Joint COE and CPHHS Ignite Colloquia: *Precision Health*

Mar 10, 2017

Presentations:
4:00 – 5:00 pm

Wine/Beer Reception:
5:00 – 6:00 pm

HFC #115
Session I
Tala Navab-Daneshmand

Transmission Pathways for Enteric Pathogens in low and middle income countries

Impact of environmental fecal *E. coli* on hand hygiene in urban Harare

1 Photo source: http://water1st.org
Fate of Pathogenic and Antibiotic Resistant Bacteria in Septic Sludge in Urban Vietnam
In older men, those with moderate to high levels of life event trajectories were about 40% more likely to die, covarying risk factors.

Those with consistently high or moderate hassles intensity are also about 50% more likely to die, but exposure does not affect mortality (Jeong et al., 2014).

Hassle and life event trajectories have independent effects on mortality (Aldwin et al. 2014b).
Why?

Planned Projects –
Need better biomarker sensors!!

- Dyadic co-regulation in older couples of cortisol in the context of daily stress
- Does daily stress affect glucose regulation??

Do biomarkers mediate these findings? In NAS, coupling analyses show that changes in life events (but not hassles) affect erythrocyte sedimentation rate -- Aldwin et al., 2017
Early Detection of Parkinson’s Disease through Innovative Technology

Remote Monitoring of PD Medication Adherence

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Advancements in sensor technology and artificial intelligence have spurred the availability of low-cost, commercially available telehealth systems that connect patients with providers in a timely and efficient manner.


Early detection of PD may increase patient quality of life and reduce cost.

Ethical, Legal, and Social Implications of Precision Medicine and Prevention

Rick Settersten
Professor, Human Development & Family Sciences
Director, Hallie Ford Center for Healthy Children & Families

Visions of the Field


Patient-Driven Genomic Research

Citizen Science and National Research Initiatives


Clinical Applications of Genomic Testing


Patient Empowerment


Precision Prevention

Xiaoli Fern
Associate Professor, COE

Machine Learning
Improving quality of life for young adult cancer survivors and their partners/family caregivers

March 10, 2017

Jessica R. Gorman, PhD, MPH
Jessica.Gorman@oregonstate.edu

“It’s far more important to know what person the disease has than what disease the person has.” - Hippocrates
We know there is significant unmet need for information, support, and care for survivors and their partners/families and that these needs vary over time.

Can we identify common patterns of need? ...so that we can tailor health promotion interventions to meet these needs and improve QOL.
Ultra Low Power Transmitter and Receivers

- Health sensing requires communication with a gateway
- Communication is usually wireless due to simplicity.

ULP wireless radios for
- Wireless body area networks
- Low data-rate (~kB/s)
- Short-range (~10m)
- Area-constrained (~1cm²)
- Wirelessly-powered
Wirelessly-Powered Integrated Circuits

RF beacon provides wireless power

Sensor Data

energy source
ISM bands: 900M/2.4G/5.8G
Max power to antenna: 30dBm

UWB Pulse TX

Energy Harvest
Power Management Unit

Sensor Data

RF beacon provides wireless power

Sensor Data

image of circuit board

image of experimental setup

Oklahoma State University

Wirelessly-Powered Integrated Circuits Group
Arun Natarajan, School of EECS
Session II
Domain-Specific Languages

- Computing support
- Understanding of domain

Explanation-Oriented Programming
- Programs not only produce results
- But also explanations of how results were obtained
A family has two children. One child is a boy. What is the probability that the other child is a girl?
Diet-gene interaction and cancer risk in large cohort studies for precision public health

Yumie Takata, Nutrition and Cancer Epidemiologist at CPHHS

Pooled Analysis of almost 2 Million Adults Worldwide

SWHS: Shanghai Women’s Health Study
SMHS: Shanghai Men’s Health Study
JPHC: Japan Public Health Center-based Prospective Study

WHI: Women’s Health Initiative
VITAL: Vitamins and Lifestyle study
IWHS: Iowa Women’s Health Study
PLCO: Prostate Lung Colorectal and Ovarian Cancer Screening Trial
AARP: American Association of Retired Persons study
SCCS: Southern Community Cohort Study
NHS: Nurses’ Health Study
HPFS: Health Professional Follow-up Study

EPIC: European Prospective Investigation into Cancer and Nutrition
Diet-gene interaction for precision health: risk prediction using large cohort study data

