



## Data Mining Medical Documentation

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## NIST/ATP Grant Technology

- Original intent
- NIST/ATP grant model evolution
- Data mining intent
- Challenges
- Process
- Current Status

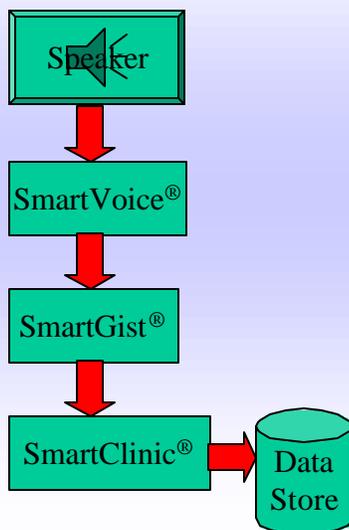


## Original Purpose

- Populate SmartClinic® with spoken data as a means to get data into an electronic medical record.



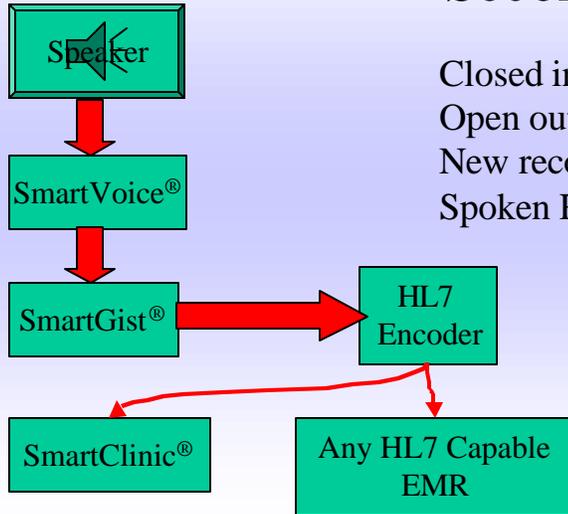
## NIST/ATP Grant Original Model



Closed system  
New records only  
Spoken records only



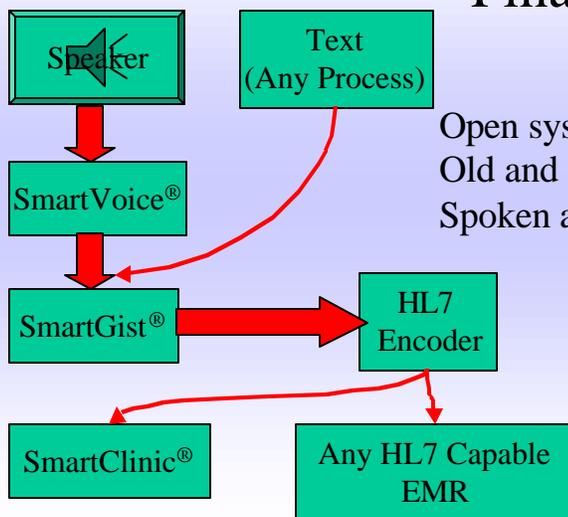
## NIST/ATP Grant Second Model



Closed input system  
Open output system  
New records only  
Spoken Records only



## NIST/ATP Grant Final Model



Open system  
Old and new records  
Spoken and non-spoken



## Data Mining Intent

- SmartGist is key technology
  - Text becomes data
  - Most medical information is text
  - Enables EMR without direct physician use



## Data Mining Intent

- Populate Electronic Medical Records with textual medical documentation from any source with any content organization



## Data Mining Intent

- Results reporting
- Drug utilization
- Drug recalls
- Longitudinal history
- Medical research
- Medical decision making



## Data Mining Challenges

- Variety of text formats
  - MS-Word
  - Corel WordPerfect
  - Straight Text
- Requires normalizer



## Data Mining Challenges

- Records not electronic
  - Paper
    - Requires Scan/OCR
  - Images
    - Requires OCR



## Data Mining Challenges

- Records not usable
  - Cursive
  - Pure image

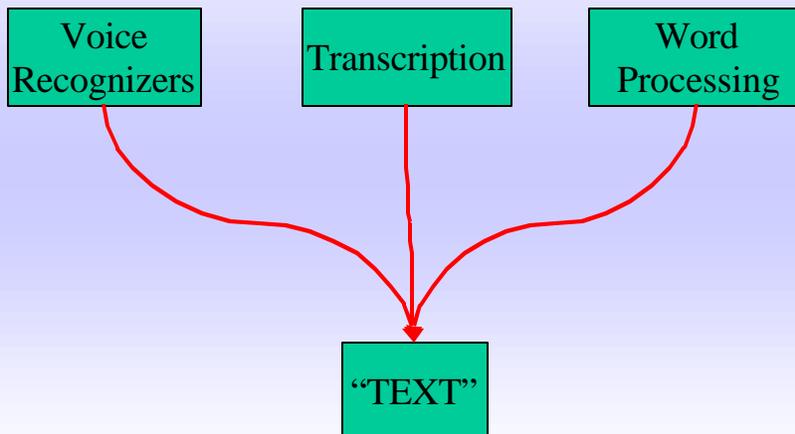


## Data Mining Challenges

- Same Concept expressed many ways
  - Problem List ...
  - History of ...
  - Assessment...
  - Diagnosis ...
- Requires Natural Language Processing
  - Grammar
  - Inference



