



## AUTOMOTIVE CYBER-PHYSICAL SYSTEMS

**Contact person:** Dr. SeungJun Kim ([sjunikim@cs.cmu.edu](mailto:sjunikim@cs.cmu.edu))

The goal of this project is to construct a “simulated” automotive cyber-physical system that allows researchers in the automotive domain to experiment various driving scenarios (e.g., hand-over of vehicle control in a self-driving situation) and make a working demonstration where we intentionally manipulate the physical and non-physical actions of the simulated vehicle to variously interact with human drivers. The first order goal is to integrate a driving simulator, a motion chair (e.g., Atomic A3), a VR headset (e.g., Oculus rift), an eye tracker (e.g., Tobii eyeX), and a gaming wheel joystick (e.g., Logitech G920) into a single working platform; therefore, we may prefer applicants who are talented/interested in making our hardware and software components interoperate together with each other.

If interested, please visit and fill out - <https://goo.gl/forms/Hi7WQzSX3iV4q9602>.

**Student requirement:** Java (preferred), Processing, Android SDK/Wear, and other related skills and experience.

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## AUGMENTED REALITY & VIRUTAL REALITY UI/UX

**Contact:** Dr. SeungJun Kim ([sjunikim@cs.cmu.edu](mailto:sjunikim@cs.cmu.edu))

The goal of this project is to discover various use case scenarios for potential AR/VR applications that can be used in real life space (e.g., while driving in a car, while taking classes in a classroom, while watching a movie in the theater, during physical exercise in indoor and outdoor) and produce prototype applications to demonstrate the scenarios.

For the purpose of producing 2~3 prototype applications, we prefer applicants who are talented/interested in setting up AR/VR headsets from the scratch (e.g., Oculus Rift, HTC Vive, Samsung VR, and Microsoft Hololens), creating own virtual objects and spaces (e.g., Unity3D; please check - <https://unity3d.com/>), and making an AR/VR system work in conjunction with other wearable devices (e.g., smart watches), and measuring devices (e.g., wearable eye tracking system; please check - <https://pupil-labs.com/store/#vr-ar>).

If interested, please visit and fill out - <https://goo.gl/forms/Hi7WQzSX3iV4q9602>.

**Student requirement:** Java (preferred), Android SDK/Wear, Unity 3D, and other related skills and experience - e.g., illustrator, photoshop, scenario development, making demo/teaser videos.

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## CYBERSECURITY

### **Relationship Cybersecurity: Understanding How Partners Affect Each Other's Cybersecurity Habits**

**Contact:** Alex Sciuto (asciuto@cs.cmu.edu)

The people we have romantic relationships with affect so much of who we are. Romantic partners influence our tastes, what activities we enjoy doing, where we prefer to live, and who we like to socialize with. Because they're so influential, we would like to know how romantic relationships affect people's cybersecurity behaviors, that is the kinds of passwords they use, whether they are aware of online scams, how often they update their computer, and other similar behaviors.

We are looking for a student who is interested in using the techniques of social psychology to investigate this question further. Either through surveys or qualitative interviews with romantic partners, you will help extract how partners affect each other's cybersecurity behaviors. We have preliminary evidence that if people talk about cybersecurity, it is most likely with their romantic partners. Now we need to understand more about this relationship. Our end goal is to develop new services and interfaces that exploit these close relationships to encourage people to keep themselves safer online.

### **Fine-Grained Semantic Traffic Analyzer**

**Contact:** Haojian Jin (haojian.jin@gmail.com)

The World Wide Web and HTTP are based on a number of request methods. Understanding the purpose of each request method could help improve privacy as well as enable new kinds of access control. For example, if a smartphone app contacts admob.com, using a combination of WHOIS information, Wikipedia, and AdMob's web pages, we want to infer that any data the app sends is used for advertising.

We're looking at building new technologies to predict the intent of each traffic request. This project will involve (a) extracting the semantic feature of various types of data, (b) exploring the methods of query expansion, (b) building a model to predict the intent of each request.

Ideal skills: Programming skills for text processing, Experience with Natural Language Processing and Machine Learning is a plus.



## **Privacy-Enhanced Android**

**Contact:** Jason Hong (jasonh@cs.cmu.edu)

The goal of this project is to make it vastly easier for developers and end-users to manage privacy in the context of sensor-based smartphone apps. This is a large DARPA project with the aim to achieve order of magnitude improvements for privacy. We are looking for students to help with a range of software development tasks, including:

- Improving our Android GUI monkey that can capture all the screens from an app
- Improving a PrivacyProxy that intercepts network traffic and looks for sensitive data
- Improving our implementations of Android user interfaces for privacy

Ideal Skills for implementation: Android, Android OS, web programming, networking. Experience with UX, privacy, and security is a plus.

## **PrivacyGrade: Crowd Analysis of Android Apps**

**Contact:** Jason Hong (jasonh@cs.cmu.edu)

The broad goal of the PrivacyGrade project is to help developers, consumers, and regulators understand and improve the privacy of smartphone apps. So far, we have downloaded and analyzed the privacy of a million smartphone apps at PrivacyGrade.org. There are two subprojects for PrivacyGrade:

I. We want to add new functionality to PrivacyGrade.org so that volunteers can come to our site and help rate the acceptability of various app behaviors, as well as flag unusual behaviors. Example questions might include things like "Does this seem to be an app intended primarily for children?" and "How comfortable are you with this app using your location data for advertising?"

