Research Digest

Georgia Tech Institute for People and Technology

Letter from the Director

Innovation in technology has the power to transform complex, human-driven endeavors such as healthcare, communication, and the development of our cities. Influencing these people-centered systems, also known as socio-technical systems, requires basic and applied research in many areas – design, computing, psychology, architecture, policy, engineering and business – and the means to integrate these insights into transformative approaches, services, and tools.

Georgia Tech's Institute for People and Technology (IPaT), established in 2011, creates a networked research ecosystem of Georgia Tech faculty, students, industry and other partners. This ecosystem amplifies their thought leadership and practical results to create a positive economic and societal impact on how people communicate, learn, heal, and take care of their communities.

The IPaT Research Digest is a triennial collection of summaries from a selected set of our faculty publications. It's a small sample of our research and showcases Georgia Tech's thought leadership in scholarly journals and research conferences.

The publications summarized in this digest span a wide range of topics from nearly 50 Georgia Tech researchers from 2017-2019. Topics include investigating Medicaid data to improve the lives of children in Georgia and beyond; the use of smart design for sustainable cities of the future; the use of wearable technology can assist people with physical disabilities; and, recent advances and challenges in the field of sports data visualization.

Through these living laboratories and multidisciplinary projects, we continue our mission of shaping the future of human-centered systems, environments and technologies to promote fulfilling, healthy and productive lives.

Beth Mynatt
Executive Director, Institute for People and Technology

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LifeLong Health and Well-Being

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Evaluating provider-level capacity is needed to measure access, and to inform policies and interventions for dental care for Medicaid-enrolled children. This data sources are the 2012–2013 Medicaid Analytic eXtract claims and the 2013 National Provider Plan Enumeration System datasets. This study suggests that the realized capacity for Medicaid-enrolled children varies among providers, with consistent trends across different provider types and urbanicity of the providers' practice address. The state median capacity for preventive care is lower than the 500:1 patient-to-provider ratio used as the minimum capacity in access estimates from other studies for all states. This study can assist states in gauging the level of dental care provided to the Medicaid-insured children in comparison to other states, with implications for the specification of access standards and oral health policies.

Citation
Serban, N., & Tomar, S. L. (2018). *ADA Health Policy Institute's methodology overestimates spatial access to dental care for publicly insured children*. Journal of Public Health Dentistry

Adherence to Recommended Care Guidelines in the Treatment of Preschool-Age Medicaid-Enrolled Children With a Diagnosis of ADHD

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurodevelopmental disorder of childhood. Clinical guidelines recommend behavior therapy as the first-line treatment for preschool-age children with ADHD. This study evaluated longitudinal patterns of services received by Medicaid-enrolled children ages 2 to 5 with ADHD in seven southeastern states (Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina). Five states had a utilization profile with a high probability of receipt of psychological services before medication among children with ADHD, covering 16% of the total study population. Most young children's ADHD care experience in the seven states (65%) fit utilization profiles characterized by a high probability of receiving any ADHD medication. Black race was significantly associated with higher utilization of psychological services in three states.

Citation
Moran, A., Serban, N., Danielson, M.L., Grosse, S.D., & Cuffe, S.P. (2018). *Adherence to Recommended Care Guidelines in the Treatment of Preschool-Age Medicaid-Enrolled Children With a Diagnosis of ADHD.* Psychiatric Services.

The Effect of Paid Family Leave on Infant and Parental Health in the United States

California's paid family leave (PFL) policy improved mothers' labor market outcomes, however, the health impacts of this program are less studied. I compared child and parental health of likely eligible households to a series of control groups before and after California's PFL program was implemented. I found improvements in parent-reported overall child health and suggestive improvements in maternal mental health status. Findings also suggest a reduction in asthma and a greater likelihood that parents feel they are coping well with the day-to-day demands of parenting. There are no significant effects on respiratory or food allergies, or father's mental health status. The results are robust to multiple control groups and placebo tests.

Citation
Bullinger LR, *The Effect of Paid Family Leave on Infant and Parental Health in the United States*, Journal of Health Economics (2019)

MyPath: Investigating Breast Cancer Patients' Use of Personalized Health Information

Following a cancer diagnosis, patients must cope with numerous physical, emotional, and practical challenges. While health information exists to help patients learn how to manage these challenges, health information seeking often declines over time, recalling information is difficult, and limited time with healthcare providers can leave patients feeling uninformed about their illness. We designed MyPath to overcome these information access challenges. The mobile system offers personalized, dynamic, and trusted health information recommendations to help patients learn about and manage their cancer. Through a seven-month deployment study with breast cancer patients, we found that use of the application encouraged proactive health management behaviors, and identified factors that motivated technology adoption and abandonment.

Citation

Jacobs, M., Johnson, J., & Mynatt E.D. (2018). *MyPath: Investigating Breast Cancer Patients' Use of Personalized Health Information.* Proceedings of the ACM on Human-Computer Interaction 2, CSCW, Article 78 (November 2018), 21 pages.

The Effect of Light on Sleep and Sleep-Related Physiological Factors Among Patients in Healthcare Facilities: A Systematic Review

Lighting is one of the environmental factors which can improve patient sleep in healthcare environments. Due to the high degree of variation in study designs and results on this topic, the implications have been difficult to interpret. This review consolidated studies on the impact of bright light exposure on sleep to identify lighting conditions that can be applied and researched in future healthcare environments. The current state of the literature includes evidence on how various durations and intensities of morning, midday, and evening bright light exposure, as well as whole-day light exposure interventions can improve specific aspects of sleep. Lighting interventions differed in all attributes (illuminance levels, exposure time, exposure duration, and spectral qualities) but showed promising results in improving patients' sleep.

Citation

Hadi, K., DuBose, J.R., & Choi, Y.S. (2019). *The Effect of Light on Sleep and Sleep-Related Physiological Factors Among Patients in Healthcare Facilities: A Systematic Review.* HERD: Health Environments Research & Design Journal

Value of Inventory Information in Allocating a Limited Supply of Influenza Vaccine During a Pandemic

To understand the value of information on vaccine inventory levels during an influenza pandemic, we proposed a simulation study to compare vaccine allocation strategies using: (i) only population information (pro-rata, or population-based, PB), (ii) both population and vaccine inventory information (population and inventory-based, PIB). We adapted an agent-based simulation model to predict the spread of the disease both geographically and temporally. We study PB and PIB when uptake rates vary geographically. The simulation studied was done from 2015 to 2017, using population and commuting data from the state of Georgia from the United States census. Compared to PB under reasonable scenarios, PIB reduces the infection attack rate from 23.4% to 22.4%, decreases the amount of leftover inventory from 827 to 152 thousand, and maintains or increases the percentage of vaccinated population.

Citation

Li, Z., Swann, J.L., & Keskinocak, P. (2018). *Value of inventory information in allocating a limited supply of influenza vaccine during a pandemic.* PLOS ONE, 13(10).

Aging With Long-Term Mobility Impairment: Maintaining Activities of Daily Living via Selection, Optimization, and Compensation

There is a growing number of adults with long-term mobility impairment aging into the older adult population. Little is known about the experiences of these individuals in maintaining activities of daily living (ADLs) and instrumental activities of daily living (IADLs) as they face age-related changes in addition to a pre-existing mobility impairment. Through in-home interviews with 21 participants (ages 52–86) with long-term mobility impairment, the present study employed a qualitative description design to explore perceptions of how and why select ADL/IADL routines (e.g., bed transfer, toileting) have changed over time. The selection, optimization, and compensation (SOC) model was used as a framework to organize participants' adaptations.

