IS 698/800: Smart Home Health Analytics
Spring 2020

Research Project Logistics

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Research Reflections

- Reading the state-of-the-art research in smart home health analytics area
  - Relevant topics may span across multiple research areas
    - Smart health sensing using sensors, smartphone, smart wristwatch, ambient, wearable sensors
    - Social media, data science, big data
    - HCI..............................

- I have created a Google sheet with multiple active ongoing research projects and ML tools and tutorials
  - Check the research projects (sponsored by NSF, NIH, US Army etc. and read through several of them before deciding yours)
  - Make us ALL aware in class what they have been doing
  - We will help you to think together what you could do next!
Research Reflections

- Check the schedule online at [Research Reflection Sign Up Sheet](#)
  - Posted at the course webpage
  - Research reflection will start from next week

- This is an informal discussion/brainstorming about the state-of-the-art research going on various topics in smart home health analytics area
  - Choose any research project, or NIH/NSF RFP (Request For Proposal) and talk about what they are doing or seeking
  - You can use notes, white board, power point slides whatever you want
  - 5% of your research project grade will be on reflection
Paper Presentation

- **Class presentation**
  - Choose a paper related to your tentative research project
  - You present one paper (20 minutes + 5 mins for Q&A)
    - Deadline for selecting a paper is March 10, 2020
  - Paper presentation and critique writing logistics will be posted soon

- Email me the title of the paper, authors list and the venue where it has been published
  - PhD students must select a paper from a conference
  - MS students can select either a workshop or conference paper
  - Do not worry about not knowing the topic
    - Read the paper and you will understand the main concepts eventually!
Selecting the Papers

- Select a paper from a top system, machine learning, data mining, data science or smart health conference (pervasive, ubiquitous, mobile or data computing)

- Few good conferences and workshops
  - IEEE KDD, ICDM, ICDE, ICML
  - ACM Ubicomp, MobiSys, CHI, PerCom
  - ACM SenSys, IPSN, IoTDI
  - Wireless Health, EMBC, Pervasive Health, WristSense, CHASE
  - International Symposium on Wearable Computers (ISWC)

- Many relevant papers will be posted at the course webpage [https://mpsc.umbc.edu/courses/is698shhasp20](https://mpsc.umbc.edu/courses/is698shhasp20)
Course Research Projects

Projects consist of 3 parts:

- Choosing an interesting topic
  - Identifying what new you can do

- Proposing your novel ideas or approaches
  - Designing or modeling the solution

- Performance evaluation
  - Data collection
  - Evaluation
Possible Research Project Ideas

- Mobile Phone and Wearable Sensor based Collaborative Activity Recognition Framework
- Collaborative Opportunistic Sensing
- CoughSense: Mobile Phone and Ambient Sensor based Cough Detection for Smart Health Applications
- StayFit: Group based Exercising using Sensor and Mobile Phones
- Control Diet: Keeping an eye on your diet
- StressSense: Measuring stress level using smart wristband
Research Project Ideas

- Am I old? Mobile phone based Virtual Age Recognition
- Am I fit? Physical fitness detection using smartphone and wristband
- Do you play regularly? Smart watch can monitor and encourage you to play
- Are you a chain smoker? Smart wristband based detection and intervention
- Tooth brushing detection using smart wristwatch
- Combing hair detection using smart band
- Pros and Cons of smartphone and smart watch activity data collection apps
Research Project Ideas

- Do you drink enough water to stay healthy?
  - Drinking water level detection using smart band

- Addiction to alcohol: Smart band to intervene

- E-Cigarettes
  - Battery Safety Concerns in Electronic Nicotine Delivery Systems (ENDS) Public Workshop - April 2017
    - [http://www.fda.gov/TobaccoProducts/NewsEvents/ucm535185.htm](http://www.fda.gov/TobaccoProducts/NewsEvents/ucm535185.htm)
New glucose-tracking smartwatch

- Dexcom G5 on Apple Watch [https://www.dexcom.com/g5-mobile-cgm](https://www.dexcom.com/g5-mobile-cgm)

- K'Track Glucose Watch Sensor(under medical certification) [https://www.pkvitality.com/ktrack-glucose/](https://www.pkvitality.com/ktrack-glucose/)

Activity Data Collection

- Smartphone and Smartwatch Data Collection Apps:
  - **iPhone Users:**
    - Activity Learning (AL)
    - PowerSense
  - **Android Users:**
    - Activity Learning (AL)
    - Sensor Kinetics
    - Androsensor
Wearable Sensors