II. We want to add new functionality to continuously crawl apps from Google Play, analyze them, and update the web site. Currently, we do this in batch, but would prefer an ongoing service that does this.

III. Improve the basic PrivacyGrade.org web site, adding new functionality to the site. Examples include better search, better filters, faster performance, faster app updates, etc.



Ideal Skills: Some subset of Android programming, machine learning, web programming, databases, crowdsourcing, visual design

### **Hubs for Internet of Things**

**Contact:** Jason Hong (jasonh@cs.cmu.edu)

One likely deployment model for Internet of Things is to have centralized hubs that can offer devices network connections, check for firmware or software updates, and monitor traffic for anomalous behaviors. This project seeks to develop new ways of adding new devices to this hub in a simple and understandable manner, as well as offering new kinds of services, such as linking different devices together or doing simple kinds of end-user programming.

Ideal Skills: Some subset of Android programming, Linux, web programming, UX design.

### **ClearTerms: Simplified Terms and Conditions**

**Contact:** Annabel Sun (annabel.c.sun@gmail.com)

Our goal is to develop methods that can find the most important statements in web policies, such as Privacy Policies and Terms and Conditions. We are using a combination of crowdsourcing and machine learning, having people rank the importance of statements. We currently have a large data set, and are interested in two things. The first is building better machine learning and Natural Language Processing models to predict important statements in policies we haven't seen. The second is building out a web site that can showcase our results.

Ideal Skills: Web programming (HTML and JavaScript and CSS), databases, UX design, machine learning

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## DATA VISUALIZATION

### Interactive exploration of research landscapes

**Contact:** Joel Chan, [joelchuc@cs.cmu.edu](mailto:joelchuc@cs.cmu.edu)

Isaac Newton once said, “If I have seen further, it is by standing on the shoulders of giants.” This describes a fact of life for researchers, students, funders, and just about anyone involved in knowledge work. But increasingly the “giants” are hidden or obscured by the scale and diversity of research being produced every year: by one count, 2.5 million new scientific papers are published every year! Existing methods like curation (e.g., in journals) and keyword search (think Google) are struggling to keep up, and, more importantly, don’t really fit the intuitive, interactive way that people build mental models of a research landscape. This project aims to imagine and build the future of knowledge search: interactive exploration of research landscapes. We are looking for students to help design and build visual interfaces that enable people to interactively and naturally build rich, flexible mental models of “who is working on what (problems) when” in a particular research landscape. An illustrative mockup of the interface can be viewed here: <http://bit.ly/2gZwOGg>. There are opportunities to not only build cool technologies, or co-author a research publication, but also deploy with and impact real users (e.g., researchers, students, and funders, connected to CMU).

We welcome inquisitive, “scrappy”, and energetic students with a desire and ability to learn on their feet and try new things. We especially welcome students with skills in web development (especially modern Javascript frameworks like NodeJS, MeteorJS, or React) and interactive visualizations. Familiarity with NLP is a plus, but not a requirement.

Interested students should send their resume, GPA, and (if available) a link to work samples to Joel Chan ([joelchuc@cs.cmu.edu](mailto:joelchuc@cs.cmu.edu)).

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## LEARNING SCIENCES & EDUCATION RESEARCH

### **Design-based learning research, citizen science, informal science education**

**Contact:** Marti Louw < [martil@cmu.edu](mailto:martil@cmu.edu) >

The Learning Media Design Center is leading an interdisciplinary team of entomologists, educators, software engineers, designers, and learning scientists to improve identification practices and training supports in citizen-science based water quality biomonitoring projects. Undergraduate research assistants on this NSF-funded project, *Learning to See, Seeing to Learn* will participate in qualitative and quantitative learning science data collection and analysis, including transcription of audio-recorded data, analysis of transcripts and screencast data, as well as design-based research to support the development of an online teaching collection and guide to freshwater insects (see our IxDA award-winning prototype at: [www.macroinvertebrates.org](http://www.macroinvertebrates.org)). Data analyses will be translated into design challenges, probes, and activities for a codesign workshop taking place in March 2017.

We are looking for an enthusiastic, detail-oriented collaborator and critical thinker with research experience in the social sciences, design based learning research, HCI user research; an interest biology and the details of science, informal science learning, and citizen science is desirable.

The HCII faculty mentor will be Marti Louw, Director of the Learning Media Design Center, and the student(s) will be working closely with postdoctoral research associate. Successful candidates will need to obtain standard Pennsylvania Act 153 background clearances and pass an IRB certification module to work with human subjects data. This is a NSF-funded Research Experience for Undergraduates (REU) part-time position (up to 20 hours/week). Interested students should email their resume and description of experience to Marti Louw < [martil@cmu.edu](mailto:martil@cmu.edu) >.

### **Intelligent Tutoring Systems**

**Contact:** Jack Mostow [mostow@cs.cmu.edu](mailto:mostow@cs.cmu.edu)

Help our \$15M Global Learning XPRIZE team remotely extend, user-test, data-mine, and improve RoboTutor, our Android tablet app in English and Swahili for children ages 7-10 who have little or no access to schools in developing countries to learn basic reading, writing, and numeracy without adult assistance. See



[www.robotutor.org](http://www.robotutor.org) for exciting details.

