Goals for the Meeting

Goal 1

Network with global thinkers: identify common challenges and opportunities for Pervasive Personalized Intelligence (PPI) for IoT systems.

Goal 2

Influence the direction of the Center: push back and challenge our research and make it better.

Goal 3

Validate the feasibility of the Center: analyze data and best practices from the National Science Foundation (NSF) on Industry/University Collaborative Research Centers (IUCRCs); analyze how PPI Center capabilities meet industry needs.

Goal 4:

List here your goals for the meeting:

CENTER ON Pervasive Personalized Intelligence

Local Planning Meeting
November 9, 2018
Boulder, Colorado, USA
Wifi: UCB Guest

Welcome from the Directors

Dear Planning Workshop Participant,

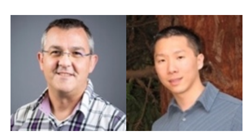
We are glad you are here. We are grateful that you are bringing your best thinking into this meeting. This is what truly makes us better. The scale and complexity required to build tomorrow's Pervasive Personalized Intelligence is beyond what any organization can successfully build on their own. We need to unite our forces and our minds. Join the movers and shakers who make things happen in industry, academia, and government funding agencies.

Innovation starts at connection. Connection truly happens best in person. We created a program for these two days with generous time to connect with other participants and access the diverse thinking and expertise in the room.

We invite you to fully validate information and ideas. This is truly two-way learning. You can read our academic research and analyze information on your own, but it doesn't allow you to push back and challenge it to make it better. Engage so that you influence the direction on which we are going as a center. It is this feedback that makes us better so that we can serve you better.

We also encourage you to analyze the data and best practices from the NSF and interact with the NSF representatives (Dee Hoffman). Ask her how the Industry/University Collaborative Research Centers (IUCRCs) across the nation are providing tremendous value for industry. In countless conversations with them, we found Dee goes the extra mile to serve the people in front of her. You will find this too.

One is too small of a number for significance. Putting together this event is truly a team effort. There are many people who worked behind the scenes to make this event possible, some of them you will not even meet today. We are grateful to the CU's Office of Industry Collaboration for organizing this event: Jenny Armendariz and Chris Muldrow you make us better, as well as appreciative to OSU Conference Services for supporting the event's website: Jen Stotts and Crystal Freeman. We are very grateful to the teams in our home campuses who worked tirelessly to connect us with industry: Rachel Robertson, Tina Batten, Deborah Kurnik, Gale Sumida, Robert Miller, Abby Benson, Chris Muldrow, Amy Hill, Bill Doe, Sara Buhr, Emily Adams – you propel us to go higher. We are grateful for the people who organize the high-tech professional associations in our states, Skip Newberry, Rylee O'Brien, Rob Schulberg (from the Technology Association of Oregon) and Ally Patterson from the Blackstone Entrepreneurs Network Colorado. We are grateful for the support from our university administrators: Scott Ashford, Irem Turmer, Julie Brandis, Tom Weller (at OSU) and Terri Fiez, Bobby Braun, Keith Molenaar, Bobby Schnabel, Liz Jessup (at CU Boulder). Last but not least, we each thank our spouse and children who had to accommodate us putting in long hours working on the Center.



Danny Dig and Bor-Yuh Evan Chang, Center Directors

Oregon State University University of Colorado Boulder NSF

CENTER ON
Pervasive Personalized Intelligence

Local Planning Meeting
November 9, 2018
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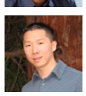
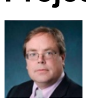
Agenda

November 9, 2018

9:00am to 10:00am	**Registration/Networking**

10:00am to 10:10am	**Welcome and Industry Introductions**  Bor-Yuh Evan Chang CU Site Director
10:10am to 10:15am	**Welcome Remarks from University Administration**  Bobby Braun Dean, College of Engineering & Applied Science, CU
10:15am to 10:30am	**Vision, Capabilities, and Value Proposition of the PPI Center**  Danny Dig Executive Director of the PPI Center
10:30am to 10:45am	**NSF IUCRC Level of Interest Feedback Evaluation (LIFE) Forms**  Chris Muldrow Industry Program Manager, CU
10:40am to 11:25am	**Project Proposal Presentations (Session 1)**  From Predictions to Decisions — Sriram Sankaranarayanan, CU Associate Professor  Intelligent Assistants for PPI-Application Developers — Bor-Yuh Evan Chang, CU Associate Professor  Retrofitting and Evolving PPI — Danny Dig, OSU Associate Professor
11:25am to 11:40am	**Lightning Talks for Project Posters** CU and OSU PhD Students
11:40am to 12:45pm	**Lunch/Poster Session/Networking**

