




Human Activity Recognition XAI

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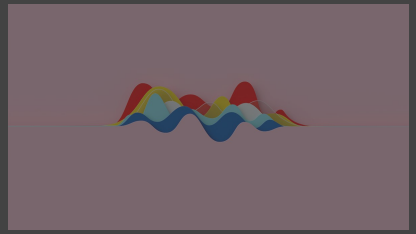
Prof. Dr. Müller-Birn and Dr. Sipos

Human Centered Data Science - S24



Credits : Andriy Onufriyenko

HAR and Dataset

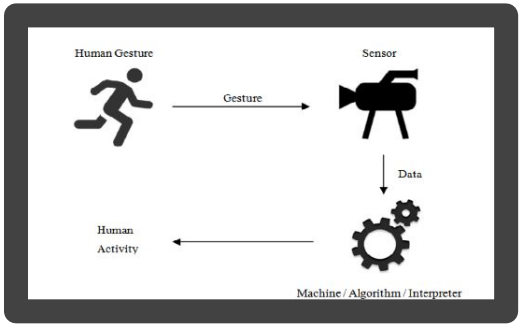
Explainer Interface and Goals

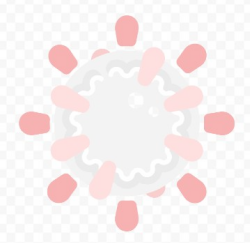
Design and Process

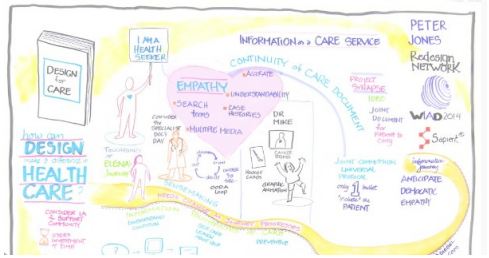
Demo and Discussion

Human activity recognition (HAR) and dataset

What is Human activity recognition (HAR) ?





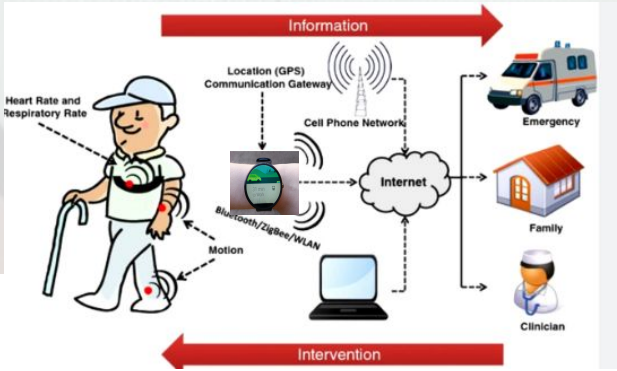


Why wearable data ?

- Emerging tool for measuring detailed physical activity - feasible and ease
- Store data for Behaviour in-the-wild (real-life)

→ Real-time feedback based on activity measurements

→ ML : more fine-tuned predictions for movement classification at population level



Challenge : Smaller, distributed, real-time, idiosyncratic with data-hungry pattern learning models

Open dataset based on research

Preprocessed dataset on Harvard dataverse : 3656 minutes of Apple Watch & 2608 minutes of Fitbit

- **Y : Target outcome six activity classes - lying(0), sitting(1), walking(2), three intensities of running(3,4,5)**
- **X : Minute-by-minute heart rate, steps, distance, and calories from - Apple Watch and Fitbit**

Participants :

- **26 women(0) and 20 men(1)**
- **recruited using social media post and word-of-mouth in Canada**
- **Inclusion criterion : 18 years and above, completing Physical Activity Readiness Questionnaire**
- **complete a 40-minutes of total treadmill time and 25-minutes of sitting or lying time**
- **provided signed informed consent and are not compensated monetarily**

*****Patients or public were not involved in the design, conduct, or reporting, or dissemination plans of research.**

Predicting lying, sitting, walking and running using Apple Watch and Fitbit data

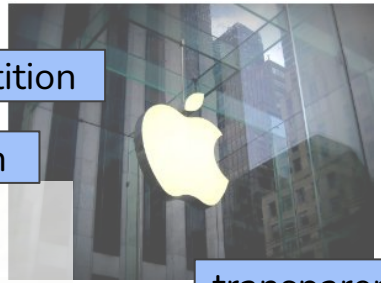
Daniel Fuller,[1,2] Javad Rahimipour Anaraki,[3] Bongai Simango,[1] Machel Rayner,[1] Faramarz Dorani,[2] Arastoo Bozorgi,[2] Hui Luan,[4] and Fabien A Basset[1]

Designing a HAR explanation interface and process

Who is the target user ?

What questions do they have ?

