NLP research trend in the last five years and VA NLP research accomplishments

Wendy Chapman
Is surgery or medication better for stroke on patients with carotid stenosis?

2008 – unable to do the research
How do I find reports describing carotid studies?

MRI, CT, Ultrasound, Angiograms of the NECK
• Not all describe carotid study
How do I determine if a patient had significant stenosis in right internal carotid artery?

**FINDINGS:** There was extensive **plaque** seen in the proximal right internal carotid artery. Only very mild atherosclerotic **plaque** was seen in the proximal left ICA. No **stenosis** in the left external carotid.

**IMPRESSION:**
1). Very severe **diameter reduction** 80-99% right proximal ICA.
2). Less than 20% **stenosis** in the left ICA.
How do I determine if a patient had significant stenosis in right internal carotid artery?

FINDINGS: There was extensive plaque seen in the proximal right internal carotid artery. Only very mild atherosclerotic plaque was seen in the proximal left ICA. No stenosis in the left external carotid.

IMPRESSION:
1). Very severe diameter reduction 80-99% right proximal ICA.
2). Less than 20% stenosis in the left ICA.
How do I determine if a patient had significant stenosis in right internal carotid artery?

FINDINGS: There was extensive plaque seen in the proximal right internal carotid artery. Only very mild atherosclerotic plaque was seen in the proximal left ICA. No stenosis in the left external carotid.

IMPRESSION:
1). Very severe diameter reduction 80-99% right proximal ICA.
2). Less than 20% stenosis in the left ICA.
How do I determine if a patient had significant stenosis in right internal carotid artery?

FINDINGS: There was extensive plaque seen in the proximal right internal carotid artery. Only very mild atherosclerotic plaque was seen in the proximal left ICA. No stenosis in the left external carotid.

IMPRESSION:
1). Very severe diameter reduction 80-99% right proximal ICA.
2). Less than 20% stenosis in the left ICA.
I need someone with NLP expertise!

• Where do I look?
• How long will it take until they can get access to VA data?
• Do they understand the peculiarities of VA reports?
• How will they create train and test data?
• Can we install their NLP tool in the VA firewall?
NLP with the VA

2008
• Where do I look?
• How long will it take until they can get access to VA data?
• Do they understand the peculiarities of VA reports?
• How will they create train and test data?
• Can we install their NLP tool in the VA firewall?

Now
• NLP expertise/partners
• Annotation processes
• NLP tools
Is surgery or medication better for stroke on patients with carotid stenosis?

2015 – leveraging NLP to make it possible
State of NLP in the VA

1. NLP has shown tremendous impact within the VA

2. NLP research within the VA contributes to the science of clinical NLP

3. Synergy within and outside of VA NLP community
Impact

NLP Expertise

Supporting Research

NLP Development & Application

New Variables in CDW
NLP Expertise in the VA

Developed and recruited

Cindy Brandt
26-44% of VA publications use NLP
Supporting Health Services Research

VA Grants

Cognitive Support Informatics for Nurse Medication Stewardship
Charlene Weir
Salt Lake City

Automated Surveillance for Patients with Cirrhosis
Samuel Ho
San Diego

Cognitive Support Informatics for Antimicrobial Stewardship
Michael Matheny
Nashville

Peter Glassman
Los Angeles
Supporting Health Services Research

NIH grants

**NHLBI**
An Evaluation of Novel Domains for Predicting 30-day Admission

*Salomeh Keyhani*
*UCSF*

**NIAMS**
Determinants of Achieving Target Serum Urate in Gout & Safety of Gout Treatments

*Jasvindar Singh*
*U of Alabama*

**NIGMS**
Clinical Personalized Pragmatic Predictions of Outcomes

*Leslie Lenert*
*MUSC*
NLP Development & Application

- **Vocabulary/Ontology Building**
  - Knowledge Author, IE-Viz, Nora

- **Annotation**
  - eHOST, VTT, Knowtator, UIMA, Chart Review

- **Chart Review workflows**
  - Annotation Admin, RapTat

- **Information Retrieval**
  - Voogo

- **Information Extraction**
  - Leo, Moonshine, V3NLP, Sophia, cTAKES, metaMap, YTEX, HiTEX, RapTAT, pyConText