- Samsung Gear: Smart Wristwatch

- Features:
  - Accelerometer, Gyroscope, Compass, Heart Rate monitor, Ambient Light sensor, UV sensor and Barometer.
  - Watch is able to connect directly to the internet, make phone calls and send SMS without needing a phone
  - Wearable device to include Wi-Fi, Bluetooth and 3G connectivity
Wearable Sensors

- Empatica
  - [https://www.empatica.com/](https://www.empatica.com/)
  - PPG Sensor (heart rate)
  - 3-axis Accelerometer
  - EDA Sensor (GSR Sensor)
  - Infrared Thermopile
Wearable Sensors

- Actigraph
  - [http://actigraphcorp.com/](http://actigraphcorp.com/)
  - Ultimate fitness and sleep tracker with extended battery life and water resistance
- Sensors
  - 3-Axis Accelerometer
  - Magnetometer
  - Gyroscope
  - Secondary accelerometer
Wearable Sensors

- Samsung Simband
  - Help drive the next era of Digital Health and Wellness
  - The Samsung Digital Health team is driving a new era in health and wellness by developing a platform to provide a deeper understanding of personal health and wellness.
    - "The Voice of the Body".
      - especially focused on exploring new technologies, algorithms and applications for lifestyle and health management towards our next generation
  - https://www.simband.io/
  - Apply for a Simband (previously)
Wearable Sensors

- **Microsoft band**
  - Live healthier and achieve more there is Microsoft band
    - Continuous optical heart rate monitor
    - Activity tracking
    - Email, text, and calendar notifications
    - Sleep quality tracking
    - Track calories burned
    - Control your music from your band
  - [https://www.microsoft.com/microsoft-band/en-us](https://www.microsoft.com/microsoft-band/en-us)
  - Companion App for collecting data from Microsoft band
Wearable Sensor

- Blood Glucose Monitoring
  - Pulse monitoring
  - Blood Pressure Monitor
  - Integration with Peripheral Sensors

Smartwatch

Motorola Moto 360
- android.sensor.accelerometer
- android.sensor.step_counter
- android.sensor.wrist_tilt_gesture
- android.sensor.gyroscope
- android.sensor.magnetic_field
- android.sensor.light
- android.sensor.rotation_vector
- android.sensor.orientation
- android.sensor.gravity
- android.sensor.linear_acceleration
- android.sensor.significant_motion
Smartwatch

- LG Watch Urbane 2nd Edition
- Samsung Gear S
- LG Watch W100
Ambient Sensors

- **iBeacon** [http://estimote.com/](http://estimote.com/)
  - tiny wireless sensors
  - attach to any location or object
  - broadcast tiny radio signals
  - smartphone can receive and interpret
  - location and context awareness applications

- **Texas Instrument Sensor Tags**
  - supports Bluetooth Smart, 6LoWPAN and ZigBee
  - low-power sensors such as light, microphone and magnetic sensors
More Devices

- DrinkMate: [http://www.getdrinkmate.com/](http://www.getdrinkmate.com/)
- Amazon Echo: [www.amazon.com/echo](http://www.amazon.com/echo)
- Nike Sensor
- Jawbone UP 3
- Myo Armband
  - Voice through Motion
More Devices
Smartphones

- Motorola Moto E 4G
- Huawei Union
- Alcatel One Touch
- Samsung Galaxy SII
- Samsung Galaxy S3
- Samsung Galaxy S3 mini
- Samsung Galaxy S
- Moto E
- Google Nexus smartphone
Research Proposal

- Research reflections and research paper presentations will help each of you to define your own research project.
- Get a research proposal idea or tentative abstract as part of this exercise.
  - Will work on the due date soon.
- Start collecting data with your smartphones or other devices ASAP.
  - Talk to me about the potential research ideas.
What is our goal from this course project?

- Publish your work

Possible venues

- CHASE’20 Conference and workshops
  - 5th IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE),
  - [https://conferences.computer.org/chase2020/index.html](https://conferences.computer.org/chase2020/index.html)

- Pervasive Health 2020 workshop
  - 12th EAI International Conference on Pervasive Computing Technologies for Healthcare

- SMARTCOMP 2020 conference workshop

Disclaimer: All the devices will be provided by the Mobile, Pervasive and Sensor Computing (MPSC) Lab in the Information Systems department at UMBC.