Student requirements: Please follow instructions at [www.cmu.edu/scs/robotutor/join-the-team](http://www.cmu.edu/scs/robotutor/join-the-team) ASAP if interested.

### **PeerPresents (Front End Designer/Developer)**

Jessica Hammer / OH!Lab

**Contact:** Amy Shannon ([amyshann@andrew.cmu.edu](mailto:amyshann@andrew.cmu.edu))

We are looking for a student with strong design skills who is familiar with HTML, CSS, and Jade. The primary task would be to streamline the design of our web app. A second task could be to design a suite of emoji's that are relevant to peer feedback discussions in classrooms. In addition to directly influencing and improving the look and feel of the tool, you would also be involved in the research side of the project.

### **PeerPresents (Back End Developer)**

Jessica Hammer / OH!Lab

**Contact:** Amy Shannon ([amyshann@andrew.cmu.edu](mailto:amyshann@andrew.cmu.edu))

We are looking for a student with strong backend development skills who is familiar with Node.js, MongoDB, and MySQL. The primary task would be to transition our web app from mongoose to MySQL. You would also be involved in the research side of the project and could influence future features and contexts of the tool. There is the possibility of making this a paid position.

### **Education/user research**

**Contact:** Amy Ogan [aeo@andrew.cmu.edu](mailto:aeo@andrew.cmu.edu)

In this project, we explore ways to improve the uptake of the guidelines for technology-enhanced learning in higher education. Specifically, we investigate the utility of the website "Technology-Enhanced Learning: Best Practices and Data Sharing in Higher Education," developed by the Global Learning Council's Best Practices Working Group. This website was designed to share challenges, best practices, and case studies that inform faculty and administrators looking for guidance on implementing technology-enhanced learning. In order to support the widespread adoption of TEL best practices at universities across the country, we investigate 1) what needs these stakeholders have with respect to understanding



how to deploy new educational technologies, 2) where they currently look for support when making decisions about technology in the classroom, 3) whether and how these stakeholders have engaged with the website and the guidelines, 4) what approaches to the distribution of GLC content would support their needs. We will conduct a set of user studies to answer these four questions, with a population derived from the possible stakeholders interested in investing in such content.

Student requirements: Some experience with user research methods

Please note this position can be paid or an Independent Study.

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## GAME DESIGN RESEARCH

### Game Design / Citizen Science / Informal Science Learning

**Contact:** Marti Louw < [martil@cmu.edu](mailto:martil@cmu.edu) >

The Learning Media Design Center is leading an interdisciplinary team of entomologists, educators, software engineers, designers, and learning scientists to improve identification practices and training supports in citizen-science based water quality biomonitoring projects. Undergraduate research assistants on this NSF funded project, "*Learning to See, Seeing to Learn*" will participate design research and development activities related the expansion of our online teaching collection and guide to freshwater insects (see the IxDA award-winning prototype at: [www.macroinvertebrates.org](http://www.macroinvertebrates.org)).

In particular, we are looking for a student interested in game design to first develop and test a set of exploratory tabletop game approaches to support insect identification practice and learning. And then to develop one of these analog game approaches into a high-quality interactive prototype that can be tested with audiences at the Carnegie Museum of Natural History and citizen scientists online. Candidates should have game design and development skills for web-based game creation including graphic design and game artwork skills, as well basic coding abilities in one or more of the following: p5.js, Java, HTML5, Python. An interest in photography, insects, informal science learning, and citizen science is desirable.

The HCI faculty mentor will be Marti Louw, Director of the Learning Media Design Center, and the student(s) will be working closely with postdoctoral research associate. Successful candidates will need to obtain standard Pennsylvania Act 153 background clearances and pass an IRB certification module to work with human subjects data. This is a NSF-funded Research Experience for Undergraduates (REU) part-time position (up to 20 hours/week) with the potential to continue over the summer. Interested students should email their resume or description of experience and a portfolio link to Marti Louw < [martil@cmu.edu](mailto:martil@cmu.edu) >.



### **SCIPR: Sensing Curiosity in Play and Responding (Researcher/Playtest Coordinator)**

Jessica Hammer / OH!Lab

**Contact:** Alexandra To ([aato@andrew.cmu.edu](mailto:aato@andrew.cmu.edu))

The SCIPR project is about designing and studying tabletop games as interventions to increase scientific curiosity in marginalized middle school students. We are looking for a playtest/lab study coordinator. You will be recruiting students and running a lab study where middle school students play our tabletop games. More important than any technical requirements is enthusiasm to learn and ability to work with children.

You must be willing to get clearance to work with children.

### **SCIPR: Sensing Curiosity in Play and Responding (Sensing Programmer)**

Jessica Hammer / OH!Lab

**Contact:** Alexandra To ([aato@andrew.cmu.edu](mailto:aato@andrew.cmu.edu))

We have designed three tabletop games that we would like to instrument with sensing devices that will let us keep track of physical game state digitally. You will be working closely with our Unity programmer to ensure that the physical game and the digital game stay in sync.

You should have experience with some type of sensing technology (e.g. RFIDs, fiducials + computer vision).