competition



health-driven

transparency

innovative

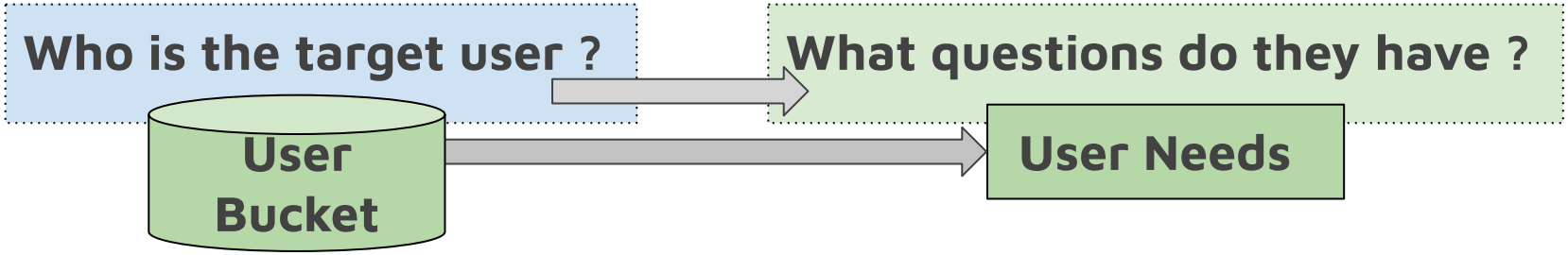
risk-driven

risk-aversive

mission-driven

analytical

curious



- Can ML techniques be deployed to predict activity class from wearable data ?
- What are the properties of chosen data ?
- What are the performance metrics ?
- Are the predictions fair, reproducible and scalable ?
- How do the outcomes vary for different models ?
- How do the outcomes vary across wearable brands ?
- How do the model perform with reduced features ?
- Which features are deemed useful for the model ?
- What if - features or data are perturbed impacts the resulting model output ?

Goal: HAR explanation interface will enable the User who has the following questions.

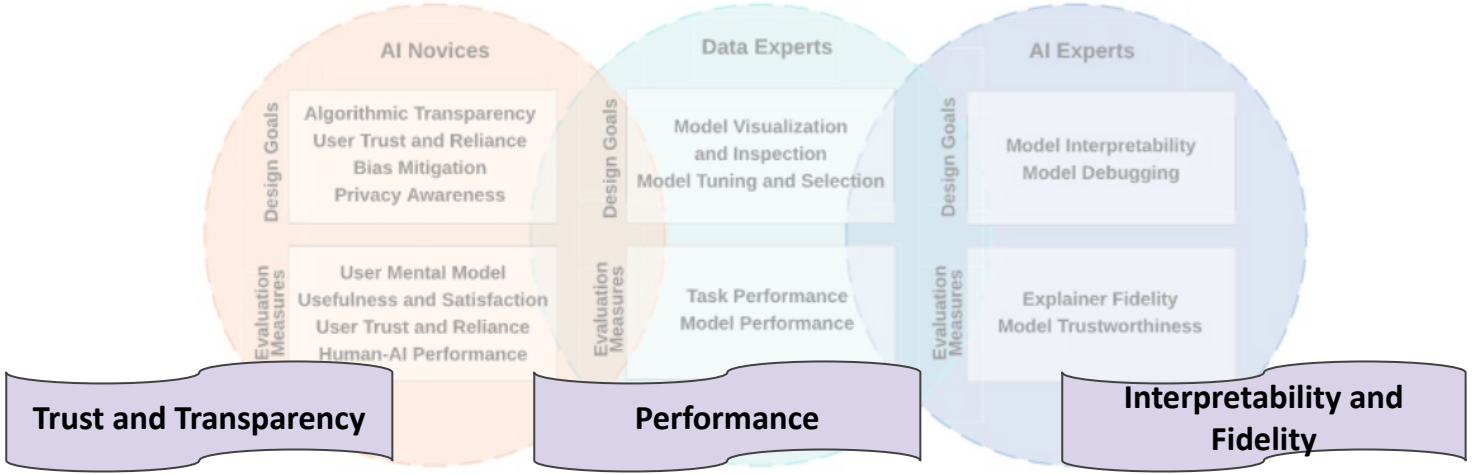
What HAR explanation interface can’t do ?

- Can’t help us ask questions..
  - which feature to dismiss…..
- What insights can be drawn from the obtained modeling results ?
- How to apply the results in a given Context ?

→ HAR Explanation Interface is an Enabler.

What are the design goals guiding the HAR XAI ?

1. Accurate information is available
2. Access to information be intuitive - from simple to complex
3. Have a good mix of structure with flexibility
   - help understand primaries, but also give ease to ask what-ifs



Design guidelines *in action*

1. Choose the ***right*** amount of content - description or model choice or visualization..
   - ➢ BMI plot or demo-dataset moved to Introduction section

1. Break the content into smaller digestible chunks
   - ➢ Sections, subsections, tabs and page breaks

1. Aids for ease of navigation
   - ➢ naming conventions, icons, font style and color…
   - ➢ drive the navigation decision. e.g., explanation tab has two icons

Information is not only available but also easily and consistently accessible

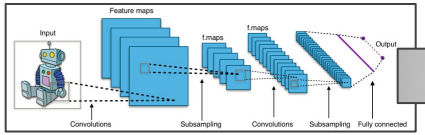
Design guidelines *in action*

4. Flow of content hierarchy
   - — moves from basic & primary to more detailed & complex
   - ➢ Statics : summary statistics, heatmaps …
   - ➢ User-driven : filtering and interactive options …
   - ➢ Sidebar : information available to user all the time

5. Cognitive load and human fatigue as a function of information display
   - ➢ Choice of tabs in Introduction: Interface → Data → HAR (left → right)

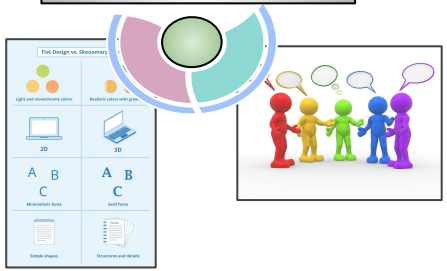
User depends and trusts the interface, and then may interact actively for a more independent view

Process and challenges with design



Thinking style

Integrate



Layer-by-Layer

Balance

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Demonstration and please share your feedback … Thank you!