12:45pm to 1:15pm	**Project Proposal Presentations (Session 2)**  Learned Edge Accelerated Data for PPI Communication — Dirk Grunwald, CU Professor

Oregon State University   University of Colorado Boulder   NSF

End-User Customizable Wearables for Accessibility, Athletics, and Expression — Ben Shapiro, CU Assistant Professor

1:15pm to 1:45pm — **Coffee/Poster Session/Networking**

1:45pm to 2:45pm

Q&A about NSF IUCRC and Industry Roundtable

Discussion of the benefits of NSF IUCRC, projects and company needs **not** addressed in the above presentations, and the direction of the Center.

Moderated by

Dee Hoffman
NSF IUCRC Center Evaluator

Danny Dig
Executive Director of the PPI Center

Bor-Yuh Evan Chang
CU Site Director

2:45pm to 2:50pm

Next Steps, Action Items, and Closing Remarks

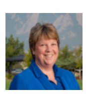
Danny Dig
Executive Director of the PPI Center

Bor-Yuh Evan Chang
CU Site Director

2:50pm to 3:00pm

Closing Remarks from University Administration

Bobby Schnabel
Campus Thought-Leader on Computing, CU



Terri Fiez
Vice Chancellor for Research & Innovation, CU

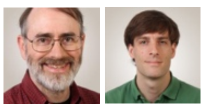
3:00pm to 4:00pm — **Networking/Follow-Up Discussions**

Project Abstracts

Machine Learning

In this thrust, we explore questions such as,

- How can we detect anomalous behaviors and patterns in data that are of interest for a PPI application?
- How can developers and end-users gain understanding and trust of software that learns?
- How can we automatically optimize policies for interacting with end-users based on observations of individual users and the overall user population?
- How can we onboard new users when PPI applications do not have enough training data about them?



Interactive Anomaly Detection

Tom Dietterich (Center Faculty, OSU) and Alan Fern (Center Faculty, OSU)

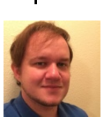
Identifying anomalous behaviors and patterns is important. Examples include: unusual IoT sensor readings, changes in health indicators from wearables, day-zero cyberattacks, unknown and rare software bugs, and anomalous behaviors in customer data. We will describe our state-of-the-art anomaly detectors and methods, both automated an interactive, for reducing false alarms and improving the efficiency at finding interesting anomalies.

Student Poster: Md Amran Siddiqui (PhD Student, OSU), "Explanation and User Feedback for Anomaly Detection."

Explainable Machine Learning

Alan Fern (Center Faculty, OSU), Tom Dietterich (Center Faculty, OSU), Prasad Tadepalli (Center Faculty, OSU), Fuxin Li (Center Faculty, OSU), and Margaret Burnett (Center Faculty, OSU)

Machine learning (ML) components are increasingly being integrated into large software systems. In some cases, ML components will be trained at development time, e.g. to recognize certain types of text documents, and then frozen before deployment. In other cases, the ML components will continually learn after deployment, e.g. to learn about household behavior patterns. In either case, the decision logic carried out by trained ML components will be black boxes to both the software developers and end users. This raises many issues regarding trust and reliability, since no human has understood the logic implemented by the ML components. With this motivation, we are studying explainable ML, where the goal is to develop algorithms and techniques for explaining ML components in software systems. We will describe our ongoing work in this area under the DARPA Explainable Artificial Intelligence program and present our vision for explainable ML in the future.



Student Poster: Andrew Anderson (PhD Student, OSU), "AI Explanations: Can people understand them?"