### **Playtest Night (Playtest Coordinator)**

Jessica Hammer / OH!Lab

**Contact:** Rachel Moeller ([rpmoelle@andrew.cmu.edu](mailto:rpmoelle@andrew.cmu.edu))

We run a weekly playtest night to help game designers at CMU find playtesters and to build community among game designers at CMU. Your responsibilities will include: setup and teardown of the weekly playtest night; ordering food; publicizing the event; maintaining the group's Facebook page; and collecting data about how to improve playtesting at CMU.

This is a paid position.



### **Rosenstrasse (Visual Designer/Playtest Coordinator)**

Jessica Hammer / OH!Lab

**Contact:** Jessica Hammer ([hammerj@cs.cmu.edu](mailto:hammerj@cs.cmu.edu))

Working with an external partner, we have designed a tabletop role-playing game about the erosion of civil liberties in 1930s Berlin. We are looking for a student to help with visual design, instructional design, and playtesting of the game. You will be creating handouts and other materials, as well as coordinating and documenting playtests. There will be an opportunity for you to contribute in a game design role if desired.

Experience with tabletop role-playing games is a plus.

### **Audience Participation Games (Game Designer/Developer)**

Jessica Hammer / OH!Lab

**Contact:** Safinah Ali ([safinaha@andrew.cmu.edu](mailto:safinaha@andrew.cmu.edu))

We are exploring the design space of audience participation games on Twitch. We are looking for student game design teams who would like to create experimental Twitch-enabled gameplay. We have a Unity-HTML5 technical pipeline and can provide both design and technical support. We can also provide support for teams who would like to explore Amazon's Lumberyard engine.

We strongly encourage you to apply as a team; we can provide limited help in finding a team by connecting you with other students interested in this opportunity. If you prefer to work alone, send us a sample of your prior game design / development work.

### **Twitch Community Design (Web Developer)**

Jessica Hammer / OH!Lab

**Contact:** Joseph Seering ([jseering@andrew.cmu.edu](mailto:jseering@andrew.cmu.edu))

We are designing a new tool to support community participation on Twitch. We are looking for a Javascript developer to help us develop a first prototype. You will have the opportunity to participate in design sessions if you are interested.

Javascript experience required; it's a plus if you have previously worked with browser plugins.

### **Teens with Chronic Illness on Twitch (Researcher)**

Jessica Hammer / OH!Lab

**Contact:** Conrad Bassett-Bouchard ([conradbb@gmail.com](mailto:conradbb@gmail.com))



We have some preliminary evidence that teens with chronic illness are seeking social support on Twitch, as an alternative to health-specific websites. We would like to verify this insight, understand what motivates these teens to seek support on Twitch, what they get out of it, and what challenges they face in accomplishing their goals. You will identify members of the target group, conduct interviews and observations, and analyze qualitative data.

You must be willing to get clearance for working with children.

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## UBIQUITOUS COMPUTING

### Hardware Prototyping And Ubiquitous Computing Personal Medical Devices

**Contact:** Mayank Goel <mayankgoel@cmu.edu>

A key trend emerging from the popularity of smart, mobile devices is the quantified-self movement. The movement has manifested into prevalence of two kinds of personal wellness devices: (1) fitness devices (*e.g.*, FitBit), and (2) portable and connected medical devices (*e.g.*, Bluetooth-enabled blood pressure cuffs). The fitness devices are seamless, very portable, but offer low-fidelity information to the user. They do not generate any medically-relevant data. The devices that actually generate data that doctors can use for their diagnosis are still cumbersome to use. For example, a “smart” glucose monitor is same as the conventional one. The only difference is that now you can see the measurement on your smartphone. However, the user still needs a finger prick for the actual measurement.

We are currently working on building personal medical devices that are as seamless to use as a FitBit, but generate medically-relevant data. As an example, one of the projects we are working on right now is looking at calculating a user’s blood glucose levels using a wrist-worn device. The device will also monitor the user’s eating behavior and aims to find correlation between their eating activities and their effect on the user’s glucose levels.

We are looking for students to contribute to various aspects of this project. Depending on their interest, the students can help in building and prototyping the hardware device, or they can contribute to the signal processing and machine learning component. Interested students will also have the option of collecting the data, annotating the data, and also contributing to the manuscript of the project.

Tools involved (you can work on a subset of these):

1. 3D printing
2. Embedded Computing
3. Sensors – Inertial, optical, and audio sensors.
4. Python
5. Matlab

### HCI, Ubiquitous Computing, Data Analytics



**Balanced Campus** – Improving students’ physical and mental health through sensing and data analytics

**Contact:** Afsaneh Doryab <[adoryab@cs.cmu.edu](mailto:adoryab@cs.cmu.edu)>

Research categories: HCI, Ubiquitous Computing, Data Analytics (Machine Learning, Data Mining, Statistics, Visualization)

We have an exciting project to help students achieve academic success by establishing a healthy lifestyle. We use passive and automatic sensing data from smartphones, smart watches, and other wearable devices to assess students’ physical and mental health (e.g., depression, loneliness, stress), academic performance and behavioral trends (e.g., how stress, sleep, visits to the gym, etc. change in response to school workload). This data will be used to provide health recommendations and interventions. Students in this project will develop applications to automatically collect, process, and analyze physiological and behavioral data from mobile and wearable devices.