Citation

Remillard, E.T., Fausset, C.B., & Fain, W.B. (2017). *Aging With Long-Term Mobility Impairment: Maintaining Activities of Daily Living via Selection, Optimization, and Compensation.* The Gerontologist.

Addressing Medication Adherence Technology Needs in an Aging Population

Using technology to inspire behavior change motivated by a health goal is a challenge. Technologies, often rooted in sound scientific principles, sometimes do not perform as expected in real world scenarios. Quite often the barriers to use are not inherent in the behavior change model of the product or service, but are issues associated with the failure to appropriately consider the needs of the end users when designing an intervention. We deployed a large, multi-stage research study with aging adults to assess the facilitators and barriers of technologies aimed to create or support behavior changes related to medication adherence. Our results indicate that the user experience associated with delivery of the content is at least as important as the content.

Citation

Pater, J., Owens, S., Farmer, S., Mynatt, E.D., & Fain, W.B. (2017). *Addressing medication adherence technology needs in an aging population.* PervasiveHealth '17 Proceedings of the 11th EAI International Conference on Pervasive Computing Technologies for Healthcare, Pages 58-67.

Design Strategies to Improve Healthcare Worker Safety in Biocontainment Units: Learning from Ebola Preparedness

We identified ways that the built environment may support or disrupt safe doffing of personal protective equipment (PPE) in biocontainment units (BCU). In each facility, we observed how the physical environment influences risky behaviors by the healthcare (HCW). The environmental design impeded communication between trained observers (TOs) and HCWs because of limited window size or visual obstructions with louvers, which allowed unobserved errors. The size and configuration of the doffing area impacted HCW adherence to protocol, and lack of clear demarcation of zones resulted in HCWs inadvertently leaving the doffing area and stepping back into the contaminated areas. Lack of standard location for items resulted in equipment and supplies frequently shifting positions. Finally, different solutions for maintaining balance while removing shoe covers (ie, chair, hand grips, and step stool) had variable success.

Citation

DuBose J.R., et al. (2018). *Design Strategies to Improve Healthcare Worker Safety in Biocontainment Units: Learning from Ebola Preparedness.* Infection Control & Hospital Epidemiology 2018, 1–7.

Asthma Academy: Developing Educational Technology to Improve Asthma Medication Adherence and Intervention Efficiency

Asthma is a leading chronic disorder among children and adolescents. Although some children outgrow asthma while transitioning into adulthood, there are others who continue to suffer from life-threatening asthmatic exacerbations. Teenagers tend to have certain misconceptions about their asthmatic condition and treatment which are rarely recognized or addressed in regular clinical consultations. On these very lines, Georgia Institute of Technology designed an interactive educational application called Asthma Academy in conjunction with Children's Healthcare of Atlanta. This website resides in the public cloud and uses a novel animation video-based curriculum to deliver essential healthcare education to asthmatic adolescents in an interactive manner. What distinguishes it from similar initiatives is the use of a cost-effective technique to simulate caregiver-patient interactions and the ability to cater to a wide range of socio-economic statuses and educational levels.

Citation

Nair, A.S., DeMuth, K., Cheng, C.W., & Wang, M.D. (2017). *Asthma Academy: Developing educational technology to improve Asthma medication adherence and intervention efficiency.* 2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).

A Review of Mobile Apps for Epilepsy Self-Management

Mobile health app developers increasingly are interested in supporting the daily self-care of people with chronic conditions. The purpose of this study was to review mobile applications (apps) to promote epilepsy self-management. It investigates the following: 1) the available mobile apps for epilepsy, 2) how these apps support patient education and self-management (SM), and 3) their usefulness in supporting management of epilepsy. We conducted the review in Fall 2017 and assessed apps on the Apple App Store that related to the terms "epilepsy" and "seizure". Inclusion criteria included apps (adult and pediatric) that, as follows, were: 1) developed for patients or the community; 2) made available in English, and 3) less than $5.00. Exclusion criteria included apps that were designed for dissemination of publications, focused on healthcare providers, or were available in other languages. The search resulted in 149 apps, of which 20 met the selection criteria.

Citation

Escoffery, C., McGee, R., Bidwell, J., Sims, C., Thropp, E.K., Frazier, C., & Mynatt, E.D. (2018). *A review of mobile apps for epilepsy self-management.* Epilepsy & Behavior, 81, 62–69.

SmartBathroom: Developing A Smart Environment To Study Bathroom Transfers

Individuals' functional abilities change over time; they increase and then decrease over the lifespan, and in some they may fluctuate over the course of a day. While these fluctuations may not impact one's ability to engage in daily activities, they can be problematic for people aging with disability or a progressive chronic condition such as arthritis or multiple sclerosis, particularly when performing toilet or shower/bath transfers. The SmartBathroom Laboratory is being developed as part of the RERC TechSAge as a highly sensed, adjustable residential bathroom environment to accommodate a wide variety of research studies on task performance during bathroom transfers. These studies focused on identifying the problems faced by people with functional limitations as they age as well as on exploring viable solutions to these problems.

Citation

Jones, B.D., Pandey, S., Presti, P., Taylor, R., Natarajan, P., Mahajan, S., Mahajan, H., & Sanford, J. (2017). *SmartBathroom: Developing A Smart Environment To Study Bathroom Transfers.* RESNA Annual Conference

Beyond ADA Accessibility Requirements: Meeting Seniors' Needs for Toilet Transfers

We identified the optimal spatial and dimensional requirements of grab bars that support independent and assisted transfers by older adults and their care providers. Although research has demonstrated that toilet grab bars based on the Americans with Disabilities Act (ADA) Accessibility Standards do not meet the needs of older adults, the specific dimensional requirements for alternative configurations are unknown. The optimal configuration derived in Phase 1 included fold-down grab bars on both sides of the toilet (14" from centerline [CL] of toilet, 32" above the floor, and extended a minimum of 6" in front of the toilet) with one side open and a sidewall 24" from CL of toilet on the other. Phase 2 feedback was significantly positive for independent and one-person transfers and somewhat lower, albeit still positive, for two-person transfers.

Citation

Lee, S.J., Sanford, J., Calkins, M., Melgen, S., Endicott, S., & Phillips, A. (2017). *Beyond ADA Accessibility Requirements: Meeting Seniors' Needs for Toilet Transfers.* HERD: Health Environments Research & Design Journal, 11(2), 32–44.

Hands-Free, Nonwearable Technology for Outpatient Clinic Gait Speed Assessment

We read with great interest about Barry and colleagues' pilot study assessing a system to unobtrusively measure gait speed in an outpatient geriatrics clinic as patients walk to the examination room. Gait speed is a critically important performance-based measure of the frailty phenotype, based on independent associations with chronic disability, nursing home institutionalization, injurious falls, and other health outcomes. We agree that barriers to integrating gait speed measure into the clinical workflow has so far limited everyday routine capture in patient care. Through a partnership between Georgia Institute of Technology and Emory University, we hold a provisional patent on a similar system for measuring gait speed in outpatient geriatric clinics. The Gait Pace Meter is a wall-mounted device that uses sensors at torso height and is therefore less affected by footfall variability.

Citation

Vandenberg, A. E., Jones, B. D., Nadel, L., & Johnson, T. M. (2018). *Hands-Free, Nonwearable Technology for Outpatient Clinic Gait Speed Assessment.* Journal of the American Geriatrics Society, 67(1), 183–184.

