Multimodal Medical Data Capture and Representation

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MSR
Problem

- The difficulty of capturing structured clinical information from unstructured data poses an obstacle to widespread adoption of electronic medical record (EMR) systems

- Automatic speech recognition (ASR) and handwriting recognition (HR) have been applied to EMR systems with limited success due to:
  - Lack of required accuracy
  - Poor integration with EMR systems and hospitals’ workflow
  - Problems converting doctors’ natural speech or handwritten notes to a standard format
Background

Everybody wants EMRs. Hospitals are using/building their own EMR systems. Standards committees (HITSP, CCHIT) are busy creating standards. DoD and the VA already have nation’s largest EMR systems.

At the current rate and using today’s methods, the federal government will only reach 50% of its proclaimed EMR goal by year 2014.

**Problem:** Added time and change to workflow imposed by current systems hinder EMR creation by medical professionals.

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Objective

Create a **Multimodal Medical Data Capture** Method and **Exploit** Rich Medical/Linguistic Resources and Standards to **Represent** the Captured Information for Enterprise Interoperability
Activities

- Evaluating ASR and HR technologies to identify areas for enhancement and adaptation to medical applications
- Evaluating open source EMR systems, including OpenEMR, used in a number of hospitals
- Interviewing doctors and visiting hospitals to understand the workflow and EMR requirements
- Establishing baseline performance using existing technology
- Building training corpora for ASR/HR
- Designing a multimodal research prototype
Highlight: The Prototype Architecture

Firefox Browser

VoiceXML & Voice Grammar

HTTP/XML

MySQL Server / OpenEMR DB

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Electronic Medical Records

Handwriting Recognition

Speech Recognition

Web Services:

- Medical Procedures Index
- Allergy/Prescription validation
- Medical Term Disambiguation

31 yr old complaining of headache lasting a wk.

_checked vital signs - normal

Blood test

follow up in 2 wks.

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Demonstration

Thirty-one year old complains of a headache lasting one week.
Impacts

- Multimodal technology and methodologies for medical data capture and representation can revolutionize the creation of EMRs

- Going beyond verbatim conversion to encode conceptual underpinnings is critical for interoperability among healthcare and research institutes

- We have shared our evaluation methodology and some results of ASR/HR with non-profit health organizations and have been invited to consult on their design and evaluation of EMR systems
Future Plans

1. Voice Command “Prescription”

2. HWR Digital Pen
   Benadryl? Isordil?

3. Prompt for Voice
   Automatic Speech Recognition

4. Natural Language Processing

5. Mutual Disambiguation: HWR, Voice, NLP

   Medical Domain Knowledge
   Isordil: chest pain
   Benadryl: allergies

6. Isordil
   Benadryl

   Electronic Medical Record

   No History of Allergies
   Chest Pain