NLP Introduction for Smartphone Users and Developers

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What is Natural Language Processing?

- Examples First
 - Interactive Fiction
 - Zork, etc.
 - Spellcheck
 - Grammar checkers
 - Google Search
 - Android / Siri / Cortana
 - NCC-1701's computer



2

What is NLP?



 Any time an algorithm is consuming or generating human language, it's NLP.

http://readwrite.com/2013/01/15/why-write-yourown-book-when-an-algorithm-can-do-it-for-you

NLP Layers



https://www.boundless.com/psychology/textbooks/boundless-psychology-textbook/language-10/introduction-to-language-60/structure-of-language-234-12769/?

Phonetics/Phonology



ajæmkold -> "I am cold."

http://www.politicsforum.org/images/fl ame_warriors/flame_41.php

http://upodn.com/phon.asp

Morphology

- "I am cold." \rightarrow
 - i+PN
 - be+V+Sg+Fp+Present
 - cold+ADJ



https://www.uic.edu/classes/psych/psych352jw/c17.html

https://code.google.com/p/foma/wiki /MorphologicalAnalysisTutorial



Syntax

Sentence diagrams!

http://tomato.banatao.berkeley.edu:8080/parser/parser.html

Semantics

• Semi-real example: (*A-BE (argument-class theme+attribute) (tense present) (punctuation period)

```
(attribute
  (*P-COLD
  (degree positive)))
(theme
  (*O-PRONOUN
       (person first)
        (number singular)))
```

http://farafoot.files.wordpress.com/2014/01/the-shining.jpg

8

Semantics

• Real example: Insert the tray into the printer.

(*A-INSERT (argument-class agent+theme) (mood imperative) (punctuation period) (q-modifier (*Q-goal_INTO (case (*K-INTO)) (object (*0-PRINTER (number singular) (reference definite))) (role goal))) (tense present) (theme (*0-TRAY (number singular) (reference definite))))

• "Interlingua"

 http://www.cs.cmu.edu /~teruko/KANT-ir-desc ription.html
 http://www.lti.cs.cmu .edu/Research/Kant/PD F/mts3-nofoot.pdf

Pragmatics

- Context matters.
- Are you in a house?
 - turn down the AC / turn up the heat
- Are you outside in winter?
 - find the closest heated building and navigate to it
- Are you ill?
 - call your doctor?
 - call in sick?

http://arnoldzwicky.org/2013/03/19/more-needing-to-talk/



NLP on Smartphones



• How does all of that work on your phone?

http://www.google.com/nexus/images/nexus-5new/moments/moment_android_phone_2400.png

Android Voice Actions: A Tale of Two Meanings

Helpful

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Meeting		- 8
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Android Voice Actions: A Tale of Two Meanings

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🛿 🛜 🐵 2:47 рм

S schedule an appointment with my dentist

Schedule an Appointment | Willamette Dental Group https://www.willamettedental.com/schedule-an-appointment.htm Just call us at 1-855-433-6825 to schedule your appointment today!... 1 honestly look forward to going to my dental appointments because I know I will not have ...

My Dentist Provides Cosmetic Dentistry, Dental Implants ... www.mydentistinc.com > Find by Zip Code > Office Locations by Pat Steffen - Make My Dentist your Dentist. Call Now 1-866-921-5348. Emergency dental appointment available.

Schedule an Appointment in Massachusetts - Perfect Dental www.myperfectdental.com/schedule-an-appointment/

To schedule an appointment with our expert dentists, please fill out the form ... bad headaches and my doctor suggested I take a visit to the dentist and it turned

Book Appointments - Tricare www.tricare.mil/FindDoctor/Appointments.aspx

Jun 17, 2014 - Get My Plan Info. Service Status ... How you book appointments depends on which health plan you're using. The basic steps for ... Call your primary care manager (PCM) to book an appointment *; If your PCM ... Dental Care

How do I schedule an appointment with my doctor or dentist? https://mydoctime.com/.../How-do-I-schedule-an-appointment-with-my-do... To schedule an appointment, click on the Find A Doctor button to search for your doctor or dentist. Find-A-Doctor-1. Next enter the city and state and click the red ...

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Q Web Q Maps III News 10 Images MORE

Not helpful

 Why does "with my dentist" make it fall back to a web search?

Android Voice Actions: Two More Meanings

 "make" and "schedule" appear to be interchangeable, right?

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g make an appointment			Ļ
3:00-3:30 PM			
Meeting			
Continue in Calendar			

Web results

make an appointment - Idioms by The Free Dictionary idioms.thefreedictionary.com/make+an+appointment

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Android Voice Actions: Two More Meanings

1	📩 W 📑 📑 📑 📑 🖬 🖬 🖬	
	g make an appointment with my dentist	
	3:00-3:30 PM With my dentist	
	Continue in Calendar	

Web results

My Dentist Provides Cosmetic Dentistry, Dental Implants ... www.mydentistinc.com > Find by Zip Code > Office Locations

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 "with my dentist" doesn't break when you use "make"

> Still doesn't really know what to do with "with my dentist"

> > 15

Speech Input Support in Android Wear

Show heart rate	"OK Google, what's my heart rate?" "OK Google, what's my bpm?"	Action vnd.google.fitness.VIEW Mime Type vnd.google.fitness.data_type/com.google.heart_rate.bpm	
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- As a developer, you can tie into Intents that are very simple semantic pairs
 - Typically an action and a MIME type target
 - Supports multiple languages

Mobile Voice Commands: Parlor Tricks

- "schedule an appoinment with my dentist" != "schedule an appointment"
- "make an appointment with my dentist" == "make an appointment"
- Why is there no semantic API for developers?



http://www.c64sets.com/details_db.html? 17 id=3550&t=Zork%20I&i=manual%20front%20cover

Mobile Voice Commands: Parlor Tricks



http://www.funnyjunk.com/funny_pictures/38 33914/Asperger+King/ Current production "voice assistant" technology seems to rely a lot on hardcoded phrasing.

 If there is a semantic model being built, it's not being used.

What I'd Like to See

- At a minimum: Let developers register apps to handle *meanings*.
- E.g. "schedule/make an appointment":
- (*A-SCHEDULE*

(argument-class agent+theme)
(mood imperative)
(tense present)
(theme
 (*0-APPOINTMENT

(number singular)
(reference indefinite))))

 By registering for the base semantic model directly, the user is free to rephrase or add parameters (e.g. "with my dentist").

What I'd Like to See

- Some minimal pragmatics would be really useful.
 - A skeletal appointment with "my dentist" isn't as useful as knowing who my dentist is.
 - If I already have a dental appointment scheduled, remind me and ask to proceed or cancel.
 - Offer to call my dentist to complete the task.



http://marvel-movies.wikia.com/wiki/J.A.R.V.I.S.²⁰