Learning to Optimize User Experiences
Alan Fern (Center Faculty, OSU) and Prasad Tadepalli (Center Faculty, OSU)

Optimizing user experience through machine learning is an important problem with applications to advertising, recommendation systems, intelligent user interfaces and social networks. In this research we will develop user behavioral models from observational data and employ them to derive optimal interaction policies to maximize an objective. After an initial interaction policy is developed offline, it will be fine-tuned and specialized to particular users and user classes in the online setting.


Transfer Learning for Personalized Intelligence
Xiaoli Fern (Center Faculty, OSU) and Xiao Fu (Center Faculty, OSU)

An ideal personalized machine learning system would be a system built upon a large volume of personal data and an extremely comprehensive feature space that is able to distinguish everyone from each other - which are both without reach of any practical system. Can we make personal decisions based on diversely and sparsely recorded data? This project offers viable and implementable approaches towards this goal. Our recent research shows that this seemingly bold objective is entirely feasible - leveraging aggregated pieces of information learned and transferred from the general population. The discovery is exciting, implying that highly personalized machine learning is well-grounded and many barriers such as scarcity/diversity of personal data, curse of dimensionality, and privacy/security issues can be circumvented effectively. This project will push forward this line of work to build up scalable computational frameworks and to provide performance guarantees for personal machine learning systems.

Personalized Simultaneous Translation
Liang Huang (Center Faculty, OSU)

Simultaneous translation is an important use case of machine translation where the latency requirement is real-time, similar to human interpretation in the United Nations.

Security and Privacy

In this thrust, we investigate questions such as,

- How can we help end users make configuration decisions that do not violate privacy preferences?
- How can we compute on users' private data without revealing private information?

Secure Computation for PPI
Mike Rosulek (Center Faculty, OSU)

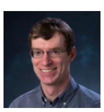
Secure computation allows parties to perform computations on private data, and learn only the outcome of that computation. For example, users could determine whether they have at least 10 friends in common without revealing their list of friends; they could find a compatible meeting time without revealing their entire calendar of availability; etc. We will discuss recent advances in making secure computation more efficient, and discuss which types of problems are currently solvable in practice using secure computation.


Personalized Privacy in PPI
Rakesh Bobba (Center Faculty, OSU) and Anita Sarma (Center Faculty, OSU)

Providing personalized, intelligent services pervasively requires devices to access and process personal and private data. This raises serious privacy concerns for end-users of the system. End-users need to be able to balance their privacy with the level of personalized services. To be able to do that, end-users should first understand the privacy implications of accessing a service at a certain personalization level, and be able to configure services based on their privacy preferences. Research has shown that neither of these tasks is easy for end-users. We will discuss end-user awareness of privacy implications with current home automation technologies, the challenges they face in configuring them, and the lack of privacy controls in such systems.

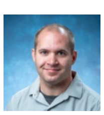
Software-Defined Everything Approach for Security and Privacy
Yeongjin Jang (Center Faculty, OSU)

Security and privacy control of Internet of Things (IoT) devices are never easy, and the difficulty stems from complex IoT ecosystems. That is, each manufacturer of a device uses a variety of sensors on a different OS/architecture to build a variety of applications; thus their control is convoluted. To address this complexity, we describe a new approach to applying more flexible security configurations to a network of IoT devices by utilizing edge clouds.



NATscan: Using Web Browsers to Scan Internal Networks
Aimee Coughlin, Eric Wustrow (Center Faculty, CU)

Internet wide-scanning is an important tool that can help discover widespread vulnerabilities of devices. However, current scanning techniques cannot see the many devices deployed in homes behind network address translation (NAT) routers, making it difficult to study the growing number of Internet-of-Things (IoT) and other smart-home devices. We have developed a tool that can scan and study these currently invisible devices: Our tool, NATscan, leverages users' web browsers to measure the IoT devices behind NAT networks, allowing us to study the types and versions of devices, their longevity of use, and the configurations and behavior of the device. Armed with this information, we can help discover and mitigate vulnerabilities in these devices, detect emerging threats, and inform the design of new devices to make them more secure, reliable, and usable.



Student Poster: Ian Martiny (PhD Student, CU), "NATscan: Using Web Browsers to Scan Internal Networks."