The scope of this project is very broad and there are opportunities for students in any discipline to participate. We prefer students with programming skills (Java, JavaScript, Python, Android and/or iOS development), and experience and interest in algorithm development, machine learning, data mining, statistics, and visualization techniques. We welcome curious, energetic, and fast learning students.

Contact person: Afsaneh Doryab, [adoryab@cs.cmu.edu](mailto:adoryab@cs.cmu.edu)

**Sensors: Adaptive, rapidly deployable, human-intelligent sensor feeds**

**Contact person:** Jeff Bigham ([jbigham@cs.cmu.edu](mailto:jbigham@cs.cmu.edu)), Anhong Guo ([anhongg@cs.cmu.edu](mailto:anhongg@cs.cmu.edu))

Sensors is a new sensing approach that fuses real-time human intelligence from online crowd workers with automatic approaches to provide robust, adaptive, and readily deployable intelligent sensors. With Sensors, users can go from question to live sensor feed in less than 60 seconds. Through our API, Sensors can enable a variety of rich end-user applications and moves us closer to the vision of responsive, intelligent environments.

Sensors could support a variety of IoT applications, including optimization of domestic tasks (e.g., “what food in my fridge will go bad if I don’t cook them the next day?”), health (e.g., “who is experiencing the most severe depression right now?”), public space monitoring (e.g., “how many cars are in this parking lot?”), and



item finding (e.g., “where did I last leave my keys?”). These questions were also tied to a strong set of contexts and environments: including the home, urban and public spaces, educational institutions (e.g., “are students interested in the topic?”), health facilities, and supply chains (e.g., “what items should I restock from my inventory?”). Please refer to this website for a video demo: <http://sensors.com>

We are currently working on deploying the technology to understand what applications users are interested in, and how the existing system can be extended to better support those.

**Ideal skills:** Django Web Programming, Amazon Web Services, Computer Vision, Machine Learning

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## HEALTHCARE

### Designing a Health Application for Undergraduate/Graduate Students

**Contact:** Dr. Grace Bae <[gracebae@andrew.cmu.edu](mailto:gracebae@andrew.cmu.edu)>

Our research aims to study the impact of design on health logging applications for college students. We will explore: 1) How college students can effectively log their health and increase benefits such as self-efficacy from the mobile application. In addition, we will investigate 2) How doctors can quickly review logs to determine if the individuals need medical attention or mental counseling.

#### **\* For a potential designer**

##### **Task description:**

We are looking for students who can deploy user studies using our mobile prototype (mobile and web- it's designed but not actually working) and refine the design.

- 1) Interview smart phone journal and health logger for undergraduate /graduate students
- 2) Identify design suggestions or refine current prototyping
- 3) Develop better solutions

Required background:

Any experience of user studies and experience designing interfaces for mobile/web

#### **\*For a potential developer**

##### **Task description:**

We are looking for developers who can develop a mobile app and integrate it into a wearable tracker dashboard such as Fitbit. Our health diary app is already designed as a design prototyping. A potential candidate actually develops the Android app.

- 1) Develop a smartphone journal and health logger for college students
- 2) Develop a web dashboard for physician/counselor

Required background:

Java, Android programming, experience with Android SDK, third-party libraries and APIs



Email contacts:

Dr. Grace Bae ([gracebae@andrew.cmu.edu](mailto:gracebae@andrew.cmu.edu)), Ubicomp Lab. HCI

### **Intelligent Systems & Training Tools For Rehabilitation**

**Contact:** Dan Siewiorek <[dps@cscmu.edu](mailto:dps@cscmu.edu)>, Asim Smailagic <[asim@cs.cmu.edu](mailto:asim@cs.cmu.edu)>

For individuals who undergo partial arm amputations, robotic myoelectric prosthetic devices can allow them to recover a great deal of their arm and hand functionality. Without effective pre-prosthetic training, patients are likely to abandon their prosthesis and consequently decrease their activity level and productivity or overuse their intact limb. A significant challenge in adapting to a prosthetic device is learning to use their brain to control the device effectively and safely. In the project, we use a Microsoft Kinect and a skin EMG reader to help provide feedback to users learning to use a prosthetic device. Example exercises are: lifting a light object, lifting a heavy object, lifting a tray, and pouring from a glass jug. The project focuses on modalities of interaction for pre-prosthesis training tools.

Student requirements: Experience with wireframing and prototyping tools

### **Evaluating and Designing an Application for Relatives of Critically Ill Patients**

**Contact:** Brady Myers [bam@cs.cmu.edu](mailto:bam@cs.cmu.edu)

In collaboration with Dr. Doug White from the Department of Critical Care Medicine at the University of Pittsburgh, we are designing a web-enabled, tablet-based system to help the families of a critically ill, incapacitated patient communicate with the medical care team and make decisions about treatments for the patient. The goal of the research project is to develop a web-based decision aid based on semi-structured interviews and the principles of user-centered design. The HCI team will use iterative usability testing to identify areas that need further refinement or development. The ultimate goal is to design a refined prototype that is ready for a pilot study in the ICU. The HCI team - in conjunction with the University of Pittsburgh Team - will be responsible for: updating the tool's design, conducting usability testing, and corresponding with programmers.