Smart Cities and Inclusive Innovation

Coupling Data Science with Community Crowdsourcing for Urban Renewal Policy Analysis: An Evaluation of Atlanta's Anti-Displacement Tax Fund

We estimated the cost and impact of a proposed anti-displacement program in the Westside of Atlanta with data science and machine learning techniques. This program intends to fully subsidize property tax increases for eligible residents of neighborhoods where there are two major urban renewal projects underway, a stadium and a multi-use trail. We first estimated household-level income eligibility for the program with data science and machine learning approaches applied to publicly available household-level data. We then forecasted future property appreciation due to urban renewal projects using random forests with historic tax assessment data. We found that our household-level data and machine learning techniques result in fewer eligible homeowners but significantly larger program costs, due to higher property appreciation rates than the original analysis, which was based on census and city-level data.

Citation
Auerbach, J., Blackburn, C., Barton, H., Meng, A., & Zegura, E. (2018). *Coupling data science with community crowdsourcing for urban renewal policy analysis: An evaluation of Atlanta's Anti-Displacement Tax Fund*. Environment and Planning B: Urban Analytics and City Science

Spaces and Traces: Implications of Smart Technology in Public Housing

Smart home technologies are beginning to become more widespread and common, even as their deployment and implementation remain complex and spread across different competing commercial ecosystems. Looking beyond the middle-class, single-family home often at the center of the smart home narrative, we report on a series of participatory design workshops held with residents and building managers to better understand the role of smart home technologies in the context of public housing in the U.S. The design workshops enabled us to gather insight into the specific challenges and opportunities of deploying smart home technologies in a setting where issues of privacy, data collection and ownership, and autonomy collide with diverse living arrangements, where income, age, and the consequences of monitoring and data aggregation setup an expanding collection of design implications in the ecosystems of smart home technologies.

Citation
Kozubaev, S., Rochaix, F., DiSalvo, C., & Le Dantec, C.A. (2019). *Spaces and Traces.* Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19

More-Than-Human Participation: Design for Sustainable Smart City Futures

Out of necessity or choice, people and wildlife are increasingly living side-by-side in urban environments. As more species live together in cities, this presents significant environmental challenges associated with high density living, poor resource management, long supply chains, habitat loss and pollution. These conditions can be toxic for humans and non-humans alike. One response has been to make cities "smart" using networked sensing, cloud and mobile computing, to optimize, control and regulate urban processes. "Smart" initiatives are often presented as a social and environmental good. In this article we proposed an alternative smart city agenda for the interaction design community in responding to a more-than-human perspective. To help us explore and imagine what this agenda could be like we illustrated our discussion with examples shared as part of an interdisciplinary workshop at the Participatory Design Conference, Hasselt Belgium in 2018.

Citation
Clarke, R., Heitlinger, S., Light, A., Forlano, L., Foth, M., & DiSalvo, C. (2019) *More-Than-Human Participation: Design for Sustainable Smart City Futures.* Interactions, 26(3), pp. 60-63.

Devising a Game Theoretic Approach to Enable Smart City Digital Twin Analytics

Despite investments in advancing information and communications technology (ICT)-integrated infrastructure systems toward becoming Smarter Cities, cities often face a large gap between smart sustainable supply and demand. Here, we reviewed the core concepts of ICT-integrated infrastructure systems as they pertain to developing smart and sustainable cities, and describe how a game theoretic-based digital twin of a city can enable more visibility and insight into the successful implementation of such systems. This study is a foundational step toward enabling participation of all city stakeholders (i.e., government, industry, and citizens) in the decision-making process and the creation of smart sustainable cities. Engaging city stakeholders in such a manner allows for collective participation in changes, which can enable continuous adaptation toward more sustaining growth and prosperity.

Citation
Mohammadi, N., Taylor, J. (2019) *Devising a Game Theoretic Approach to Enable Smart City Digital Twin Analytics.* Proceedings of the 52nd Hawaii International Conference on System Sciences

Grassroots Resource Mobilization Through Counter-Data Action

In this paper, we documented the counter-data action and data activism of a grassroots affordable housing advocacy group in Atlanta. Our observation and insight into these data activities and strategies are achieved through ethnographic and engaged research and participatory design. We found that counter-data action through community-collected data is rooted in a legacy of Atlanta's black activism and black scholarship; that this data activism enabled resource mobilization and critical conscious making; and that design and media production are essential post counter-data action activities in data activism. Based on these findings, we urge the field of open government data to broaden their concept of social impact of data to include the use data to mobilize resources within oppressed communities not to influence policy and government but to build capacities within community in order to transform, not join, political structures.

Citation
Meng, A., DiSalvo, C. (2018) *Grassroots resource mobilization through counter-data action,* Big Data & Society

Safety Impacts of Bicycle Infrastructure: A Critical Review

This paper takes a critical look at the present state of bicycle infrastructure treatment safety research, highlighting data needs. Safety literature relating to bicycle treatments is examined, including findings, study methodologies, and data sources used in the studies. Some preliminary conclusions related to research efficacy are drawn from the available data and findings in the research. While the current body of bicycle safety literature points toward some defensible conclusions regarding the safety and effectiveness of certain bicycle treatments, such as bike lanes and removal of on-street parking, the vast majority treatments are still in need of rigorous research. Fundamental questions arise regarding appropriate exposure measures, crash measures, and crash data sources.

Citation
DiGioia, J., Watkins, K. E., Xu, Y., Rodgers, M., & Guensler, R. (2017). *Safety impacts of bicycle infrastructure: A critical review.* Journal of Safety Research, 61, 105–119

Does the Future of Mobility Depend on Public Transportation?

We've all seen the headlines. "Will self-driving cars, taxis make mass transit obsolete?" (Davidson 2017) and "What happens if Uber or Lyft outcompetes public transit?" (Sen 2017) or even "Department Of Transportation Says The Future Of Transit Looks Pretty Bleak" (Griggs 2015). We are entering the next great revolution in how people move about in cities. But does the future of transportation mean the end of transit?

Citation
Watkins, K.E (2018). *Does the Future of Mobility Depend on Public Transportation?*. Journal of Public Transportation, 21 (1): 53-59

Using Value Sensitive Design to Understand Transportation Choices and Envision a Future Transportation System

The increasing passengerization of transportation through shared ride services and driverless vehicles has the potential to vastly change the transportation system. Although values are sometimes considered in the design of information tools and through attitudes toward travel, the systematic approach of value sensitive design (VSD) should be used in the design of transportation infrastructure to create a sustainable transportation future.

Citation
Watkins, K.E. Ethics and Information Technology (2018)

Privacy and Cybersecurity Lessons at the Intersection of the Internet of Things and Police Body-Worn Cameras

Prepared for the North Carolina Law Review symposium on police body-worn Cameras ("BWC"s), this Article shows that BWCs can be conceptualized as an example of the Internet of Things ("IoT"). Part I adopts the IoT definition of (1) a sensor connected to the Internet that (2) stores and/or processes data remotely, typically in the cloud. Part II examined lessons from the substantial IoT literature for BWC privacy and cybersecurity. Part III examined two areas where study of BWCs might offer lessons for the broader domain of IoT. First, to protect police officer privacy during breaks and for other reasons, BWCs are not always on. By contrast, IoT best practices to date have not emphasized the implications of toggling the sensor on and off. Second, an important debate for BWCs is how to promote transparency—to provide accountability while protecting individual privacy.

