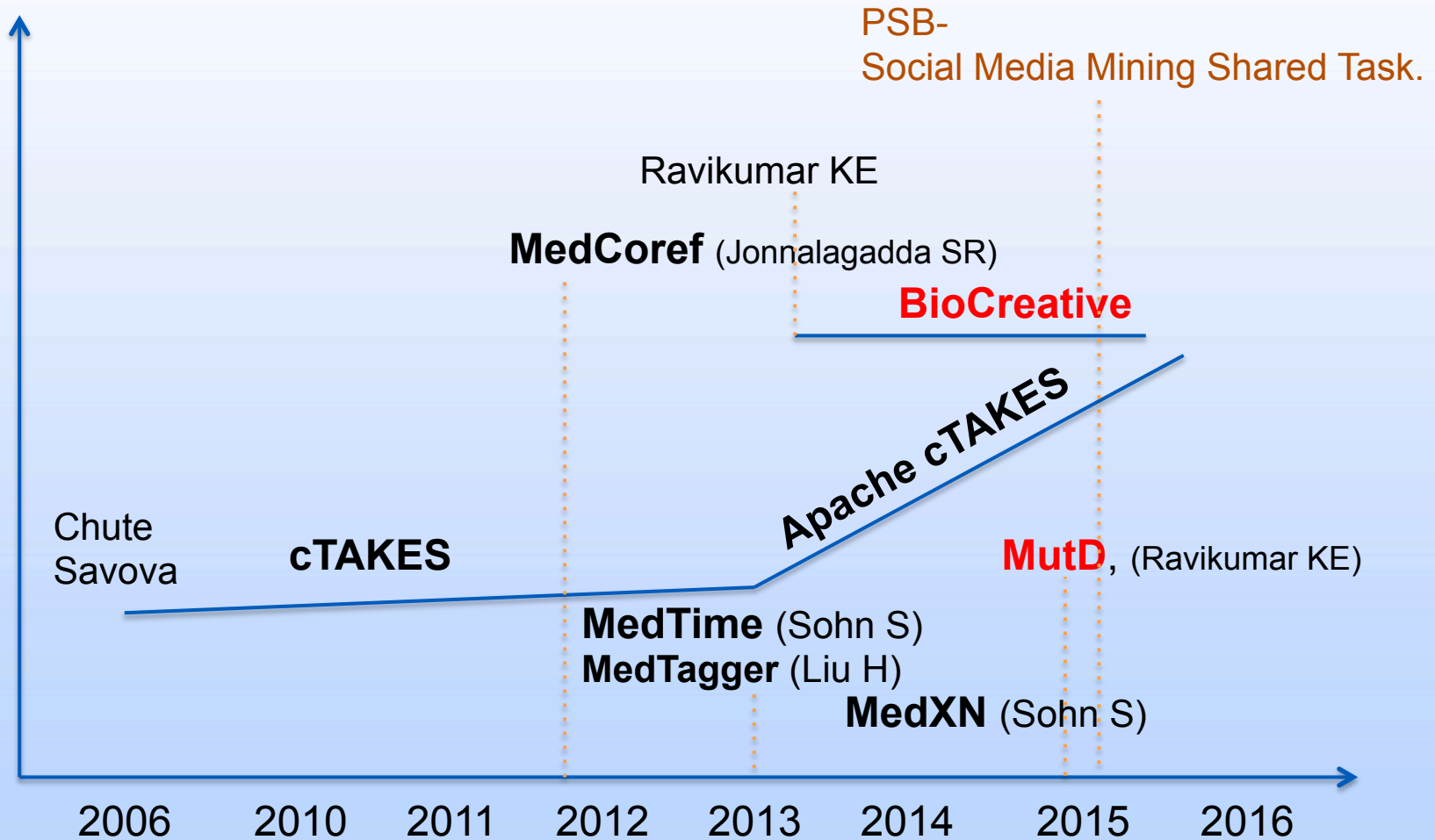




Sentiment Analysis in Healthcare

Saeed Mehrabi, PhD

Mayo NLP



Social media and medicine – What it is about?