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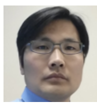
Systems and Fog Computing

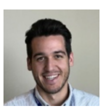
In this thrust, we investigate questions such as,

- Can we identify and develop a small set of fundamental system-level services at the middleware layer to integrate mobile nodes, IoT devices and edge servers?
- Can we develop a personalized, context-aware sensing-analysis-actuation solutions in smart home settings?
- How can we develop a wearable sensing system that can unobtrusively, continuously, comfortably, and simultaneously sense a multitude of head-based vital signals while remaining virtually invisible to the public?

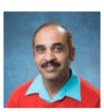



Learned Edge Accelerated Data (LEAD) for PPI Communication
Dirk Grunwald (Center Faculty, CU), and Sangtae Ha (Center Faculty, CU)

To reduce latency of PPI applications in the edge of the network, placing data closer to computation is extremely important. The placement of data, however, will depend on local network conditions. In this project, we will develop lightweight mechanisms that infer individual link and node performance over a region while reducing communication overhead. One example would be that a PPI application on a mobile device can infer the network conditions (e.g., # of users, load, latency, and throughput) to minimize battery consumption with minimal help from the core network.



Student Poster: Max Hollingsworth (PhD Student, CU), "Learned Edge Accelerated Data (LEAD) for PPI Communication."



System Level Support to Enable PPI at the Edge
Shiv Mishra (Center Faculty, CU)

Today's IoT applications are largely built in silos due to the variety of vendors in the field and a lack of any interoperability among them. In this project, we propose a middleware layer that integrates mobile nodes, IoT nodes and edge servers to shield the complexity of IoT infrastructure from IoT application logic thereby paving the way for accelerated innovation in the field of IoT. Introducing new standards in the area to end applications silos is challenging as it requires competing IoT industries to adhere to these new standards. Consequently, our design methodology introduces changes at the mobile systems level by introducing standard set of fundamental services that will avoid requiring changes to deployed IoT applications and enable faster development of sophisticated applications such as PPI.

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iES: An "Invisible" Wearable Sensing System from Inside Human's Ears

Tam Vu (Center Faculty, CU)

We propose a new class of wearable systems, namely in-Ear System (iES), that can be worn comfortably inside human ear canals to capture at the same time many of the wearer's vital signals such as brain signals (EEG), eye signals (EOG), muscle signals (EMG), heart signals (ECG), breathing signals, and more. The concept of in-ear sensing is motivated from the fact that human's ear canals are relatively close to the sources of many important vital signals such as brain, eyes, facial muscles, making the ear canal a promising location for sensing. Moreover, placing the sensors inside the ear canals would make the sensor less visible to the public, which is highly desirable since it is potentially a more socially acceptable wearable solution for continuous and long-term head-based vital signal monitoring. With the ability to capture these signals unobtrusively, iES has a potential to become a fundamental sensing device solving problems ranging from personalized and precision health care, such as focus monitoring in Smart offices, sleep quality monitoring in Smart home, meditation coaching, to non-health such as drowsiness detection in Smart car, and accident avoidance on manufacturing line in Smart manufacturing; to enabling new form of human-computer interaction interfaces.

Student Poster: Anh Nguyen (PhD Student, CU), "iES: An 'Invisible' Wearable Sensing System from Inside Human's Ears."


DronePD - Cost-effective and Passive Drone Intrusion Detection and Tracking System for Smart City and Smart Home

Tam Vu (Center Faculty, CU) and Richard Han (Center Faculty, CU)

Beyond their benign uses, civilian drones have increasingly been used to fly in unauthorized territory that have stirred privacy concern from individuals, public, and authorities. While many approaches have been proposed to take down offending drones, such systems often rely on a fundamental assumption that the presence of the drone has already been detected. The drone trajectory and physical characteristics such as size, speed are often assumed to be known to the defender. However, these assumptions do not hold in almost all practical scenarios. We propose DronePD, a lightweight, cost effective, and completely passive drone intrusion detection and tracking system to address this challenge. The goal of this proposal is to develop a novel distributed drone detection and tracking system that can detect and discern the physical characteristics of drones, such as their presence, instantaneous location and velocity, trajectory to protect areas and airspace where the drones are not allowed.

Student Poster: VP Nguyen (PhD Student, CU), "DronePD - Cost-effective and Passive Drone Intrusion Detection and Tracking System for Smart City and Smart Home."