Citation
Swire, P., Woo, J., *Privacy and Cybersecurity Lessons at the Intersection of the Internet of Things and Police Body-Worn Cameras* (April 2, 2018). North Carolina Law Review, Vol, 96, 2018; Georgia Tech Scheller College of Business Research Paper No. 18-11

Engaging Gentrification as a Social Justice Issue in HCI

Gentrification—the spatial expression of economic inequality—is fundamentally a matter of social justice. Yet, even as work outside of HCI has begun to discuss how computing can enable or challenge gentrification, HCI's growing social justice agenda has not engaged with this issue. This omission creates an opportunity for HCI to develop a research and design agenda at the intersection of computing, social justice, and gentrification. We began this work by outlining existing scholarship describing how the consumption side dynamics of gentrification are mediated by contemporary socio-technical systems. Subsequently, we built on the social justice framework introduced by Dombrowski, Harmon, and Fox to discuss how HCI may resist or counter such forces. We offered six modes of research that HCI scholars can pursue to engage gentrification.

Citation
Corbett, E., & Loukissas, Y. (2019). *Engaging Gentrification as a Social Justice Issue in HCI.* Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19

Smart City Digital Twins

Driven by the challenges of rapid urbanization, cities are determined to implement advanced socio-technological changes and transform into smarter cities. The success of such transformation, however, greatly relies on a thorough understanding of the city's states of spatiotemporal flux. The ability to understand such fluctuations in context and in terms of interdependencies that exist among various entities across time and space is crucial, if cities are to maintain their smart growth. Here, we introduce a Smart City Digital Twin paradigm that can enable increased visibility into cities' human-infrastructure-technology interactions, in which spatiotemporal fluctuations of the city are integrated into an analytics platform at the real-time intersection of reality-virtuality. Through learning and exchange of spatiotemporal information with the city, enabled through virtualization and the connectivity offered by Internet of Things (IoT), this Digital Twin of the city becomes smarter over time, able to provide predictive insights into the city's smarter performance and growth.

Citation
Mohammadi, N., & Taylor, J. E. (2017). *Smart city digital twins.* 2017 IEEE Symposium Series on Computational Intelligence (SSCI)

All the Homes: Zillow and the Operational Context of Data

Zillow, an online real estate marketplace that seeks to make information available about "all the homes" in the United States, tells us that "data want to be free." But a close analysis reveals that Zillow works to ground data: to put data into an operational context. I used the phrase "operational context" to denote a setting in which data—for real estate: current listings, tax assessments, and other digital property records—are meant to be fully understood. This paper examined the design of operational contexts for data as well as their cultural and political significance, using Zillow as a case. Zillow was founded in 2006, at the height of the housing bubble. Although practices with real estate have been under scrutiny ever since, the treatment of real estate data has not. This paper examines how Zillow operationalizes data for the housing market through a combination of analytical, discursive, and algorithmic devices.

Citation
Loukissas Y. (2018). *All the Homes: Zillow and the Operational Context of Data.* In: Chowdhury G., McLeod J., Gillet V., Willett P. (eds) Transforming Digital Worlds. iConference 2018. Lecture Notes in Computer Science, vol 10766. Springer, Cham

All Data Are Local: Thinking Critically in a Data-Driven Society

How to analyze data settings rather than data sets, acknowledging the meaning-making power of the local.

In our data-driven society, it is too easy to assume the transparency of data. Instead, Yanni Loukissas argues in *All Data Are Local*, we should approach data sets with an awareness that data are created by humans and their dutiful machines, at a time, in a place, with the instruments at hand, for audiences that are conditioned to receive them. The term data set implies something discrete, complete, and portable, but it is none of those things. Examining a series of data sources important for understanding the state of public life in the United States—Harvard's Arnold Arboretum, the Digital Public Library of America, UCLA's Television News Archive, and the real estate marketplace Zillow—Loukissas shows us how to analyze data settings rather than data sets.

Citation
Yanni Alexander Loukissas is Assistant Professor of Digital Media in the School of Literature, Media, and Communication at Georgia Institute of Technology. He is the author of *Co-Designers: Cultures of Computer Simulation in Architecture*. MIT Press 2019

Open Government Data in the Smart City: Interoperability, Urban Knowledge, and Linking Legacy Systems

Open government data (OGD) promise to reveal new insights and inform governance decisions related to changing populations, departmental operations, and economic drivers. Yet, where OGD figure prominently in the vision of a smart city, OGD are, in fact, scarce. From production and distribution practices to file types, organizational structure, and repositories, large quantities of potential OGD remain as legacy data trapped in incumbent systems. This article confronts the challenges of legacy data through a constructivist analysis of data wrangling (i.e. converting data into useful formats). The analysis illustrates that wrangling legacy data is more than a rote technical activity. Our findings suggest that smart governance in practice depends on the ways that social, organizational, and institutional strategies cope with technical change. Further, our research demonstrates that wrangling legacy data is not a discrete problem to overcome, but an operating condition defining the rapidly changing landscape of smart governance.

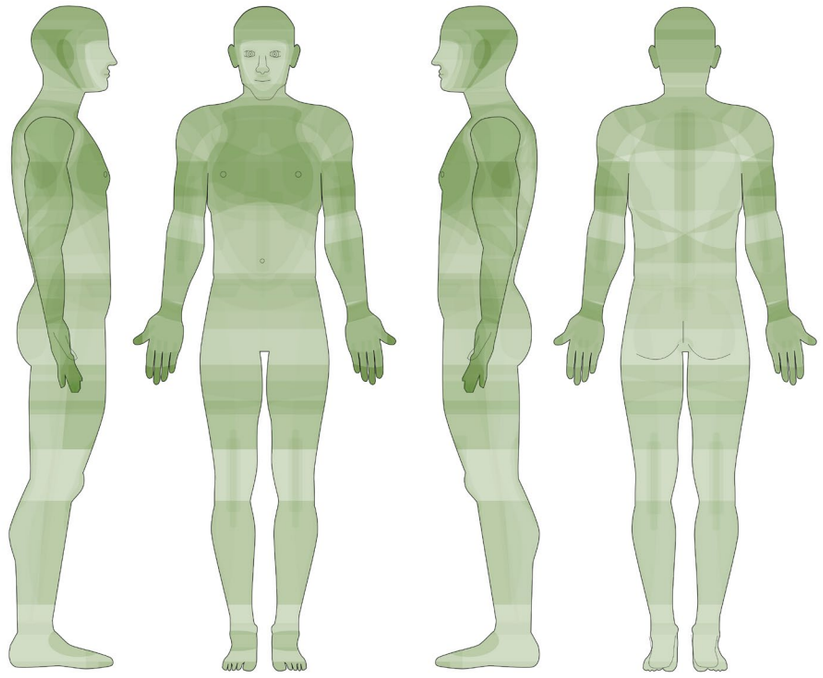
Citation
Lodato, T., French, E., & Clark, J. (2018). *Open government data in the smart city: Interoperability, urban knowledge, and linking legacy systems.* Journal of Urban Affairs, 1–15

Shaping the Human-Technology Frontier

The Assistive Wearable: Inclusive by Design

Wearable technology has the potential to usher in a new wave of assistive technology. Many wearable devices are already being used by people with disabilities as assistive technology. Here we discussed how designers might use design considerations and body maps to make sure that the wearable devices they are creating are accessible to everyone. The hope is that, with a thoughtful process, new wearable technology can also act seamlessly as assistive technology.

Citation
Zeagler, C., Gandy, M., & Baker, P. (2018). *The Assistive Wearable: Inclusive by Design.* Assistive Technology Outcomes and Benefits, Volume 12, Summer 2018, pp. 11-36



Where to Wear it: Functional, Technical, and Social Considerations in On-Body Location for Wearable Technology 20 Years of Designing for Wearability

One of the first questions a researcher or designer of wearable technology has to answer in the design process is where on the body the device should be worn. It has been almost 20 years since Gemperle et al. wrote “Design for Wearability,” and although much of her initial guidelines on humans factors surrounding wearability still stand, devices and use cases have changed over time. This paper is a collection of literature and updated guidelines and reasons for on-body location depending on the use of the wearable technology and the affordances provided by different locations on the body.