My expertise
- Nutritional and molecular epidemiologist
- Cancer and chronic disease epidemiologist (lung, colorectal, prostate and breast cancers)
- Data scientist (data cleaning and management and statistical analysis)
- Advanced SAS programmer
The Robotics and Human Control System Lab
Research

Ravi Balasubramaniam
Assistant Professor
Robotics, MIME

Bio-inspiration

Human hand

Robotic devices

Robo-inspiration
Advancing Orthopedic Surgery

- Re-engineer the human body from inside
- Implantable passive mechanisms: gears, pulleys, links
- Customizable and superior force and movement transmission
- Biomechanics, biomedical device design/validation, cadaver testing, live animal testing

Restore hand function

Restore foot arch
Virtual Coach

Connected Health

- Social
- Health profile
- Medication
- Food prefer.
- Food taste
- Food safety
- Food cost
- Availability
- Time
- Lifestyle

Immediate feedback, results ready to share with healthcare provider and/or social network

Serious Games

Nutrition Games

- Develop augmented reality or virtual reality games that focus on healthy eating or healthy living
- Implement & measure impact

Automated Assessment

Robotic Researcher

- Administer surveys
- Interview
- Identify food objects
- Estimate quantity
- Check for accuracy
- Check for missing food
- Store and analyze data
- Give meaningful, immediate feedback and reward
- Multilingual
SIEW SUN'S EXPERTISE IN PRECISION HEALTH

**Education**
- Nutrition & food science content
- Game development (board games, card games, computer games – OpenSim & Unreal)
- Family & Consumer Sciences @ Home Economics skill building

**Research**
- Experimental design
- Dietary assessment:
  - **Quantitative:** survey development and validation, phone-app aided food logs.
  - **Qualitative:** focus groups & interviews with children and parents

**Outreach & Engagement**
- Outreach to low-income population
Fast Prediction of RNA Secondary Structures

Liang Huang (EECS)

- Experimental: NMR crystallography
  - Slow, expensive

- Computational: dynamic programming
  - Slow: $O(n^3)$, $n$ could be ~10,000 (e.g. HIV)
  - Takes ~4 hours for $n=10,000$

- Our Work: Linear-Time Prediction
  - Fast: $O(n)$ time; only 10 secs for $n=10,000$

natural language processing
machine learning
computational biology
Fast Prediction of RNA Secondary Structures

Future Work:
- fast protein folding
- RNA design
- protein design
Original assumptions of population level breast cancer screening have not been met by mammogram. Need for new screening tools.
Goal
Find cancer **before symptoms appear** with few false-negative or false-positive test results

Criteria
Assure that benefits outweigh harms
- Important health problem
- Detectable preclinical phase
- Offer treatment advantages
- Affordable
- Acceptable
- Accurate

- Current workgroup between OSU & OHSU
- Discussions for new screening modalities
- Road map for future work to improve screening efficacy
Prasad Tadepalli
Professor, COE

Focus of Expertise: Machine learning and decision support as applied to precision health
Personal Understanding of Life & Social Experiences (PULSE) Project

- Capturing daily experiences
- Understanding mechanisms of well-being (over 100 days)
- Adding sensors to link to biological level
- Using data visualization to engage people in health behaviors
### Data Mining or Machine Learning Approaches

- Extract new insights on optimal aging from existing datasets
- Large/longitudinal datasets that can be linked with other data sources (e.g., Medicare claims data)
- Outcomes of interest include mental health, ...
- Please contact me:

**Karen Hooker, Ph.D.**
Jo Anne Leonard Petersen Endowed Chair in Gerontology and Family Studies; Head of the School of Social and Behavioral Health Sciences
hookerk@oregonstate.edu
541-737-4336

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<thead>
<tr>
<th>Cohorts</th>
<th>Medicare Advantage Beneficiaries per cohort</th>
<th>Expanded race/ethnicity categories, physical and mental health variables</th>
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<td>14, 15, 16 (2011-2015)</td>
<td>~300,000</td>
<td>Health, financial, family, &amp; biomarker data</td>
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<th>Biennial data collection since 1992</th>
<th>~38,000 panel participants in 2014</th>
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<td>HRS Health and Retirement Study</td>
<td>Health, financial, family, &amp; biomarker data</td>
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<tr>
<th>HRS Health and Retirement Study</th>
<th>~4,600 participants in last wave</th>
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<td>3 waves beginning in 2005</td>
<td>Emphasis on social factors, includes biomeasures</td>
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Thank you - Please join us at the reception!