- Medical Condition
 - Diseases, Signs and Symptoms
Seriously. My **back** hurts so bad I just want to cry.
#icanhandleeverythingggggg
- Treatment
 - Procedures - Complications
So damn painful. I just had a **spine surgery** Tuesday.
 - Medication – Side effects
I took **trazodone** last night and it really helped- but it was difficult to **wake up**

Social media mining in medicine – How is it different?

- Judgment of medical conditions:
 - Blood pressure decreased!
 - Positive HIV
- Considering Sentiments over time
 - New episode vs. ongoing back pain

Social media mining in medicine – Where is it now?

- Patient-reported outcome measure
 - Survey vs. Social media
- Monitoring the side effects of medication
 - Academia
 - PSB - Social Media Mining Shared Task
 - Commercial
 - Treato and iodine

Treato

Crestor is a cholesterol lowering medication ([statin](#)).

Satisfaction Score [?]

2.7  Slightly Satisfied

Helpfulness for High Cholesterol  3.6

Concern level  2.5

16,816 Discussions

APPROVAL DATE

August 12, 2003

SIDE EFFECTS AND CONCERNS

Cre

Muscle Pain



Tiredness



Lipitor is a cholesterol lowering medication ([statin](#)).

Satisfaction Score [?]

2.3  Slightly Satisfied

Helpfulness for High Cholesterol  3.1

Concern level  2.8

55,826 Discussions

December 17, 1996

Lip

Muscle Pain



Tiredness



Treato

Crestor. ...The **Crestor** also gave me leg cramps at night so I decided on my own to take it every 4 days..."

 Comment  Helpful?

Save

I previously tried very low doses of Lipitor and Crestor ...

August 25, 2009 | peoplespharmacy.com

"I previously tried very low doses of **Lipitor** and **Crestor** (5mg) with great results but I experienced some mild muscle soreness. I do want to try the statins again as my LDL is 128 even with my..."

 Comment  Helpful?

Save

I had terrible muscle pain with Crestor and was switched ...

June 12, 2010 | netdoctor.co.uk

"I had terrible muscle pain with **Crestor** and was switched to **Lipitor**, The reason I am up at 3:00 am is the terrible muscle pain. Just doing a little browsing myself and apparently and found this..."

 Comment  Helpful?

Save

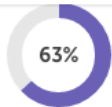
After several years of Lipitor I was switched to Crestor.

| dailystrength.org

Iodine

MDINE Helping people find what works

Medications Compare Drugs Depression Test



of people
say **Atorvastatin** is worth it



say it works well



say it's a big hassle

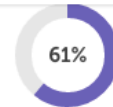
1354
[reviews](#)

Have you used Lipitor (Atorvastatin)?
Help someone out with your quick review.

Worth it

Not sure

Not worth it



of people
say **Crestor** is worth it



say it works well



say it's a big hassle

743
[reviews](#)

Have you used Crestor (Rosuvastatin)?
Help someone out with your quick review.