Citation
Zeagler, C. (2017). *Where to wear it.* Proceedings of the 2017 ACM International Symposium on Wearable Computers - ISWC '17

Imagining Futures: A Collaborative Policy/Device Design for Wearable Computing

The rapidly expanding market for wearable computing devices (wearables), driven by advances in information and communication technologies (ICT), wireless access, and public acceptance of a design aesthetic, is indicative of the near limitless potential for changing the relationship of users to information context(s). As the adoption of wearable devices spreads, there are cultural and social impacts that represent both barriers and opportunities, with subsequent policy ramifications. All too often designers, technologists, and policymakers operate independently developing products that are out of sync, lack interoperability, or are hindered by well meaning, but obstructive policy. This paper proposes a futures-based, iterative policy-informed design framework for developing wearable devices that guides interdisciplinary collaborators early in the process of designing a research & development plan.

Citation
Gandy, M., Baker, P., & Zeagler, C., *Imagining futures: A collaborative policy/device design for wearable computing,* Futures

Intersectional HCI: Engaging Identity Through Gender, Race, and Class

Understanding users becomes increasingly complicated when we grapple with various overlapping attributes of an individual's identity. In this paper we introduced intersectionality as a framework for engaging with the complexity of users'—and authors'—identities, and situating these identities in relation to their contextual surroundings. We conducted a meta-review of identity representation in the CHI proceedings, collecting a corpus of 140 manuscripts on gender, ethnicity, race, class, and sexuality published between 1982-2016. Drawing on this corpus, we analyzed how identity is constructed and represented in CHI research to examine intersectionality in a human-computer interaction (HCI) context. We found that previous identity-focused research tends to analyze one facet of identity at a time. Further, research on ethnicity and race lags behind research on gender and socio-economic class.

Citation
Schlesinger, A., Edwards, W.K., & Grinter, R.E. (2017). *Intersectional HCI.* Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems - CHI '17.

Passive Haptic Training to Improve Speed and Performance on a Keypad

Learning text entry systems is challenging, yet necessary. Many layouts and keyboards exist, but they rely on laborious learning techniques. Passive haptic learning (PHL) has already demonstrated some benefit for learning the Braille text entry system. Could this computing-enabled technique be used to improve desktop keyboard typing skills? It is unknown whether passive haptic training can improve speed on a motor task (as opposed to initial learning). We used a randomized numeric keypad to examine users' typing performance with or without passive haptic training. When users were prevented from looking at the keyboard, the PHL group demonstrated consistent accuracy (-0.011 KSPC) while those in the control group greatly increased their error (+1.26 KSPC on average). This result is consistent with the finding that PHL users looked significantly less at the keyboard.
In a second, longer study, users exposed to PHL were found to significantly improve their typing speed (mean increase of 11 WPM) versus control (mean increase of 2.2 WPM).

Citation
Seim, C., Doering, N., Zhang, Y., Stuerzlinger, W., & Starner, T. (2017). *Passive Haptic Training to Improve Speed and Performance on a Keypad.* PACM Interact. Mob. Wearable Ubiquitous Technol. 1, 3, Article 100 (September 2017), 13 pages.

Implementing EarSketch: Connecting Classroom Implementation to Student Outcomes

The expansion of computer science into more classrooms invites researchers and evaluators to shift their focus from predominantly measuring student-level factors to measuring both student- and classroom-level variables. Research presented in this article used multi-level modeling to study student-level factors within the larger context of classroom-level factors. Specifically, we analyzed EarSketch, a collaborative and authentic learning tool, that introduced students to programming through music remixing, has previously been shown to increase student engagement, and increases learners' intentions to persist in computing. This article presents classroom implementation frameworks commonly used in math and science education but rarely, if ever, applied to computer science. The results from a multi-level modeling analysis show that classroom implementation correlates with students' intentions to persist in computing but may not be related to student attitudes toward computing or content knowledge acquisition.

Citation
McKlin, T., Wanzer, D., Lee, T., Magerko, B., Edwards, D., Grossman, S., & Freeman, J. (2019). *Implementing EarSketch.* Proceedings of the 50th ACM Technical Symposium on Computer Science Education - SIGCSE '19

Wearable Knee Health System Employing Novel Physiological Biomarkers

Knee injuries and chronic disorders, such as arthritis, affect millions of Americans leading to missed workdays and reduced quality of life. Currently, after an initial diagnosis, there are few quantitative technologies available to provide sensitive sub-clinical feedback to patients regarding improvements or setbacks to their knee health status; instead, most assessments are qualitative, relying on patient-reported symptoms, performance during functional tests, and physical examinations. Recent advances have been made with wearable technologies for assessing the health status of the knee (and potentially other joints) with the goal of facilitating personalized rehabilitation of injuries and care for chronic conditions. This review describes our progress in developing wearable sensing technologies that enable quantitative physiological measurements and interpretation of knee health status. Our sensing system enables longitudinal quantitative measurements of knee sounds, swelling, and activity context during clinical and field situations.

Citation

Inan, O.T., Whittingslow, D.C., Teague, C.N., Hersek, S., Pouyan, M. B., Millard-Stafford, M., Kogler, G.F., & Sawka, M.N. (2018). *Wearable knee health system employing novel physiological biomarkers.* Journal of Applied Physiology, 124(3), 537–547.

Multimodal Anomaly Detection for Assistive Robots

Detecting when something unusual has happened could help assistive robots operate more safely and effectively around people. However, the variability associated with people and objects in human environments can make anomaly detection difficult. We previously introduced an algorithm that uses a hidden Markov model (HMM) with a log-likelihood detection threshold that varies based on execution progress. We now present an improved version of our previous algorithm (HMM-D) and introduce a new algorithm based on Gaussian process regression (HMM-GP). We also present a new and more thorough evaluation of 8 anomaly detection algorithms with force, sound, and kinematic signals collected from a robot closing microwave doors, latching a toolbox, scooping yogurt, and feeding yogurt to able-bodied participants.

Citation

Park, D., Kim, H., & Kemp, C.C. (2018). *Multimodal anomaly detection for assistive robots.* Autonomous Robots

Defining Digital Self-Harm

Self-harm is the infliction of pain or injury onto oneself. Though historically these behaviors were relegated to the fringes of communities, information technology now enables new ways to foster and encourage these dangerous activities. This paper defined the concept of digital self harm as the online communication and activity that leads to, supports, or exacerbates, non-suicidal yet intentional harm or impairment of an individual's physical wellbeing. We outlined a research agenda for the CSCW community to understand the correlation and possible causation of offline self-harm behaviors due to online activities, and to design and assess technologies focused on prevention, mitigation and treatment. CAUTION: This paper includes media that could potentially be triggering to those dealing with an eating disorder or with other self-harm related illnesses. Please use caution when reading or disseminating this paper.

Citation
Pater, J., & Mynatt, E.D (2017). *Defining Digital Self-Harm.* Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing - CSCW '17

Even When Icons are Not Worth a Thousand Words They are Helpful in Designing Asthma mHealth Tools

Asthma is the most common childhood chronic illness. Its management requires that caregivers have access to a variety of information. For example, asthma action plans (AAP) are written instructions for responding to escalating asthma symptoms. Icons have been used to facilitate the accessibility of health information and we investigate whether they benefit parents of young children. We conducted a 4-part study with 36 participants where we (1) gathered requirements for an asthma management mHealth tool (2) assessed the comprehension of icons to be used in an AAP (3) compared the usability of a text-based (T-B) vs. icon-based (I-B) AAPs (4) and gathered feedback about an mHealth tool we designed. Results suggest that the icons we developed were highly matched to their meaning (92% translucency). We concluded with recommendation on how designers and researchers can improve mHealth tools for caregivers of asthmatic children.