Accelerating Deep Learning Vision Models on Mobile and Embedded Devices
Chungkuk Yoo, Inseok Hwang, Eric Rozner (Center Faculty, CU)

Pervasive Personalized Intelligence (PPI) requires a rich set of sensors deployed throughout the environment, so as to enable intelligent computing to become proactive and contextual in nature. One of the most important sensors both today and in the future is the video camera. Cameras are widely deployed in fixed locations for security or information gathering, and are also utilized in mobile devices like smartphones, robotics, and drones. As deep learning-based computer vision models obtain human, and even super-human, accuracy in a variety of tasks, cameras are likely to become an integral sensor input to PPI technologies. The issue, however, is that many deep learning computer vision algorithms are computationally expensive, limiting the effectiveness of running them directly on mobile or embedded devices. In this project, we enable deep learning models to run significantly more quickly while consuming less energy. Our hope is to enable continuous mobile vision analysis on a large variety of computationally-limited devices. The core of our approach utilizes caching to reuse large amounts of computation when frame inputs vary little over time. We aim to integrate our scheme with traditional deep learning pipelines, as well as newer low-overhead vision architectures.

Device-free WiFi Sensing and Human Activity Analytics for Smart Home
Qin Lv (Center Faculty, CU)

This project focuses on device-free WiFi sensing of human activities in smart home settings, and how that can replace and/or augment existing device-based solutions such as smartphones, wearable devices, and IoT devices. We aim to develop sensing and analytical models and systems to effectively capture various human activities/routines with high robustness and/or easy adaptation for personalized use; and evaluate in real-world applications..

Programming Languages and Verification

In this thrust, we investigate questions like,

- How do we enable software developers to effectively create rich PPI applications that, by construction, are secure, privacy-preserving, and reliable?
- What programming models, specification approaches, and analysis-validation-verification techniques provide a disciplined approach for programming security and reliability into PPI components?


From Predictions to Decisions
Sriram Sankaranarayanan (Center Faculty, CU), Stephen Becker (Center Faculty, CU)

With the advent of big-data comes the need to systematically use data to make predictions about the future course of a stock, the blood glucose level of a patient or the future position of a UAV under windy conditions. We will describe ongoing work that programs and reasons about probabilistic models in a systematic fashion, and its applications to prediction in two seemingly disparate areas: treating type-1 diabetes and predicting the likelihood of UAV collisions.


Student Poster: Souradeep Dutta (PhD Student, CU), “From Predictions to Decisions.”


Student Poster: Osman Malik (PhD Student, CU) “Tensor Methods in Machine Learning and Data Analysis.”


Student Poster: Jessica Gronski (PhD Student, CU), “Improved Optimization Techniques: Stable Control and Optimal Power Flow.”

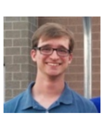
 
Intelligent Assistants for PPI-Application Developers
Sergio Mover, Bor-Yuh Evan Chang (Center Faculty, CU), and Sriram Sankaranarayanan (Center Faculty, CU)

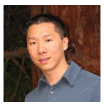
The demands on software developers to create rich PPI applications that are safe, secure, privacy-preserving, and reliable will be immense. For example, almost inevitably, PPI applications will be built on rich software frameworks that abstract the commonalities amongst such applications. While rich software frameworks enable software engineers to build complex applications on sophisticated platforms, developing against them in a safe and secure way relies on following often complex and incompletely documented protocols. Violating these protocols leads to unexpected and pernicious bugs. To make PPI application-development feasible, we develop program analysis techniques that assist PPI application developers in finding, fixing, and understanding defects.


Student Poster: Shawn Meier (PhD Student, CU), “Intelligent Assistants for PPI-Application Developers.”

 
Verification of Adaptive Software Systems
Ashutosh Trivedi (Center Faculty, CU), and Fabio Somenzi (Center Faculty, CU)

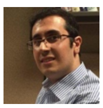
To address the shortcomings of current verification technology when applied to adaptive (learning-enabled) software systems, we plan to develop techniques that use mathematically rigorous specifications to guide the learning process. We will demonstrate that this is an efficient way of constructing safe, verified controllers in areas where this is not possible using state-of-the-art techniques. We plan to address three main technical challenges: *training deep reinforcement learning controllers from a set of formal requirements*, developing techniques for abstraction refinement through learning,and developing techniques for incremental verification of adaptive software systems.


