Smart Home Health Analytics
Spring 2020

Research Project
Reflections

Nirmalya Roy
Department of Information Systems
University of Maryland Baltimore County
Health Technology

- Interdisciplinary academic and professional field
  - Health
  - Technology

- Use technology to study aging

- Design technology to provide solutions to deal with the challenges of aging

- NIH workshop on Technologies for Improving the Independence of Older Adults and Individuals with Disabilities
NIH Research Grant Initiatives

- **Diet and Physical Activity Assessment Methodology (R21)**

- **Design and Development of Novel Technologies for Healthy Independent Living (R21)**

- **mHealth Tools for Individuals with Chronic Conditions to Promote Effective Patient-Provider Communication, Adherence to Treatment and Self-Management (R21)**

- **Collaborative Aging (in Place) Research Using Technology (CART) (U2C)***
  
NIH Research Grant Initiatives

- Mobile Health: Technology and Outcomes in Low and Middle Income Countries (R21)

- mHealth Tools for Individuals with Chronic Conditions to Promote Effective Patient-Provider Communication, Adherence to Treatment and Self-Management (R01)

- Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (HIT) (P50)
Relevant NIH Funded Research Centers

- National Institutes of Health Big Data to Knowledge (BD2K) Center of Excellence
  - Centers of Excellence for Big Data Computing

- Center of Excellence for Mobile Sensor Data-to-knowledge (MD2K)
  - Advancing biomedical discovery and improving health through mobile sensor Big Data
  - https://md2k.org/software/

- The National Center for Mobility Data Integration to Insight (The Mobilize Center)
  - Revolutionizing mobility research through innovative data science methods
NSF Supported Research Programs

- **Smart and Connected Health**

- **NSF Funded Research**
  - A scientific smartphone tool for personalized health
    - Researchers from Carnegie Mellon University and PARC use predictive analytics and artificial intelligence to develop tailored, health interventions for personalized wellness
  - FITTLE+: Theory and Models for Smartphone Ecological Momentary Intervention
    - CMU project
    - Xerox PARC project
NSF Supported Research Programs

- USC research project
  - SCH: INT: Collaborative Research: Monitoring and Modeling Family Eating Dynamics (M2 FED): Reducing Obesity Without Focusing on Diet and Activity

- MIT research project
  - SCH: EXP: Collaborative Research: TThink - Inferring Cognitive State From Subtle Behaviors
NSF Supported Research Programs

- UC Berkeley + OHSU research project
  - SHB: Large: Collaborative Research: Integrated and Inference Systems for Continuous Coordinated Care of Older Adults in the Home

- University of Colorado at Boulder
  - Health Sense: Motivating Health Awareness in Children through Wearable Computing
NSF Supported Research Programs

- Virginia Tech + North Carolina Agricultural & Technical State University research project
  - SCH: INT: Collaborative Research: BESI: Behavioral and Environmental Sensing and Intervention for Dementia Caregiver Empowerment
  - BESI Project
    - [http://wirelesshealth.virginia.edu/content/BESI](http://wirelesshealth.virginia.edu/content/BESI)
NSF Supported Research Programs

- Few recent one 2019
  - SCH: INT: Collaborative Research: Uniting Causal and Mental Models for Shared Decision-Making in Diabetes
  - SCH: INT: Collaborative Research: Smart Alarms 2.0: Foundations for Caregiver-in-the-loop Suppression of Non-Informative Alarms
  - Many more
Random Search

- UMass Center for mHealth and Social Media
  - http://www.umassmed.edu/mhealth/
CRA workshop

- NIH Aging In Place Workshop
  - Aging in Place Panel: Innovation Needed: Sensing, actuation and system integration technology
MIT News

- **Wearable AI system can detect a conversation's tone**
  - Coupled with audio and vital-sign data, deep-learning system could someday serve as a “social coach” for people with anxiety or Asperger’s

- **Detecting emotions with wireless signals**
  - Measuring your heartbeat and breath, CSAIL device can tell if you’re excited, happy, angry, or sad.
Machine Learning Techniques & Tools

- **MLPack**: a scalable machine learning library
  - [http://mlpack.org/](http://mlpack.org/)

- **Theano**: A Deep Learning Toolkit
  - [http://deeplearning.net/software/theano/tutorial/](http://deeplearning.net/software/theano/tutorial/)

- **TensorFlow**: An open-source software library for Machine Intelligence
  - [https://www.tensorflow.org/](https://www.tensorflow.org/)
  - How a Japanese cucumber farmer is using deep learning and TensorFlow!

- **TensorFlow Tutorials**
  - [https://www.tensorflow.org/tutorials/](https://www.tensorflow.org/tutorials/)
Machine Learning Techniques & Tools

- Café: Deep learning framework
  - [http://caffe.berkeleyvision.org/](http://caffe.berkeleyvision.org/)

- Lasagne is a lightweight library to build and train neural networks in Theano

- ImageNet
  - [http://image-net.org/](http://image-net.org/)

- ImageNet Large Scale Visual Recognition Challenge 2016 (ILSVRC2016)
Machine Learning Techniques & Tools

- Deep Learning Part 1: Comparison of Symbolic Deep Learning Frameworks -- by Microsoft Data Scientist

- Deep Learning Part 2: Transfer Learning and Fine-tuning Deep Convolutional Neural Networks -- by Microsoft Data Scientist
Machine Learning Techniques & Tools

- Google DeepMind
  - https://deepmind.com/

- Open-sourcing DeepMind Lab
  - https://deepmind.com/blog/open-sourcing-deepmind-lab/

- Deep Learning Research
  - http://deeplearning.net/
White House Press Release

- **Smart Cities Initiatives**

- One research project from UMBC has been mentioned!
  - NSF is bringing together academic researchers from an array of disciplines with community stakeholders to unlock transformational progress on important community challenges. Examples of this work include a flood-warning pilot project in several Maryland cities that integrates sensor data and social media posts in a novel way to potentially save lives by providing advance notice of flash floods, which kill more people in the United States each year than tornadoes, hurricanes, or lightning.

- Who is working on this project?
  - One of our past course students!!
Publication from this course

- HappyFeet: Recognizing and Assessing Dance on the Floor, ACM HotMobile, February 2018
Why do we want to do this exercise?

- Research of the people, by the people, for the people!!