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Amit P. Sheth
Wright State University - Main Campus, amit.sheth@wright.edu

Hong Y. Yip
Wright State University - Main Campus

Utkarshani Jaimini
Wright State University - Main Campus

Dipesh Kadariya
Wright State University - Main Campus

Vaikunth Sridharan
Wright State University - Main Campus

See next page for additional authors
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Augmented Personalized Health: Using Semantically Integrated Multimodal Data for Patient Empowered Health Management Strategies

Amit Sheeh1, Hong Yung Yip1, Utkarshani Jaimini1, Dipesh Kadariya1, Vaikunth Sridharan1, Revathy Venkataramanan1, Tanvi Banerjee2, Krishnaprasad Thirunarayam1, Maninder Kalra2

1Ohio Center of Excellence in Knowledge-enabled Computing (Knoesis), Wright State University, Dayton, OH, USA
2Dayton Children’s Hospital, Dayton, OH

{amit, joey, utkarshani, dipesh, vaikunth, revathy, tanvi, tkprasad}@knoesis.org
KalraM@childrensdayton.org

Augmented Personalized Health (APH) is a vision to enhance the healthcare by using Artificial Intelligence (AI) techniques on semantically integrated Patient Generated Health Data (PGHD), environmental data, clinical data, public health data and social data. The ability to create and capture data is already here, the upcoming innovations will be in converting this BIG data into SMART data through contextual and personalized processing such that patients and clinicians can make better decisions and take timely actions for Augmented Personalized Health.

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**RATIONALIE**

**Healthcare** as we know it is in the process of going through a massive change from:

- **Episodic to continuous**
- **Disease-focused to wellness and quality of life focused**
- **Clinic-centric to anywhere a patient is**
- **Clinician controlled to patient empowered**
- **Being driven by limited data to 360-degree, multimodal personal-public-population specific health knowledge**

While the ability to create and capture data is already here, the upcoming innovations will be in converting this BIG data into SMART data through contextual and personalized processing such that patients and clinicians can make better decisions and take timely actions for Augmented Personalized Health.

**Data Components**

- PGHD: Clinical Data, Environmental Data, Social Data

**Smart Data**

Meaningful data obtained after contextualized processing

**Insights**

- Analysis of the data to find out what the data tells about the patient
- Provide timely actionable information specific to patient disease

**Actionable Information**

Turning Big Data into Insights into Actionable Information

**Augmented Personalized Health**

**Contextualization** refers to data interpretation in terms of knowledge (context).

**Personlization** refers to future course of action by taking into account the contextual factors such as user’s health history, physical characteristics, environmental factors, activity, and lifestyle.

**Abstraction** Computational technique that maps and associates raw data to action-related information.

**CHATBOTS FOR HEALTHCARE**

Putting it all together: Example chatbot conversation which utilizes background health knowledge graph and patient’s knowledge graph to infer and generate recommendation to patients.

3 Strategies of Augmented Personalized Health for Better Disease Management and Patient’s Well-Being

1. **Self Monitoring**
   - Contextual and patient centered point of care, given patient

2. **Self Ayurveda**
   - Feedback and recommendations based on patient’s current state (per Ayurveda)

3. **Self Management**
   - Provide timely actionable information specific to patient disease

**Domain Knowledge**

- Clinical data
- Social data

**Contextualized data**

- Additional data (e.g., label)
- Additional data (e.g., number)

**Interpretation of the condition**

- Understanding the patient's health knowledge graph and patient's knowledge graph to infer and generate recommendation to patients.

**Putting it all together: Example chatbot conversation which utilizes background health knowledge graph and patient’s knowledge graph to infer and generate recommendation to patients.**

**Current APH Applications**

- [a] Evaluation Outcomes: Pediatric Asthma, Bariatric Surgery, [Dementia - Caregivers] [b] Preliminary: ADHF, Liver Cirrhosis

**5 Strategies of Augmented Personalized Health**

1. **Self Monitoring**
   - Contextual and patient centered point of care, given patient

2. **Self Ayurveda**
   - Feedback and recommendations based on patient’s current state (per Ayurveda)

3. **Self Management**
   - Provide timely actionable information specific to patient disease

4. **Disease Progression and Tracking**
   - Longitudinal data collection and analysis to capture patient’s health over the time

5. **Current APH Applications**
   - (a) Evaluation Outcomes: Pediatric Asthma, Bariatric Surgery, [Dementia - Caregivers] (b) Preliminary: ADHF, Liver Cirrhosis

**Example chatbot conversation**

- "How was my weight trend since the last year?"
- "Based on weight regain, the system recommends you to follow more strict diet?"
- "What is my weight trend?"
- "Show me the data that is relevant to my weight.

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- [a] Evaluation Outcomes: Pediatric Asthma, Bariatric Surgery, [Dementia - Caregivers] [b] Preliminary: ADHF, Liver Cirrhosis

**Example chatbot conversation**

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