Where Communication Meets Healthcare

Wade Trappe
trappe@winlab.rutgers.edu
Why is a Wireless Center Talking About Healthcare?

- Communications is essential to health at many levels:
  - Individual patient data is needed for managed care
  - Realtime multimodal and multipatient data is needed for smart health
  - Lifestyle management will play an increasing role in addressing diseases
  - Many diseases are the result of breakdown in biological communication pathways

- Smart Health needs 5G:
  - The patient will be mobile!
    - Preventative and sustained, personalized care
    - It will take a village: there is knowledge in the village!
    - Deep learning will lead to better predictions and recommendations
  - The communication fabric will be the infrastructure across which data will be delivered to the cloud and deep analytics!

- The patient needs better data for analysis
  - There are new sensors being developed that will make new data available for analysis
  - Critical to partner the network with bio-sensors
The IoMT and Smarth Health is really about “DATA”

- Smart healthcare is about the DATA and closing the loop!!!
  Many communications challenges: latency, ubiquity and volume!

Needs…

And…
WINLAB is collaborating with industry to develop medical sensing, inference, and active monitoring technologies.

**Sensing Layer**
- Physical Sensors
  - Blood pressure: high
  - Insulin: bad
  - Hydration: low
  - Tcell Assay: CD8+, CD4+
  - Other: location, voice, etc...
- External Events
  - Weather
  - Schedule
- Social Feeds
  - Family events
- Wireless Link Signal
  - Signal: strength

**Inference Layer**
- Feature/Context Inferences
  - Passive Location/mobility Inference
    - Location: kitchen
    - Speed: 1 m/s
    - Activity: eating
  - Passive Socialization inference
    - Activity: talking to 3 people
    - Duration: 15 minutes
    - Last time left house: 2 hours ago
  - Passive Cognitive level inference
    - Location: leaving kitchen
    - Stove: on

- Behavioral/Correlation Inferences
  - Average walking speed? Any recent degradation?
  - Does indoor atmosphere impact her balance?
  - Any leading indicators before she falls?
  - How is hydration correlated with historical data?
  - Does blood analysis suggest increasing diabetic risk?

**Wellbeing Management**

- Assessment
  - Degradation alerts:
    - Walked slower by 30% yesterday!
    - Talked less by 80% last week!
    - Forgot to take her pills last 3 days!
  - Causal alerts:
    - Low air pressure + slow pace walk → high fall likelihood
    - Alone in Holiday → social withdrawal
    - Glucose levels → diabetic shock
  - Emergency alerts:
    - Still in shower after 1 hour!!!