This project is open to students who are at any level: undergrad, Masters or PhD, and who have 9 or 12 hours/week available for Spring, 2017. Students are encouraged to work for course credit. Students should be familiar with the



principles of user-centered design and have experience conducting usability testing. If you are interested in this project, please send by email to [bam@cs.cmu.edu](mailto:bam@cs.cmu.edu) the following:

- (1) Your resume
- (2) A description of your experience with HCI methods
- (3) Your grades in any HCI-related courses

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## INTERACTION DESIGN

### RainCheck

**Contact:** Mayank Goel <mayankgoel@cmu.edu>

It is extremely hard to use the smartphone's touchscreen when it is wet. The modern smartphones are increasingly becoming waterproof but the screen still doesn't work well when it is raining or our fingers are wet.

The main reason the screens do not work is that the water droplets change the capacitance in a similar way to a user's finger. Therefore, the screen gets confused between the water droplets and fingers. We are looking to modify the touchscreen code on the phones to remove this confusion. This project requires hacking into the kernel of the phone and changing the way phone reacts to the change in capacitance on the touch screen. We currently have a system that is able to do this much but there is still enough work left. We need to collect a bunch of data while using the phone when the screen is wet and understand the subtle differences in the signal for different conditions.

The project will give the student an experience on how to collect data for a research study, introduction to signal processing, machine learning (we will make models to understand the difference between fingers and water droplets), and writing a research paper on the whole problem.

### Tools involved:

1. Linux
2. Python
3. MATLAB

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## IOS DEVELOPMENT / WEB DEVELOPMENT

### **Bento Browser**

**Contact:** [nhahn@cs.cmu.edu](mailto:nhahn@cs.cmu.edu)

We are working to reimagine how individuals use web browsers on mobile devices. We are looking for students who are interested in building or working off some of the systems we have developed so far. Some possible projects we are considering include:

- Adding assistance from crowd workers for online search tasks
- Adding collaborative features to allow for a better browsing experience among friends / colleagues
- Redesigning the current user interface to be more aesthetically pleasing
- Building a browser client for OS X or a Chrome extension to supplement existing browsers.
- Analyzing behavioral trends among users utilizing our application.
- Work with the current prototype to perform user testing, including: think alouds, diary studies, questionnaires, and A/B tests

Skills desired include programming proficiency (Objective-C, Node.js), Front-end development experience, NLP/ML familiarity, or UI/UX design skills.

Shoot me an email at [nhahn@cs.cmu.edu](mailto:nhahn@cs.cmu.edu) if you are interested in the project.

### **End-user Programmable Intelligent Assistant for Smartphone Task Automation**

**Contact:** **Toby Li** <[tobyli@cs.cmu.edu](mailto:tobyli@cs.cmu.edu)>

Intelligent assistants on smartphones like Siri and Google Assistant can perform tasks on the user's behalf, but their capabilities are limited to the apps and services they support, without a way for the end-users to teach them new tasks. Prof. Brad Myers and PhD student Toby Li in the HCII (along with collaborators across SCS) have a research project on designing and building a multi-modal smartphone intelligent agent that enables the end-users to program it to perform new tasks by demonstration. We have finished the development of the first version of the system and are looking for one or two students to help program new features. We need students who are experienced programmers in Java, preferably with Android development experience.



Sample projects for the students could include:

- Design and implement new ways for visualizing or presenting the scripts that users created.
- Develop mechanisms to expand the applicability of the system to new fields (e.g. web, text entry tasks) and Internet of Things (IoT) devices.
- Develop mechanisms for retrieving and processing sensor inputs of the phone (like location and time-of-day) to enable context-awareness for user-created tasks.
- Design and develop interfaces to enable the end-users to create more complicated scripts with complex control structures (e.g. conditionals, triggers, loops).

Students are also particularly encouraged to talk with us if they have their own ideas around end-user programmable intelligent personal assistants. This project can be done for pay or for independent study credit, but for credit is preferred. We envision this taking about 9 to 12 hours per week, and expect to start the week of January 17, 2017 - the start of classes.

Applicants for this project should be strong programmers with experience in mobile development (preferably Android).

Please send to Toby Li ([tobyli@cs.cmu.edu](mailto:tobyli@cs.cmu.edu)) (1) your your grade or level and degree program (e.g., Masters of HCI or Junior BHCI second major), (2) if you are an undergraduate, then whether you are a US citizen, (3) your resume, (4) a list of your grades in CS classes, (5) a description of your experience programming in Java and for Android, and (6) whether you want to work for money or credit.

### **End-user Programmable Intelligent Assistant for Smartphone Task Automation**

**Contact:** Toby Li ([tobyli@cs.cmu.edu](mailto:tobyli@cs.cmu.edu)) & Brady Myers

Intelligent assistants on smartphones like Siri and Google Assistant can perform tasks on the user's behalf, but their capabilities are limited to the apps and services they support, without a way for the end-users to teach them new tasks. Prof. Brad Myers and PhD student Toby Li in the HCII (along with collaborators across SCS) have a research project on designing and building a multi-modal smartphone intelligent agent that enables the end-users to program it to perform new tasks by demonstration. We have finished the development of the first version of the system



and are looking for one or two students to help program new features. We need students who are experienced programmers in Java, preferably with Android development experience. You will likely end up with your name on published papers.