Citation
Lefco, M., Gise, J., Lesnick, B., & Arriaga, R.I. (2017). *Even when Icons are Not Worth a Thousand Words They are Helpful in Designing Asthma mHealth Tools.* Lecture Notes in Computer Science, 23–33.

Variability in Adolescent Portal Privacy Features: How the Unique Privacy Needs of the Adolescent Patient Create a Complex Decision-Making Process

Medical privacy policies, which are clear-cut for adults and young children, become ambiguous during adolescence. Yet medical organizations must establish unambiguous rules about patient and parental access to electronic patient portals. We conducted a national interview study to characterize the diversity in adolescent portal policies across a range of institutions and determine the factors influencing decisions about these policies. We interviewed informants from 25 medical organizations. Policies established different degrees of adolescent access (from none to partial to complete), access ages (from 10 to 18 years), degrees of parental access, and types of information considered sensitive. Federal and state law did not dominate policy decisions. Some informants believed that clearer standards would simplify policy-making; others worried that standards could restrict high-quality polices.

Citation

Sharko, M., Wilcox, L., Hong, M. K., & Ancker, J. S. (2018). *Variability in adolescent portal privacy features: how the unique privacy needs of the adolescent patient create a complex decision-making process.* Journal of the American Medical Informatics Association, 25(8), 1008–1017

A Practical Approach to Integrating Live 2D Web Content with the Immersive Web

As 3D on the web gains momentum via standards such as WebGL and WebXR, a reoccurring frustration among web developers is inability to leverage 2D web technologies within immersive presentation contexts. The use-cases for blending 2D and 3D web content include progressive enhancement of 2D web pages, re-use of existing 2D web content, and layout/design of complex interactive user interfaces for 3D environments. We introduced WebLayer3D, a JavaScript plugin for three.js (a popular 3D scene-graph library) that makes it easy for web developers to integrate live interactive 2D web content (built using standard web technologies) into a 3D scene (rendered using WebGL). In this paper, we demonstrated that existing DOM-to-Texture techniques (when used thoughtfully) are sufficient for enabling a performant, flexible, and simple approach to building interactive 3D user interfaces for the immersive web.

Citation

Speiginer, G., MacIntyre, B. (2019). *A Practical Approach to Integrating Live 2D Web Content with the Immersive Web.* Web3D '19 The 24th International Conference on 3D Web Technology Pages 1-10

Investigating the Accuracy of a Novel Telehealth Diagnostic Approach for Autism Spectrum Disorder

Research indicates that a substantial amount of time elapses between parents' first concerns about their child's development and a formal diagnosis of autism spectrum disorder (ASD). Telehealth presents an opportunity to expedite the diagnostic process. This project compared a novel telehealth diagnostic approach that utilizes clinically guided in-home video recordings to the gold standard in-person diagnostic assessment. Participants included 40 families seeking an ASD evaluation for their child and 11 families of typically developing children. Children were between the ages of 18 months and 6 years 11 months. Families completed the Naturalistic Observation Diagnostic Assessment (NODA) for ASD, which was compared to an in-person assessment (IPA). NODA utilizes telehealth technology for families to share information with professionals and provides a method to inform clinical judgment for a diagnosis of ASD.

Citation

Smith, C. J., Rozga, A., Matthews, N., Oberleitner, R., Nazneen, N., & Abowd, G. (2017). *Investigating the accuracy of a novel telehealth diagnostic approach for autism spectrum disorder.* Psychological Assessment, 29(3), 245–252

Design in the HCI Classroom: Setting a Research Agenda

Interaction design is playing an increasingly prominent role in computing research, while professional user experience roles expand. These forces drive the demand for more design instruction in HCI classrooms. In this paper, we distilled the popular approaches to teaching design to undergraduate and graduate students of HCI. Through a review of existing research on design pedagogy, an international survey of 61 HCI educators, and an analysis of popular textbooks, we explored the prominent disciplinary perspectives that shape design education in the HCI classroom. We drew on our analyses to discuss the differences we see in forms of design taught, approaches to adapting design instruction in computing-based courses, and the tensions faced by instructors of these classes. We concluded by arguing for the importance of pedagogical research on design instruction as a vital and foundational area of inquiry in Interaction Design and HCI.

Citation

Wilcox, L., DiSalvo, B., Henneman, D., & Wang, Q. (2019). *Design in the HCI Classroom: Setting a Research Agenda.* In Proceedings of the 2019 on Designing Interactive Systems Conference (DIS '19). ACM, New York, NY, USA, 871-883

NerdHerder: Designing Colocated Physical–Digital Games with Sociological Theories

We developed and evaluated a multiplayer mobile-augmented reality (MAR) game, NerdHerder, to research social play in a shared physical-digital space. NerdHerder is inspired by the recent innovations in physical game interfaces, such as Wii and Kinect. These interfaces enable a hybrid physical-digital gaming space by mapping physical actions to digital game controls. But current multiplayer games designed for the hybrid game space often involve players standing next to each other, yet staring at their own character and activities on the screen. We believe that digital games have the potential to bring more engaging and cooperative social experience to players. To achieve this goal, we adapt sociological theories to the specific domain of collocated hybrid physical-digital games.

Citation

Xiu, Y., MacIntyre, B., *Games User Research*, Edited by Miguel Angel Garcia-Ruiz, Chapter 9

SeeSaw - Rapid One-Handed Synchronous Gesture Interface for Smartwatches

We present SeeSaw, a synchronous gesture interface for commodity smartwatches to support watch-hand only input with no additional hardware. Our algorithm, which uses correlation to determine whether the user is rotating their wrist in synchrony with a tactile and visual prompt, minimizes false-trigger events while maintaining fast input during situational impairments. Results from a 12-person evaluation of the system, used to respond to notifications on the watch during walking and simulated driving, show interaction speeds of 4.0 s - 5.5 s, which is comparable to the swipe-based interface control condition. SeeSaw is also evaluated as an input interface for watches used in conjunction with a head-worn display. A six subject study showed a 95% success rate in dismissing notifications and a 3.57 s mean dismissal time.

Citation

Wu, J., Colglazier, C., Ravishankar, A., Duan, Y., Wang, Y., Ploetz, T., & Starner, T. (2018). *Seesaw.* Proceedings of the 2018 ACM International Symposium on Wearable Computers - ISWC '18

Platforms and Services for Socio-Technical Systems

State of the Art of Sports Data Visualization

In this report, we organized and reflected on recent advances and challenges in the field of sports data visualization. The exponentially-growing body of visualization research based on sports data is a prime indication of the importance and timeliness of this report. Sports data visualization research encompasses the breadth of visualization tasks and goals: exploring the design of new visualization techniques; adapting existing visualizations to a novel domain; and conducting design studies and evaluations in close collaboration with experts, including practitioners, enthusiasts, and journalists. In this report, we analyzed current research contributions through the lens of three categories of sports data: box score data (data containing statistical summaries of a sport event such as a game), tracking data (data about in-game actions and trajectories), and meta-data (data about the sport and its participants but not necessarily a given game).

