Jeffrey Kramer
Solving hard problems with hardware and software

Redmond, WA - Email me on Indeed: indeed.com/r/Jeffrey-Kramer/47448a1acb3829cf

I'm interested in leading teams to solve thought to be impossible problems at the intersection of hardware and software.
Willing to relocate: Anywhere
Authorized to work in the US for any employer

WORK EXPERIENCE

Senior Member of Technical Staff
Microsoft - Redmond, WA - August 2014 to Present

Working at Microsoft Research - software and hardware expert on a variety of secret projects.

Project Natick - subsea data centers.

- IEEE Spectrum: http://spectrum.ieee.org/computing/hardware/want-an-energyefficient-data-center-build-it-underwater
- New York Times article: http://www.nytimes.com/2016/02/01/technology/microsoft-plumbs-oceans-depths-to-test-underwater-data-center.html?_r=0
- Microsoft article: http://news.microsoft.com/features/microsoft-research-project-puts-cloud-in-ocean-for-the-first-time/
- Video: https://www.youtube.com/watch?v=L2oJw1a_qEM&feature=youtu.be

Mobile Holoportation - real time full 3D free viewpoint video capture and transmission

- Main Page: https://www.microsoft.com/en-us/research/project/holoportation-3/
- Video: https://youtu.be/nTkFO2xNkIk

Project Manager
Consulting - Redmond, WA - September 2011 to Present

Developer of Custom Prototypes
- Worked with design teams at a major international corporations
- Delivered multiple prototype systems with new hardware/software/interactions

Developer of Computer Vision Systems and Algorithms
- Worked closely with upper management at a Fortune 500 company
- Developed demo applications and proof of concept works

Project Manager and Developer for Pipe Rupture and Gas Flow Simulations
- Managed small team to develop project to specification
- Developed software for a numerical method of simulation
- Handled budgeting and financial accountability of the project

Lead Robotics Engineer
MTD Products Inc - Valley City, OH - April 2013 to July 2014

Responsibilities
Software and Electrical Team Lead on autonomous lawnmower project

Accomplishments
- Led software and electrical product design for autonomous robot system
- Worked in a crossfunctional group to design a product using privileged consumer insights
- Interfaced with stakeholders and suppliers to drive requirements and system choices
- Built system requirements from focus group and consumer event interactions
- Designed the software and hardware architecture from the ground up
- Wrote advanced robot simulation software for test, validation, and analysis
- Performed sensor system design and analysis

Senior Roboticist
Deeplocal - Pittsburgh, PA - December 2012 to March 2013

Creative coding and design for multiple clients
- Designed innovative experiences for major brands
- Implemented prototypes of experiences
- Addressed proposals and technology feasibility requests with both advertising agencies and brands

Research Programmer
NREC - National Robotics Engineering Center - Pittsburgh, PA - October 2010 to December 2012

Research Programmer on engineering projects
- Industrial robot safety
- Sensor fusion and occupancy probability
- Self-driving vehicles and obstacle detection

Cofounder
Spark Inc - Pittsburgh, PA - February 2012 to November 2012

Cofounder and Technology Lead
- Led development of cross-platform interactive motion API
- Designed and implemented gesture recognition systems
- Created technology demonstrations utilizing the Microsoft Kinect SDK
- Wrote business plans and models
- Interviewed customers

Project Manager
iSSRT - Institute - Tampa, FL - January 2008 to August 2008

Developed and managed commercial medical company website
- Responsible for budgeting and financial accountability of the project
- Created and responsible for scope and design
- Managed foreign coding teams to complete projects on time and under budget

Engineering Research Assistant
iSSRT - Institute - Tampa, FL - August 2005 to August 2008

Research assistant on engineering projects while continuing my graduate education in Computer Science, including:
- Robot testing and verification
- Design and development of a 3D laser range finder
- Optic flow for obstacle avoidance

- Fuzzy sensor fusion for navigation and control
- Design and development of an unmanned surface vehicle (SeaRAI)
- Adaptive sensor fusion for robot localization

Researcher

iSSRT - Institute - Panama City, FL - June 2006 to August 2006

Designed and developed sensor fusion method for both unmanned ground and surface vehicles
• Collaborated with preeminent researchers on various Navy robotics projects

Teaching Assistant

AI Robotics - 2006 to 2006

Instructor - AI Robotics

Teaching Assistant

Behavioral Robotics - 2005 to 2005

Consultant

Yaskawa Electric America - Lake Forest, IL - August 2004 to December 2004

Responsible for the development of a revolutionary new method of timing motion for industrial machines - completing a task that was thought to be impossible. This resulted in a patent currently held by this company for this process (US20080082206)