Worth it

Not sure

Not worth it

Side effects

Diarrhea 8%

Common cold 5%

Muscle pain 5%

Joint pain 5%

Nausea 3%

Headache 4%

Constipation 3%

Joint pain 3%

Nausea 3%

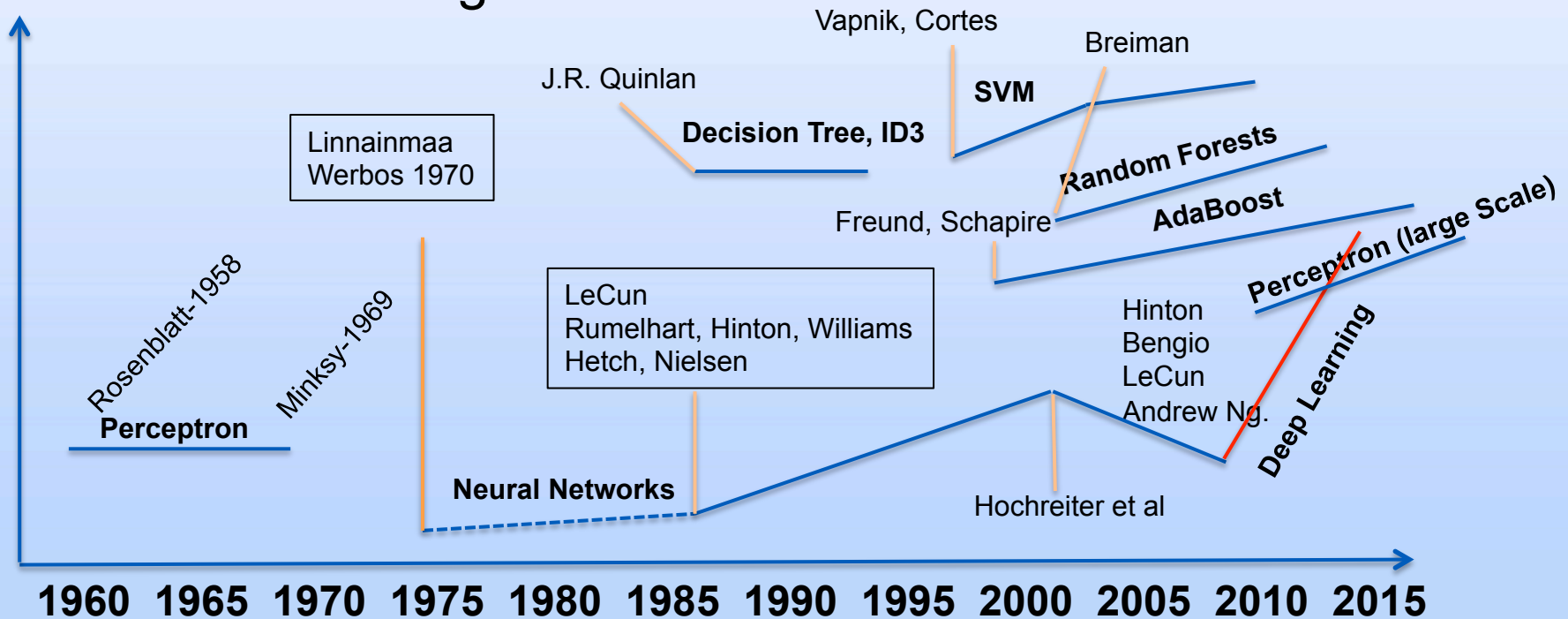
Muscle weakness 2%

Nuts and Bolts of sentiment analysis

- Language
 - SentiWordNet: assigns sentiment scores (+,0,-) to each synset of WordNet
 - Word-NetAffect: affective labels representing emotional states of WordNet synsets
 - Affective Norms for English Words (ANEW)
 - General Inquirer
- Performances of the lexicons are domain dependent.

Machine Learning

- Feature Engineering:
 - Distributed vs. localist representation
 - Character vs. Word
- Classification Algorithm



Features: Distributed vs. Localist

- **Localist:** a given object is represented as a single unit.

Left arm

Right vertebral

proximal humerus

- **Distributed:** a given object is represented by a pattern over multiple units
Typically, there is *sharing* of units between objects.

Side

organ

Features Character Vs. words

- Character-level features for language processing
- Bag of words representation :
 - Weaknesses
 - Lose the ordering of the words
 - Ignore semantic contexts of the words

Vector representation for words in lower dimension

- Word Embedding
 - Word2vec (predictive model)
 - GloVe (count-based model)
- Sent2vec:
 - Map sentences to vectors
- Doc2vec
 - Generalization of word2vec to variable length sized text like

Classification Algorithms

- Deep Learning:
 - Convolutional Models
 - Recurrent Neural Networks
- Stanford Sentiment Analysis Method
 - Recursive Neural Tensor Network model developed and trained on the treebank dataset

Summary

- Sentiment analysis has the potential to impact patient reported outcome measure
- Doc2vec & character representation have shown promising results in sentiment classification.

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Questions | Discussions

Q & A