## Data Mining Process



- Doctorname, M.D.  
211 South 9th Street  
Suite 300  
**RE: lastname**

Dear Dr. Doctorname

Lastname was seen by me on July 1, 1998 with the chief complaint of vertigo. H.P.I. severe in nature, positional also in type, of three weeks duration. There has been no hearing loss and no other neurological deficits. Over the past several days, he felt that the dizziness is getting gradually better. He also denies any epistaxis. Physical Examination of the nasal passages was clear with no epistaxis. The ears were clear .

My impression was benign positional vertigo with nystagmus and I have advised him this is a benign condition which should gradually recover. I have told the patient that if the symptoms persist beyond six weeks, I would like to see him here and go ahead with further testing. The patient had a CT scan of his skull about three months earlier which was within normal range.

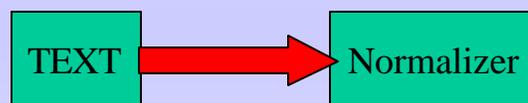
Thank you again for this referral. Kindest regards.

Sincerely yours,

Doctorname, M.D.



## Data Mining Process

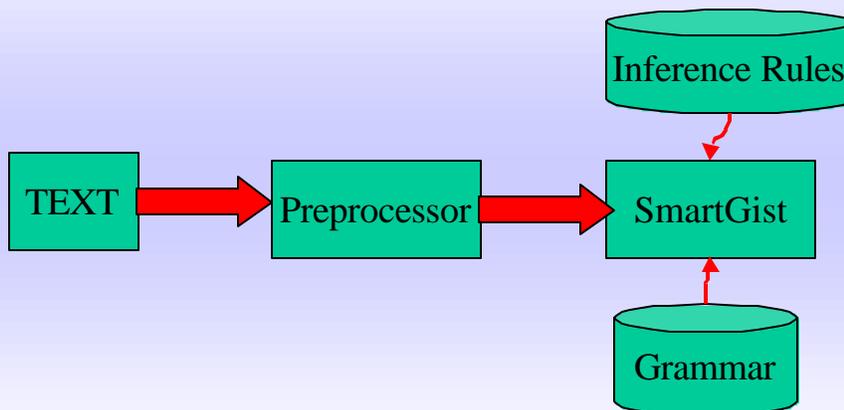




- Lastname was seen by me on July one nineteen ninety eight with the chief complaint of vertigo H.P.I. severe in nature positional also in type of three weeks duration There has been no hearing loss and no other neurological deficits Over the past several days he felt that the dizziness is getting gradually better He also denies any epistaxis Physical Examination of the nasal passages was clear with no epistaxis The ears were clear My impression was benign positional vertigo with nystagmus and I have advised him this is a benign condition which should gradually recover I have told the patient that if the symptoms persist beyond six weeks I would like to see him here and go ahead with further testing The patient had a C.T. scan of his skull about three months earlier which was within normal range



## Data Mining Process

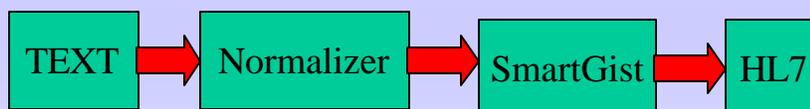




- Chief Complaint:LASTNAME WAS SEEN BY ME ON JULY 1st 1998 WITH THE CHIEF COMPLAINT OF VERTIGO;
- Present Illness:SEVERE IN NATURE POSITIONAL ALSO IN TYPE OF 3 WEEKS DURATION THERE HAS BEEN NO HEARING LOSS AND NO OTHER NEUROLOGICAL DEFICITS OVER THE PAST SEVERAL DAYS HE FELT THAT THE DIZZINESS IS GETTING GRADUALLY BETTER HE ALSO DENIES ANY EPISTAXIS;
- Ears Px:EARS WERE CLEAR;
- Nose Px:NASAL PASSAGES WAS CLEAR WITH NO EPISTAXIS;
- Problem:BENIGN POSITIONAL VERTIGO WITH NYSTAGMUS;
- Plan: AND I HAVE ADVISED HIM THIS IS A BENIGN CONDITION WHICH SHOULD GRADUALLY RECOVER I HAVE TOLD THE PATIENT THAT IF THE SYMPTOMS PERSIST BEYOND 6 WEEKS I WOULD LIKE TO SEE HIM HERE AND GO AHEAD WITH FURTHER TESTING THE PATIENT HAD A CT SCAN OF HIS SKULL ABOUT 3 MONTHS EARLIER WHICH WAS WITHIN NORMAL RANGE ;