Sample projects for the students could include:

- Design and implement new ways for visualizing or presenting the scripts that users created.
- Develop mechanisms to expand the applicability of the system to new fields (e.g. web, text entry tasks) and Internet of Things (IoT) devices.
- Develop mechanisms for retrieving and processing sensor inputs of the phone (like location and time-of-day) to enable context-awareness for user-created tasks.
- Design and develop interfaces to enable the end-users to create more complicated scripts with complex control structures (e.g. conditionals, triggers, loops).

Students are also particularly encouraged to talk with us if they have their own ideas around end-user programmable intelligent personal assistants. This project can be done for pay or for independent study credit, but for credit is preferred. We envision this taking about 9 to 12 hours per week, and expect to start the week of January 17, 2017 - the start of classes.

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## SOCIAL COMPUTING

### **Collaborative Innovation**

**Contact:** Felicia Ng ([fng@cs.cmu.edu](mailto:fng@cs.cmu.edu))

This project investigates how creative innovations can be generated collaboratively by multiple people with diverse ideas and expertises. We are developing a process called “distributed analogical innovation” that breaks creative thinking down into multiple steps like an assembly line, and distributes each step to a different group of people to pass their ideas on to inspire the next group.

We are looking for students who will help us run online or lab experiments and analyze the resulting data. Possible tasks include designing surveys, finding or developing interesting innovation tasks, interacting with online or lab participants, and evaluating creative ideas. Ideal students will have interests in cognitive science and/or social computing. Familiarity with Amazon Mechanical Turk, Qualtrics, and/or R are a plus, but not required.

Interested students should send their resume and GPA to Felicia Ng ([fng@cs.cmu.edu](mailto:fng@cs.cmu.edu)).

### **Augmenting Email into Snapchat, Dropbox, and a Dashboard**

**Contact:** Haojian Jin ([haojian.jin@gmail.com](mailto:haojian.jin@gmail.com))

Email may be the most successful application yet devised. However, email functionality has remained static in years, lagging behind users' evolving communication needs. The recent universal adoption of HTML5 allows us to think about the email interface in exciting new ways that were not possible in the early days. We're looking at re-inventing the existing Email protocol with new functionalities, including sending self-destruct email like Snapchat, updating sent email like Dropbox, and using email as the information dashboard, etc.

Ideal Skills: HTML5/CSS/Javascript, Interface Design, Web development, Experience with Python and Chrome extension is a plus.

### **MessageOnTap: Intelligent Agents for Streamlining Communications on Messaging Apps**

**Contact:** Fanglin Chen ([chenfanglintc@gmail.com](mailto:chenfanglintc@gmail.com))



MessageOnTap is an intelligent agent we are building for offering auto-responses and fast responses to messages on your smartphone. For example, if you get a text message, your smartphone might check your location data or calendar and auto-respond “I’m driving, will get back to you soon” or “I’m in a meeting right now”. As another example, a friend might ask “Can you send me the pictures at the park last weekend”, and your smartphone might show you a preview window of your photos, making it very fast and easy to respond. We’re looking at improving the intelligent agent in a number of ways, including managing privacy issues with auto-responses, making the agent work with other messaging apps, and offering crowd analysis of messages to improve responses.

Ideal Skills: Android programming, Natural Language Processing, intelligent agents, machine learning, user interface design, crowdsourcing

### **Inferring User Interests and Activities based on Geotagged Photos and Tweets**

**Contact:** Jason Hong (jasonh@cs.cmu.edu)

How much can your smartphone infer about you based on your photos and tweets, if all it had were your geotags? Can it figure out that you like baseball, apples, or Taylor Swift? Can it figure out where you went on vacation, what foods you like, where your friends live, and what kinds of activities you like doing? This project will involve (a) extracting a person's geotags from smartphone photos, (b) crawling metadata from Yelp, Flickr, Foursquare, Wikipedia, and other places to build a World Knowledge Graph that describes what those places are and what people do there, and (c) combining these two to build a model of a person's interests and activities. Looking for 2-3 people with strong dev skills for this work.

Ideal Skills: Some subset of Android programming, web programming, databases, machine learning, natural language processing

### **Urban Analytics for Neighborhoods**

**Contact:** Jason Hong (jasonh@cs.cmu.edu)

If you just moved to Pittsburgh, you probably had a bunch of questions about what neighborhood to live in. How safe is this neighborhood? How noisy is it? How hard is it to find parking? Where do people go shopping? What do people like the most about this neighborhood? What do they complain the most about? Are people in this neighborhood friendly? How does this neighborhood make people feel? Given



tons of geotagged metadata from Yelp, Flickr, Foursquare, Wikipedia, and other places, we are building a World Knowledge Graph that describes places. We are interested in using this data to build better models and interactive visualizations that can be used to characterize neighborhoods and answer questions like the ones above.

Ideal Skills: Web programming, databases, machine learning, information visualization, natural language processing

### **Building the future of work through peer assessment**

**Contact:** Yasmine Kotturi <[ykotturi@cs.cmu.edu](mailto:ykotturi@cs.cmu.edu)>

How will people find jobs and work ten years from now? Come help us build the future of work!

Online work platforms like UpWork enable many individuals and businesses to hire experts for particular tasks, and for short periods of time. This flexibility and access to hard-to-find expertise has many benefits, and more than 35% of Americans are freelancers today, who can find work from businesses worldwide. The problem? Employers who wish to hire online experts (and researchers who create innovative systems around expert crowdwork) face a surprising roadblock: how to distinguish someone qualified from someone who isn't?

