Jiang,** B. S. Duerstock, and J. P. Wachs, "Determining Natural and Accessible Gestures using Uncontrolled Manifold and Cybernetics", *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2015.
3. **H. Jiang,** J. P. Wachs, and B. S. Duerstock, "Integrated Vision-based System for Efficient, Semi-automated Control of a Robotic Manipulator", *International Journal of Intelligent Computing and Cybernetics (IJICC)*, 7(3): 253-266, 2014.
4. **H. Jiang,** B. S. Duerstock, and J. P. Wachs, "A Machine Vision-Based Gestural Interface for People with Upper Extremity Physical Impairments", *IEEE Transactions on Systems, Man, and Cybernetics: Systems (TSMC)*, 44(5): 630-641, 2014.
5. **H. Jiang,** B. S. Duerstock, and J. P. Wachs. "An Analytic Approach to Decipher Usable Gestures for Quadriplegic Users", *IEEE International Conference on System, Man, and Cybernetics (SMC)*, San Diego, Oct 5-8, 2014.
6. **H. Jiang,** T. Zhang, J. P. Wachs, B. S. Duerstock, "Autonomous Performance of Multistep Activities with a Wheelchair Mounted Robotic Manipulator Using Body Dependent Positioning", *IROS Workshop*, Sep 14-18, Chicago, 2014.
7. K. Chen, S. Tang, **H. Jiang,** J. P. Wachs, B. S. Duerstock, "Practical Implications for the Design of Mobile Assistive Robots for Quadriplegics Using a Service Dog Model", *IROS Workshop*, Sep 14-18, Chicago, 2014.
8. **H. Jiang,** J. P. Wachs, and B. S. Duerstock "An Optimized Real-time Hands Gesture Recognition based Interface for Individuals with Upper-level Spinal Cord Injuries", *Journal of Real-Time Image Processing (JRTIP)*, pp. 1-14, 2013.
9. **H. Jiang,** J. P. Wachs, and B. S. Duerstock. "Integrated Vision-based Robotic Arm Interface for Operators with Upper Limb Mobility Impairments", *In Proc. of IEEE International Conference on Rehabilitation Robotics (ICORR)*, Seattle, June 24-26, 2013.
10. **H. Jiang,** J. P. Wachs, M. Pendergast, and B. S. Duerstock. "3D Joystick for Robotic Arm Control by Individuals with High Level Spinal Cord Injuries", *In Proc. of IEEE International Conference on Rehabilitation Robotics (ICORR)*, Seattle, June 24-26, 2013.

HONORS & AWARDS

- Second Place of Poster Competition, Industrial Engineering Research Symposium, April 2015, Purdue University
- Second Place of Poster Competition, Industrial Engineering Research Symposium, April 2014, Purdue University
- National Scholarship, 2008, 2009, 2010, Harbin Institute of Technology, China

ACTIVITIES

- Reviewer, IEEE Transactions on Biomedical Engineering, June, 2015
- Volunteer, IEEE Conference on System, Man, and Cybernetics (SMC), 2014
- Reviewer, International Journal of Pattern Recognition and Artificial Intelligence, Aug, 2014
- Committee Member, Purdue Robotics and Automation Society
- Member, IEEE Computer Society; Robotics and Automation Society; System, Man and Cybernetics Society; Communication Society
- Host, 201 Studio, Harbin Institute of Technology, 2005-2006, China
- Social Head, Qitian Science and Technology Symposium, Harbin Institute of Technology, 2005-2006, China

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