EDUCATION

Master of Science in Computer Science

University of South Florida - Tampa, FL
August 2005 to May 2010

Bachelor of Science in Electrical Engineering

University of Illinois at Urbana - Urbana, IL
August 2000 to May 2004

SKILLS

Mobile Robotics, Computer Vision, Artificial Intelligence, Machine Learning, Control, Neural Networks, Distributed Systems, Mathematical Filters, Sensor Fusion, Autonomous Vehicles, C, C++, Java, Assembler, Ladder, Linux, OS X

LINKS

http://about.me/JeffreyKramer/

http://mind-melt.com

PATENTS

Automated conveying system (#US20080082206)

http://www.google.com/patents/US20080082206
September 2007

I designed, implemented, and pitched this system to thousands of people at PakExpo. As I was a consultant, my work defaulted to the company.

SynchBelt is an automated system for changing the position of items on conveyor belts without touching them. It can either place them in slots directly on a moving belt or fill all of the slots of a stepped belt.

From the patent:
An automated control system is described for a conveying system including an input conveyor supplying a product, a segmented output conveyor delivering a product in a pattern, and one or more synchronizing conveyors disposed between the input conveyor and the output conveyor. The control system comprises a plurality of product position sensors for sensing position of product on each synchronizing conveyor. A conveyor sensor senses segment position of the output conveyor. A plurality of drives, one for each respective conveyor, control the respective conveyors. A database stores a plurality of template pattern algorithms each defining a control algorithm for a distinct product pattern to be delivered from the segmented output conveyor. A controller is operatively connected to the product position sensors, the conveyor sensor and the drives for controlling the conveyors responsive to sensed product position and segment position. The controller includes a programmable processor...

PUBLICATIONS

Hacking the Kinect
http://amzn.to/Z4ODXb
March 30, 2012
I was the lead author on this book. Not only did I author half the chapters, but I was able to pull together an extremely strong group of contributors and convince them to write for the book.

From the publisher's description:
Hacking the Kinect is the technogeek’s guide to developing software and creating projects involving the groundbreaking volumetric sensor known as the Microsoft Kinect. Microsoft’s release of the Kinect in the fall of 2010 startled the technology world by providing a low-cost sensor that can detect and track body movement in three-dimensional space. The Kinect set new records for the fastest-selling gadget of all time. It has been adopted worldwide by hobbyists, robotics enthusiasts, artists, and even some entrepreneurs hoping to build business around the technology.

Hacking the Kinect introduces you to programming for the Kinect. You’ll learn to set up a software environment, stream data from the Kinect, and write code to interpret that data. The progression of hands-on projects in the book leads you even deeper into an understanding of how the device functions and how you can apply it to create fun and educational projects. Who knows? You might even come up with a business idea.

On Accurate Localization Given Uncertain Sensors
http://bit.ly/ZFmx1P
May 2012
The necessity of accurate localization in mobile robotics is obvious - if a robot does not know where it is, it cannot navigate accurately and reach goal locations. Robots learn about their environment via sensors. Small robots require small, efficient, and, if they are to be deployed in large numbers, inexpensive sensors. The sensors used by robots to perceive the world are inherently inaccurate, providing noisy, erroneous data or even no data at all. Combined with estimation error due to imperfect modelling of the robot, there are many obstacles to successfully localizing in the world. Sensor fusion is used to overcome these difficulties - combining the available sensor data in order to derive a more accurate pose estimation for the robot.

A feeling of “ready-fire-aim” pervades the discipline - filters are chosen on little to no information, and new filters are simply tested against a few peers and claimed as superior to all others. This is folly - the most appropriate filter is seldom the newest. This article provides an overview and in-depth tutorial of all modern robot localization methods and thoroughly discusses their strengths and weaknesses in order to assist a robot researcher in the task of choosing the most appropriate filter for their task.

Robust Small Robot Localization From Highly Uncertain Sensors

http://bit.ly/Zb2SZZ

July 2011

Localization is arguably the most important goal for a robot to solve - without knowledge of its place in the world, a robot cannot do useful work. The current best practice for providing accurate localization given uncertain sensors involves the use of sensor fusion, or combining sensor data in order to derive a better pose estimation for the robot. Small robots add another problem that needs to be solved - limited power, computational ability, and weight/space constrain both the sensors available and the filters that can be used. This article provides a detailed example in simulation of four filter types: the EKF, the Fuzzy EKF, the SPKF, and the Double Fuzzy SPKF, while discussing the strengths and weaknesses of all current state of the art sensor methods. While the field is relatively mature, there has been little to no comparative analysis of different filters performed - what roles do they best serve, how to select the “best” filter and what tradeoffs must be made for each type. This article analyzes the current state of the art filters of all categories and determines their applicability to the small robot problem.