Student Poster: Mateo Perez (BS Student, CU), “Verification of Adaptive Software System.”



Performance Debugging for Predictability and Security
Pavol Cerny (CU), Bor-Yuh Evan Chang (Center Faculty, CU), and Ashutosh Trivedi (Center Faculty, CU)

In the resource-constrained environments in IoT and PPI, it is very important for program performance to be predictable. The goal of Differential Performance Debugging is to explain unexpected performance differences of a program tested on different inputs. We will develop a data-driven technique based on two tasks: clustering of inputs which lead to similar running times (depending on input size) and explaining the differences between clusters in terms of program internals (such as what functions were called in what order).



Student Poster: Saeid Tizpaz Niari (PhD Student, CU), “Performance Debugging for Predictability and Security.”

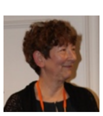
Privacy-preserving End-user Programming and Information Management
Matthew A. Hammer (Center Faculty, CU)

Nearly all computer literate people use spreadsheets to manage their personal and work lives, yet modern spreadsheets still remain limited in their scope and applicability. Further, spreadsheets only provide coarse-grained control over information privacy, if at all. My project consists of building on the successes of spreadsheets, functional programming and language-based security, to offer an integrated language and interactive system that affords users comprehensive control over their personal information, including how/when it is computed, cached and shared.

Software Engineering and Human-Computer Interaction

In this thrust, we investigate questions such as:

- How can we semi-automatically retrofit the programming model that encapsulates PPI into existing software?
- How can we ensure that our personalized, intelligent systems are inclusively designed, so that they are supportive across a wide spectrum of the population, regardless of gender?



Gender Inclusive Technologies
Margaret Burnett (Center Faculty, OSU) and Anita Sarma (Center Faculty, OSU)

Many software features are designed around problem-solving styles favored mostly by men, and have not supported problem-solving styles favored mostly by women. Our goal is to enable members to avert the resulting loss of market share and loss of group problem-solving creativity that can arise with their PPI products due to these problems. We present our vision to understand where such problems arise in members’ PPI products, and how we can learn to avert them.

Retrofitting and Evolving PPI
Danny Dig (Center Faculty, OSU)

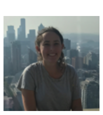
While most software systems were never designed to support learning as envisioned by the PPI, retrofitting intelligence into existing software is the only economically viable option for our members. Even software systems designed with learning capabilities still need to evolve to respond to changes in underlying libraries and frameworks. Our goal is to mechanize change tasks that are expensive, time-consuming, and error-prone. We present our vision to understand, automate, and suggest changes for retrofitting and evolving intelligence into existing software.

End-User Customizable Wearables for Accessibility, Athletics, and Expression
Ben Shapiro (Center Faculty, CU)

We will develop a toolkit for making end-user customizable wearables that afford personalization of physical form (appearance, size, shape) and computational capabilities (sensors, programs). The aim of this toolkit is to support the ad-hoc engineering of new wearable devices that can 1) provide realtime feedback on physical activities (e.g. an athlete practicing a particular skill), 2) support inclusive interaction with physical environments by people with disabilities though customizable gesture detection, 3) offer new opportunities for computer science education around machine learning.

Developing a Collective Informatics Infrastructure for Mental Health Self-Management and Community-Scale Engagement
Stephen Voida (Center Faculty, CU)

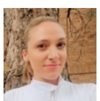
The personal data practices enabled by pervasive “Quantified Self” tools and sensing devices encompass a range of tracking activities associated with self-knowledge, behavior change, and health management. However, these tools have been almost exclusively developed and deployed from a single-user perspective. In the context of managing serious mental illnesses (SMI)—affecting 10 million adults in the U.S. each year—a diverse set of caregivers and stakeholders are drawn into personal data practices, contributing to the use and understanding of personal data traces. As communities increasingly rely on data collection from citizen scientists and community residents to enable data-driven decision-making, individuals’ data becomes part of a broader “public good,” raising questions about how to affect collective sensemaking at the scale of neighborhoods and cities and issues of data ownership and privacy protection. In this research, we introduce a collective engagement approach to personal informatics, highlighting opportunities for novel collaborative computing architectures, data representations, and interface designs in the Quantified Self domain. In better understanding the sociotechnical dynamics of these systems through co-design, prototype development, and system deployment, we aim to articulate broadly applicable guidelines for the design of the infrastructures and interfaces that will define this emerging class of computing systems.