Citation
Perin, C., Vuillemot, R., Stolper, C. D., Stasko, J. T., Wood, J., & Carpendale, S. (2018). *State of the Art of Sports Data Visualization.* Computer Graphics Forum, 37(3), 663–686

Using Machine Learning and an Ensemble of Methods to Predict Kidney Transplant Survival

We used an ensemble of statistical methods to build a model that predicts kidney transplant survival and identifies important predictive variables. The proposed model achieved better performance, measured by Harrell's concordance index, than the Estimated Post Transplant Survival model used in the kidney allocation system in the U.S., and other models published recently in the literature. The model has a five-year concordance index of 0.724 (in comparison, the concordance index is 0.697 for the Estimated Post Transplant Survival model, the state of the art currently in use). It combines predictions from random survival forests with a Cox proportional hazards model. The rankings of importance for the model's variables differ by transplant recipient age. Better survival predictions could eventually lead to more efficient allocation of kidneys and improve patient outcomes.

Citation
Mark, E., Goldsman, D., Gurbaxani, B., Keskinocak, P., & Sokol, J. (2019). *Using machine learning and an ensemble of methods to predict kidney transplant survival.* PLOS ONE

Lessons Learned From Evaluating an Enterprise Modeling Methodology

Many of the challenges that the society faces today are enterprise problems. Enterprise systems consist of technological, organizational, and social elements where there is no locus of control. Due to the complex nature of enterprise systems, they are particularly difficult to model and analyze in support of policy analysis. There is a need for accessible methods and approaches to aid those tasked with modeling enterprise problems. To that end, we considered an enterprise modeling methodology that emphasizes a layered view of an enterprise system and evaluated it by applying it to a case study on the intrusion of counterfeit parts in a supply chain. We concluded that the utility of the methodology does not lie in making specific predictions as there are many ways to accomplish that.

Citation
Pennock, M. J., Bodner, D. A., & Rouse, W. B. (2018). *Lessons Learned From Evaluating an Enterprise Modeling Methodology.* IEEE Systems Journal, 12(2), 1219–1229

Orko: Facilitating Multimodal Interaction for Visual Exploration and Analysis of Networks

Data visualization systems have predominantly been developed for WIMP-based direct manipulation interfaces. Only recently have other forms of interaction begun to appear, such as natural language or touch-based interaction, though usually operating only independently. Prior evaluations of natural language interfaces for visualization have indicated potential value in combining direct manipulation and natural language as complementary interaction techniques. We hypothesized that truly multimodal interfaces for visualization, those providing users with freedom of expression via both natural language and touch-based direct manipulation input, may provide an effective and engaging user experience. Unfortunately, however, little work has been done in exploring such multimodal visualization interfaces. To address this gap, we have created an architecture and a prototype visualization system called Orko that facilitates both natural language and direct manipulation input.

Citation
Srinivasan, A., & Stasko, J. (2018). *Orko: Facilitating Multimodal Interaction for Visual Exploration and Analysis of Networks.* IEEE Transactions on Visualization and Computer Graphics, 24(1), 511–521

Systems Engineering Simulation Experience Design: Infrastructure, Process, and Application

The Systems Engineering Experience Accelerator (SEEA) is a new approach to developing the systems engineering and technical leadership workforce. The project aims at accelerating experience assimilation through immersive, simulated learning situations where learners solve realistic problems. A prototype of the technology infrastructure and experience content has been developed, piloted, and evaluated. While the prototype proved useful, its ability to support a community of educators and developers has limits with challenges in creating or changing experiences. This paper proposes an initial taxonomy of experience archetypes to help development and reuse of experiences and describes the experience design and development process using the SEEA tool suite. We followed this by an application case study: an experience developed by the United Kingdom Ministry of Defence to accelerate the maturity of reliability engineers and their role in identifying and resolving safety issues.

Citation
Turner, R., Bodner, D., Kemp, D., Rodriguez, Y., Wade, J., & Zhang, P. (2017). *SE Simulation Experience Design: Infrastructure, Process, and Application*. INCOSE International Symposium, 27(1), 296–308

Novel Data Imputation for Multiple Types of Missing Data in Intensive Care Units

The diversity and number of parameters monitored in an intensive care unit (ICU) make the resulting databases highly susceptible to quality issues, such as missing information and erroneous data entry, which adversely affect the downstream processing and predictive modeling. Missing data interpolation and imputation techniques, such as multiple imputation, expectation maximization, and hot-deck imputation techniques do not account for the type of missing data, which can lead to bias. In our study, we first modeled the missing data as three types: “neglectable” also known as a.k.a “missing completely at random,” “recoverable” a.k.a. “missing at random,” and “not easily recoverable” a.k.a. “missing not at random.” We then designed imputation techniques for each type of missing data. We used a publicly available database (MIMIC II) to demonstrate how these imputations perform with random forests for prediction.

Citation
Venugopalan, J., Chanani, N., Maher, K., & Wang, M. D. (2019). *Novel Data Imputation for Multiple Types of Missing Data in Intensive Care Units.* IEEE Journal of Biomedical and Health Informatics

The State of the Art in Integrating Machine Learning into Visual Analytics

Visual analytics systems combine machine learning or other analytic techniques with interactive data visualization to promote sensemaking and analytical reasoning. It is through such techniques that people can make sense of large, complex data. While progress has been made, the tactful combination of machine learning and data visualization is still under-explored. This state-of-the-art report presents a summary of the progress that has been made by highlighting and synthesizing select research advances. Further, it presents opportunities and challenges to enhance the synergy between machine learning and visual analytics for impactful future research directions.

Citation
Endert, A., Ribarsky, W., Turkay, C., Wong, B. L. W., Nabney, I., Blanco, I. D., & Rossi, F. (2017). *The State of the Art in Integrating Machine Learning into Visual Analytics.* Computer Graphics Forum, 36(8), 458–486

Podium: Ranking Data Using Mixed-Initiative Visual Analytics

People often rank and order data points as a vital part of making decisions. Multi-attribute ranking systems are a common tool used to make these data-driven decisions. Such systems often take the form of a table-based visualization in which users assign weights to the attributes representing the quantifiable importance of each attribute to a decision, which the system then uses to compute a ranking of the data. However, these systems assume that users are able to quantify their conceptual understanding of how important particular attributes are to a decision. We developed a prototype system, Podium, that allows users to drag rows in the table to rank order data points based on their perception of the relative value of the data. Podium then infers a weighting model using Ranking SVM that satisfies the user's data preferences as closely as possible.

Citation

Wall, E., Das, S., Chawla, R., Kalidindi, B., Brown, E. T., & Endert, A. (2018). *Podium: Ranking Data Using Mixed-Initiative Visual Analytics.* IEEE Transactions on Visualization and Computer Graphics, 24(1), 288–297

AI for Development Series

Artificial Intelligence is growing exponentially in its impact on human society. While the field of scientific inquiry and technical progress is roughly seventy-years-old (if we pin its origin to the 1950 work of Turing and the 1956 Dartmouth workshop), it is only now that we see AI impacting many of our lives on a daily basis. AI appears in the foreground as we interact with some fluidity, through voice recognition and natural language processing, with digital assistants like Siri and Alexa. And AI is present for many of us in the background, for instance as we use a credit card and our bank applies an AI based fraud detection algorithm while approving payment. The goal of this module is to help ICT regulators and policymakers consider a few of the many core ethical and social issues that are emerging due to AI systems; these issues are developed here as a series of values and the ways that AI can positively or negatively impact these values.

Citation

Best, M.L. (2018). *AI, Ethics and Society.* In Papers of the Global Symposium for Regulators. ITU.