Sea Robot Assisted Inspection

http://bit.ly/XEVx84

June 2011

The sea robot-assisted inspection (Sea-RAI) marsupial robot team is the first known manportable unmanned surface vehicle (USV) that hosts an unmanned aerial vehicle (UAV). The Sea-RAI is designed for inspecting littoral environments for military, environmental, and disaster-response applications. The project also provides a platform for exploring the four roles in a marsupial team: courier, messenger, manager, and coach. The cooperation between the vehicles extends their capabilities beyond the capabilities of a single vehicle. This article describes the robot team, details the design and construction of low-cost USVs, and describes the demonstration of the integrated system and the four key capabilities, such as seaworthiness, data display, marsupialism, and mission logging.

Fuzzy Approaches to Driven Kalman Filtering for Small Robot Localization

http://bit.ly/Z3AO7m

June 2009

Recent robotics research has focused heavily on small robots - those that can be hand-carried or palmtop models. However, most recent research in robot localization has focused on highly computationally expensive algorithms, like various particle filter based approaches, that are inappropriate for these small platforms. This paper discusses a set of fuzzy controlled Kalman filters - fuzzy extended Kalman filter (FEKF) and a double fuzzy sigma-point Kalman filter (DFSPKF) - and compares them to traditional EKF and SPKF filters in a simulated environment. All of these filters are especially appropriate for small robots with uncertain sensors and limited computation capacity. Given a fast fuzzy logic controller, the Fuzzy EKF performs almost as well as the SPKF in the simulated environment, and the DFSPKF shows promise to create a robust and low-complexity localization scheme.

Sensor Fusion for Robot Navigation using a Fuzzy-EKF with Weighted Covariance

http://bit.ly/Zb3Kxv

June 2007

In this paper we present a method for increasing the accuracy of a standard Extended Kalman Filter (EKF) by using a Fuzzy Logic Adaptive Controller (FLAC) to perform online modification of a covariance weighting factor.

Using this method the filter runs twice as slow on actual robot sensor data as the standard EKF (6.30 seconds v. 3.257 seconds) but generated residuals with a mean which was 3.75 to 5.57 times more accurate than the standard version while the standard deviations ranged from 0.86 to 1.19 times as accurate, when compared to the standard filter. For situations requiring a more accurate sensor fusion system (and where extra processing capability is available) the Fuzzy-EKF provides a useful method for increasing the accuracy of the system.

Endurance Testing for Safety, Security, and Rescue Robots

http://bit.ly/Zud8M6

2006

This paper investigates the role of endurance testing for rescue and safety robotics. Endurance testing is a form of acceptance testing that verifies whether the robot can operate correctly over the intended period of operation. A six-hour endurance test was developed for the commercially available ASR micro-VGTV Extreme rescue robot. The test uncovered failures consistent with those previously encountered in the field but under conditions that captured the source of the failures. In addition, the data captured identified subtle design and manufacturing issues. Based on these results, this paper proposes that endurance testing become an additional requirement for standards for rescue and safety robotics and that developers adopt endurance testing as a general design and manufacturing diagnostic method. Specific recommendations on endurance testing are presented.

UGV acceptance testing

http://bit.ly/WsJ70a

May 2006

With over 100 models of unmanned vehicles now available for military and civilian safety, security or rescue applications, it is important to for agencies to establish acceptance testing. However, there appears to be no general guidelines for what constitutes a reasonable acceptance test. This paper describes i) a preliminary method for acceptance testing by a customer of the mechanical and electrical components of an unmanned ground vehicle system, ii) how it has been applied to a man-packable micro-robot, and iii) discusses the value of testing both to ensure that the customer has a workable system and to improve design. The test method automated the operation of the robot to repeatedly exercise all aspects and combinations of components on the robot for 6 hours. The acceptance testing process uncovered many failures consistent with those shown to occur in the field, showing that testing by the user does predict failures. The process also demonstrated that the testing by the manufacturer can provide important design data that can be used to identify, diagnose, and prevent long-term problems. Also, the structured testing environment showed that sensor systems can be used to predict errors and changes in performance, as well as uncovering unmodeled behavior in subsystems.