- **Machine Learning**
  - Weka, R, Mallet, Super Learner, ARC, Leo, QOTE, REDex

- **Evaluation**
  - v3NLP, Evaluation Workbench, eHOST
### New Variables in CDW

#### Pilot

- Age
- Dx

#### Evaluate

- Labs

#### Improve

- Ejection Fraction

#### Enterprise

- Smoking
- Race

<table>
<thead>
<tr>
<th>Age</th>
<th>Dx</th>
<th>Labs</th>
<th>Ejection Fraction</th>
<th>Smoking</th>
<th>Race</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
New Variables in CDW

Pilot
- Sexual trauma
- Pneumonia
- Homeless
- Pain scale
- Delirium

Evaluate
- Functional status
- Carotid stenosis
- Living alone
- Symptoms
- Substance abuse
- Gender
- Social support
- CAUTI
- Adenoma
- MRSA
State of NLP in the VA

1. NLP has shown tremendous impact within the VA

2. NLP research within the VA contributes to the science of clinical NLP

3. Synergy within and outside of VA NLP community
Scientific Contribution:
NLP Publications from VA Investigators
Number of VA publications with NLP has increased

Number of VA NLP Publications

- 2007: 1
- 2008: 4
- 2009: 9
- 2010: 37
- 2011: 35
- 2012: 48
- 2013: 40
- 2014: 0
- 2015: 5
Scientific Contributions

- Algorithms
- Knowledge Representation
- Resources
- Informatics & Health Services Research
Algorithms

- Active learning
- De-identification
- Modifier detection
- Named entity detection
- Symptom identification
- Synonym identification
- Figure detection

- Template identification
- Uncertainty detection
- Translation to consumer language
- Temporal expression identification
- Scale up and scale out
Knowledge Representation

Common Model

- Map output of NLP modules to each other
- Enable interoperability
“Patient denies a family history of colon cancer”

Disease: colon cancer
Experiencer: family
Negation: no
Historical: yes

**Schema & Modifier Ontologies**

- Represent entities and modifiers
- Provide baseline lexicon
- Support knowledge sharing
Informatics & Health Services Research

- Surveillance of Acute Kidney Injury following Cardiac Catheterization
- Automated Surveillance for Patients with Cirrhosis
- Actionable Knowledge to Guide Antimicrobial Stewardship
- Evaluation of Multistage Antimicrobial Treatment Strategies in Pneumonia
- Preventing MRSA Infections: a virtual comparative effectiveness model
- Comparative effectiveness for stroke treatment
1. NLP has shown tremendous impact within the VA

2. NLP research within the VA contributes to the science of clinical NLP

3. Synergy within and outside of VA NLP community
Synergistic Relationship

Clinical NLP Community

VA NLP Community
VA NLP Community

- Schema & annotations
- I2b2 challenge
- Common model
- Integrate modules
- Shared meetings
- Collaboration
- NLP ecosystem
- Support develop
Is surgery or medication better for stroke on patients with carotid stenosis?

2015 – leveraging NLP to make it possible
NLP Within the VA

Health Services Researchers

• Can ask questions they couldn’t ask before
NLP Within the VA

- Can ask questions they couldn’t ask before
- Can provide more comprehensive and intuitive cognitive support
NLP Within the VA

- Can ask questions they couldn’t ask before
- Can provide more comprehensive and intuitive cognitive support
- Can better participate in shared decision making
Steps on a path to cognitive computing

What is your long-term vision?
What We Are Missing

- Question answering
- Text summarization
- Visualization of data
- Speech recognition and synthesis

Recruit & Partner

Collaborative Funding

Infrastructure
Thank you!