Student Poster: Lucy Van Kleunen (PhD Student, CU), “Developing a Collective Informatics Infrastructure for Mental Health Self-Management and Community-Scale Engagement.”

MindScribe: Toward Intelligently Augmented Interactions in Highly Variable Early Childhood Environments
Tom Yeh (Center Faculty, CU)

Early childhood is a period of critical development, with impacts that can last a lifetime. And inequities in the quality of care for this vulnerable population—especially for those at-risk due to disability, family income, or trauma—can perpetuate further downstream health and school-readiness effects. Technology-enabled solutions have the ability to bridge quality-of-care gaps by intelligently augmenting daily activities. However, many traditional computational approaches to natural language interactions are not yet feasible nor affordable in highly variable and dynamic early childhood environments. Yet for rapidly developing preliterate young children, solutions are needed now. We present MindScribe, an interactive robotic object that leverages open-ended 'serve and return' natural language interactions to intelligently support reflective inquiry and school-readiness in highly variable and imaginative early childhood environments.



Student Poster: Layne Hubbard (PhD Student, CU), “MindScribe: Toward Intelligently Augmented Interactions in Highly Variable Early Childhood Environments.”

Guidelines for Effectively Participating in Level of Interest and Feedback Evaluation (LIFE) Process

Introduction: *The LIFE feedback process is not a project selection methodology but is meant to inform whatever project selection approach your center uses. There are a number of purposes served by asking industry representatives and PIs to complete LIFE feedback on project proposals: 1) Q&A time is usually limited and having member organizations provide written feedback allows everyone the chance to have input; 2) Written feedback gives PIs a chance to consider industry concerns and provide a thoughtful reply; 3) Feedback and replies can be debriefed as a group and help surface areas of agreement and disagreement and reach a consensus on the need for and feasibility of project changes.* 4)*Reviewing the interest rating distribution allows members to understand whether a few or many members are interested in a project and use this information to decide how to vote during project selection.*

Steps for Completing Feedback and Responses:

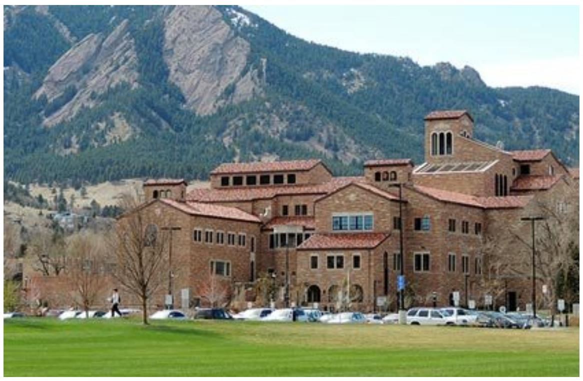
1. Website: www.iucrc.com
2. Select Center Meeting : **Pervasive Personalized Intelligence**
3. Enter PW = **PPI-Colorado**
4. Select role: **Industry** for industrial participants or **Faculty** for faculty project leads (and students)
5. IAB
    a. Click [Evaluate Project] and select a level of interest rating based on your firm's needs and interests.
    b. Provide comments, questions, and/or suggestions you have about the project. **The most valuable feedback is"actionable" comments like suggestions and questions that help the PI / student improve the project**. If you rated the project "Needs change" make sure to add a comment or suggestions on what needs to be changed or what needs to be done to get the project on course.
    c. Enter your Name and your Organization.
    d. SELECT SUBMIT AFTER EACH PROJECT.
    e. Repeat for each project.
6. PI / Student
    a. Read instructions and click [Continue to Response Page].
    b. Find your project and select [Response to Comments]
    c. Read comments provided by industry members and respond as necessary (not every comment may require a response).
    d. SELECT SUBMIT AFTER RESPONDING TO EACH page of comments. (there are usually more than one page of comments so then continue to the next page).
    e. Once you have completed responding to comments and submitted, scroll up to the blue links under the ratings to respond to the questions, and then the suggestions.
7. Both
    a. You can review the feedback and responses to each project by selecting [Summary] next to each project.
    b. If you would like to review responses to all projects presented at the meeting, you may use the [Review Meeting] link at the top of the project list page (PDF and Word versions are also available).