## Data Mining Process





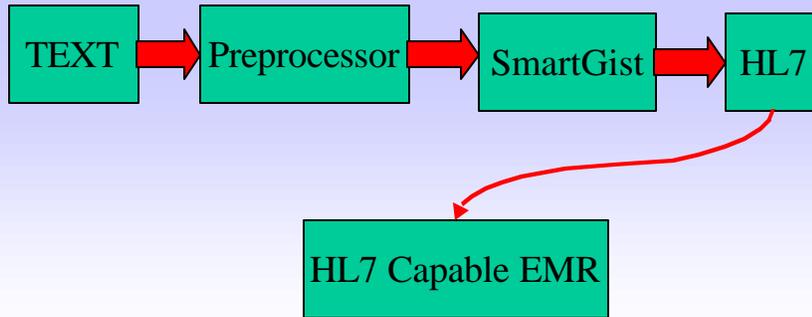
- MSH|^~\&||||19990112175826||ADT^A08|10026820|P|2.3  
EVN||19990112175826|  
PID||Ri 354||Firstname^Lastname^^L||O|||||O|  
PV1||O|  
OBX||ST|2000.40^Chief Complaint^AS4||LASTNAME WAS SEEN BY ME ON  
JULY 1ST 1998 WITH THE CHIEF COMPLAINT OF VERTIGO|||||F  
OBX||ST|2000.02^Present Illness^AS4||SEVERE IN NATURE POSITIONAL  
ALSO IN TYPE OF 3 WEEKS DURATION THERE HAS BEEN NO HEARING  
LOSS AND NO OTHER NEUROLOGICAL DEFICITS OVER THE PAST  
SEVERAL DAYS HE FELT THAT THE DIZZINESS IS GETTING  
GRADUALLY BETTER HE ALSO DENIES ANY EPISTAXIS|||||F  
OBX||ST|3000.06^Ears Px^AS4||EARS WERE CLEAR|||||F  
OBX||ST|3000.07^Nose Px^AS4||NASAL PASSAGES WAS CLEAR WITH NO  
EPISTAXIS|||||F



- MSH|^~\&||||19990112175826||PPR^PC2|10026820|P|2.3  
PID||Ri 354||Firstname^Lastname^^L||O|||||O|  
PRB|UP|19990112175826|^BENIGN POSITIONAL VERTIGO WITH  
NYSTAGMUS|Ri 354199901121758261^SmartClinic^8664^Random|||||^ AND I  
HAVE ADVISED HIM THIS IS A BENIGN CONDITION WHICH SHOULD  
GRADUALLY RECOVER I HAVE TOLD THE PATIENT THAT IF THE  
SYMPTOMS PERSIST BEYOND 6 WEEKS I WOULD LIKE TO SEE HIM  
HERE AND GO AHEAD WITH FURTHER TESTING THE PATIENT HAD A  
CT SCAN OF HIS SKULL ABOUT 3 MONTHS EARLIER WHICH WAS  
WITHIN NORMAL RANGE|||||



# Data Mining Process



Window | Reports | New Pat | Patient Change | E-mail/Reminders | Addendum | E/M SmartClinic

Commit | Note | ROS | PFSH | Medications | Write Rx | PT\_rx | All Probs | Problem Hx | Labs/Tests | Voice

Patient List - Enter Last Name  
LastName, First Name | Dob: | **Medications Alerts** | MAIN MENU | LaserCard Save

General Status  
CC: Lastname was seen by me on July 1st 1998 with a chief complaint of severe in nature positional also in type of three weeks duration there has been no hearing loss and no other neurological deficits over the past several days he felt that

HPI

BP: | I: | Wgt: | 10/08/1999  
P: | R: | Hgt: | NL | UC | Abn

HEENT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nodes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heart	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lungs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MuSkl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neuro	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Breast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pelvic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rectal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

EKG | Echo | CXR | Set to Defaults

Prob/Hosp/PMH | Resolved | Started | ICD-9  
Benign positional vertigo with nystagmus | 10/08/1999 | 0.0

Select Medication | Change Start | 10/08/1999

Add | D/C | Start | P

**HEENT** Medications Tests  
NL UC Abn  
Head     
Eyes     
ears were clear  
Ears     
nasal passages were clear with no epistaxis  
Nose     
Throat

Problem Assessment = Benign positional vertigo with nystagmus | AutoCorrect - On

PLAN and I have advised him this is a benign condition which should gradually recover I have told the patient that if the symptoms persist beyond 6 weeks I would like to see him here and go ahead with further testing the patient had a CT scan of his skull about 3 months earlier which was within normal range

10/08/199 9:43:33

**Warning: Screening Alerts Are OFF!**



## Data Mining Current Status

- Launched January, 1999
- \_\_\_\_\_ Inference rules
- \_\_\_\_\_ Grammar rules
- Successfully mines data from
  - Major Universities
  - Transcription companies
  - Hospitals
  - Large clinics



## Data Mining Current Status

- See our web pages
  - [www.berdymedical.com](http://www.berdymedical.com)
  - [www.mdrends.com](http://www.mdrends.com)