Detecting Gaze Towards Eyes in Natural Social Interactions and Its Use in Child Assessment

Eye contact is a crucial element of non-verbal communication that signifies interest, attention, and participation in social interactions. As a result, measures of eye contact arise in a variety of applications such as the assessment of the social communication skills of children at risk for developmental disorders such as autism, or the analysis of turn-taking and social roles during group meetings. However, the automated measurement of visual attention during naturalistic social interactions is challenging due to the difficulty of estimating a subject's looking direction from video. This paper proposes a novel approach to eye contact detection during adult-child social interactions in which the adult wears a point-of-view camera which captures an egocentric view of the child's behavior. By analyzing the child's face regions and inferring their head pose we can accurately identify the onset and duration of the child's looks to their social partner's eyes.

Citation

Chong, E., Chanda, K., Ye, Z., Southerland, A., Ruiz, N., Jones, R. M., Rehg, J.M. (2017). *Detecting Gaze Towards Eyes in Natural Social Interactions and Its Use in Child Assessment.* Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, 1(3), 1–20

#autism: Twitter as a Lens to Explore Differences in Autism Awareness in India and the United States

We presented an initial qualitative exploration of Twitter data on autism spectrum disorders (ASDs) and acquired immunodeficiency syndrome (AIDS) from India and the United States, conducted with the goal of learning more about the nature of existing online awareness around ASDs in India. We collected tweets from both locations during and around World Autism Awareness Day and World AIDS Day. We then qualitatively analyzed these tweets, finding differences in how each country talks about stigmatized health issues and how Indian users talk about ASDs. We used these findings to discuss potential avenues for research on supporting and extending existing levels of autism awareness in India.

Citation

Karusala, N., Kumar, N., & Arriaga, R. (2019). *#autism: Twitter as a Lens to Explore Differences in Autism Awareness in India and the United States.* In Tenth International Conference on Information and Communication Technologies and Development (ICTD '19), January 4–7, 2019, Ahmedabad, India. ACM, New York, NY, USA, 5 pages

Facebook in Venezuela: Understanding Solidarity Economies in Low-Trust Environments

Since 2014, Venezuela has experienced severe economic crisis, including scarcity of basic necessities such as food and medicine. This has resulted in over-priced goods, scams, and other forms of economic abuse. We present an investigation of Venezuelans' efforts to form an alternative, Solidarity Economy (SE) through Facebook Groups. In these groups, individuals can barter for items at fair prices. We highlighted group practices and design features of Facebook Groups which support solidarity or anti-solidarity behaviors. We concluded by leveraging design principles for online communities presented by Kollock to present strategies to design more effective SEs in environments of low trust.

Citation

Evans, H.I., Wong-Villacres, M., Castro, D., Gilbert, E., Arriaga, R.I., Dye, M., & Bruckman, A. (2018). *Facebook in Venezuela.* Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18

Visual 3D Tracking of Child-Adult Social Interactions

We described an approach to continuously capture children's 3D head pose and location during a tabletop social interaction with an adult examiner. Our approach, called face plus context, utilized a fixed room camera in conjunction with a head-worn camera on the examiner to simultaneously capture the child's face along with the toys and social partners that provide context. Our system performs head tracking and pose estimation along with multi-target tracking to provide 3D localization and disambiguate identity. We evaluated our method on a dataset of 16 children, including both typically developing and autistic children. We present encouraging results for measuring children's social behaviors, along with validation results using an IMU.

Citation
Chong, E., Southerland, A., Kundu, A., Jones, R. M., Rozga, A., & Rehg, J. M. (2017). *Visual 3D tracking of child-adult social interactions.* 2017 Joint IEEE International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob).

Crime Linkage Detection by Spatio-Temporal-Textual Point Processes

Crimes emerge out of complex interactions of human behaviors and situations; Linkages between crime events are highly complex. Detecting crime linkage given a set of crime events is a highly challenging task since we only have limited information including text descriptions, event times and locations. We proposed a new modeling and learning framework for detecting linkage between crime events using spatio-temporal-textual data, which are usually available in the form of police reports. We captured linkages by introducing a multivariate marked point process which incorporates text, time, and location. In addition, we explicitly reduced the bias in text documents. Then learned the text information by considering the notion of modus operandi (M.O.). Numerical results using real data from the Atlanta Police show that our method has competitive performance relative to the state-of-the-art.

Citation
Zhu, S., Xie, Y. (2019). *Crime Linkage Detection by Spatio-Temporal-Textual Point Processes.* arXiv 2019

Crime Event Embedding with Unsupervised Feature Selection

We present a novel event embedding algorithm for crime data that can jointly capture time, location, and the complex free-text component of each event. The embedding is achieved by regularized Restricted Boltzmann Machines (RBMs), and we introduced a new way to regularize by imposing a penalty on the conditional distributions of the observed variables of RBMs. This choice of regularization performs feature selection and it also leads to efficient computation since the gradient can be computed in a closed form. The feature selection forces embedding to be based on the most important keywords, which captures the common modus operandi (M.O.) in crime series. Using numerical experiments on a large-scale crime dataset, we show that our regularized RBMs can achieve better event embedding and the selected features are highly interpretable from human understanding.

Citation
Zhu, S., Xie, Y. (2019). *Crime Linkage Detection by Spatio-Temporal-Textual Point Processes.* arXiv 2019

Assessing the Quality of Home Detection from Mobile Phone Data for Official Statistics

Mobile phone data are an interesting new data source for official statistics. However, multiple problems and uncertainties need to be solved before these data can inform, support or even become an integral part of statistical production processes. In this article, we focused on arguably the most important problem hindering the application of mobile phone data in official statistics: detecting home locations. We argued that current efforts to detect home locations suffer from a blind deployment of criteria to define a place of residence and from limited validation possibilities. We supported our argument by analyzing the performance of five home detection algorithms (HDAs) that have been applied to a large, French, Call Detailed Record (CDR) data set (,18 million users, five months). Our results show that criteria choice in HDAs influences the detection of home locations for up to about 40% of users, that HDAs perform poorly when compared with a validation data set (resulting in 358-gap), and that their performance is sensitive to the time period and the duration of observation.

Citation

Vanhoof, M., Reis, F., Ploetz, T., & Smoreda, Z. (2018). *Assessing the Quality of Home Detection from Mobile Phone Data for Official Statistics.* Journal of Official Statistics, 34(4), 935–960.

Multicenter Clinical Assessment of Improved Wearable Multimodal Convulsive Seizure Detectors

New devices are needed for monitoring seizures, especially those associated with sudden unexpected death in epilepsy (SUDEP). They must be unobtrusive and automated, and provide false alarm rates (FARs) bearable in everyday life. This study quantified the performance of new multimodal wrist-worn convulsive seizure detectors. Hand-annotated video-electroencephalographic seizure events were collected from 69 patients at six clinical sites. Three different wristbands were used to record electrodermal activity (EDA) and accelerometer (ACM) signals, obtaining 5,928 h of data, including 55 convulsive epileptic seizures (six focal tonic-clonic seizures and 49 focal to bilateral tonic-clonic seizures) from 22 patients. Recordings were analyzed offline to train and test two new machine learning classifiers and a published classifier based on EDA and ACM. Moreover, wristband data were analyzed to estimate seizure-motion duration and autonomic responses.

Citation

Onorati, F., Regalia, G., Caborni, C., Migliorini, M., Bender, D., Poh, M.Z., Picard, R.W. (2017). *Multicenter clinical assessment of improved wearable multimodal convulsive seizure detectors.* Epilepsia, 58(11), 1870–1879

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