CENTER ON Pervasive Personalized Intelligence

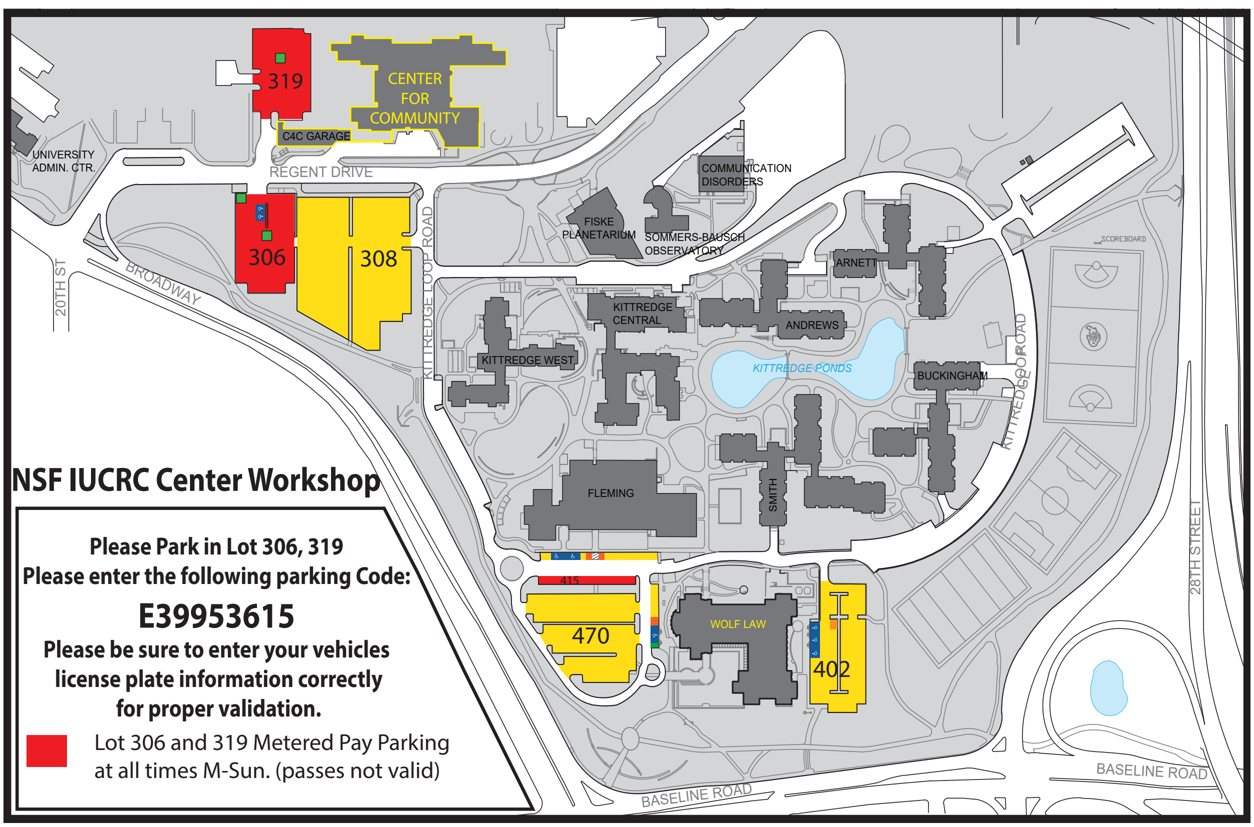
Workshop Materials

http://bit.ly/ppi-planning-materials

Location



Flatirons Room, 3rd Floor
Center for Community (C4C)
University of Colorado Boulder
2249 Willard Loop Dr, Boulder, CO 80305



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