Employers spend millions of hours every year screening applications; freelancers similarly send out hundreds of applications each year. We are creating an alternative that relies on freelancers' ability to assess each others capabilities. This is a project that combines advances in theory (with approximate impartial mechanisms) with our research on peer assessment for the last few years.

We have an opportunity for a technically skilled student to work on the design and development of the platform. HTML and Python/Ruby language skills are essential: the platform will be built either in Python, or in Ruby on Rails. We also provide opportunities for motivated students to be given authorship on papers or pursue their own research questions. Finally, students who make good progress may be offered a chance to return to the research group for a paid summer internship.

Please send your resume to Yasmine Kotturi, <[ykotturi@cs.cmu.edu](mailto:ykotturi@cs.cmu.edu)> if you are interested, and let her know a) what skills you have and b) what skills you want to develop through this project.



## **Context-Aware Matching – Connecting people at the right time and place using mobile technology**

**Contact:** Afsaneh Doryab <[adoryab@cs.cmu.edu](mailto:adoryab@cs.cmu.edu)>

Research categories: Social Computing, Mobile Computing, HCI, Data Analytics (Machine Learning, Data Mining, Statistics, Visualization)

This project is very interesting and has a huge societal impact. We use the data collected from smartphone sensors (such as GPS, Bluetooth, and wifi) to match and recommend people to people based on their current situation and context, common interests, needs, or skills. Application examples for campus students are matching potential mentors and mentees, finding roommates, and creating social groups. Students in this project will be involved in developing applications and algorithms for opportunistic matching and recommendation, doing user studies and evaluation of the application, and writing papers.

We prefer students with programming skills (Java, JavaScript, Python, Android and/or iOS development), and experience and interest in algorithm development, machine learning, data mining, statistics, and visualization techniques.

## **VizLens: A Robust and Interactive Screen Reader for Interfaces in the Real World**

**Contact person:** Jeff Bigham ([jbigham@cs.cmu.edu](mailto:jbigham@cs.cmu.edu)), Anhong Guo ([anhongg@cs.cmu.edu](mailto:anhongg@cs.cmu.edu))

The world is full of physical interfaces that are inaccessible to blind people, from microwaves and information kiosks to thermostats and checkout terminals. Blind people cannot independently use such devices without at least first learning their layout, and usually only after labeling them with sighted assistance. We have built VizLens—an accessible mobile application and supporting backend that can robustly and interactively help blind people use nearly any interface they encounter. VizLens users capture a photo of an inaccessible interface and send it to multiple crowd workers, who work in parallel to quickly label and describe elements of the interface to make subsequent computer vision easier. The VizLens application helps users recapture the interface in the field of the camera, and uses computer vision to interactively describe the part of the interface beneath their finger.

We are looking to explore extensions to VizLens that can

- capture and understand how the interface reacts to the user's interaction



- use computer vision techniques to segment and recognize the text and screens
- apply VizLens to help blind users access figures and maps, etc.

PDF: <http://www.cs.cmu.edu/~jbigam/pubs/pdfs/2016/vizlens.pdf>

Video: <https://youtu.be/Wy0656j2eig>

**Ideal skills:** iOS programming, Computer Vision, Crowdsourcing, Machine Learning

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## UX RESEARCH ASSISTANT

### **Project: Sports Fans' Rituals and Superstitions**

**Contact:** John Zimmerman <[johnz@cs.cmu.edu](mailto:johnz@cs.cmu.edu)>

Many people love sports, and many sports fans love engaging in rituals and superstitions meant to help their favorite team win. These activities, most often involving specific food or clothing, provide fans with a way to participate individually and collectively with their team.

In this project, we want to investigate how social computing systems might effectively capture fans' rituals and superstitions and visualize them to help fans understand which ones work (which ones correlate with victory and defeat). The idea is not to deceive fans into believing that these actions actually work. Instead, the goal is to help them celebrate their fan actions in a way that provides them with a deeper connection to other fans and to the team and players they support. Teams work on this project will operationalize various attachment theories (e.g., possession attachment, brand attachment, experience attachment, celebrity attachment), all of which show that meaning emerges through the actions people take. In this case, a fan's attachment to their team is bound up in the actions they take to support their team. We want to develop designs that help fans revel in their relationship with their favorite teams and players by helping them act more collectively and effectively.

I am looking for undergraduate and master students with an interest in user experience design and social computing. The work for the semester involves:

- Reading the literature on sports fans, rituals, and attachment
- Investigating fans current social media practices, especially where they intersect with rituals and superstitions
- Designing and prototyping social media applications that allow fans to share their actions and visualize their effectiveness
- Evaluating these designs with local fans

This project can be done independent study credit; either 9 or 12 units

If you are interested, please send the following to me <[johnz@cs.cmu.edu](mailto:johnz@cs.cmu.edu)>:

- Resume



- Short description of your UX design experience
- Names of two CMU instructors who can vouch for your individual and teamwork

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For more information regarding Independent Study opportunities with the Human-Computer Interaction Institute at Carnegie Mellon University, visit the [Independent Study webpage](http://www.hcii.cs.cmu.edu/academics/independent-study) <http://www.hcii.cs.cmu.edu/academics/independent-study>.