

C SC 620
Advanced Topics in Natural
Language Processing

Lecture 23

4/20

Reading List

- *Readings in Machine Translation*, Eds. Nirenburg, S. *et al.* MIT Press 2003.
 - 19. Montague Grammar and Machine Translation. Landsbergen, J.
 - 20. Dialogue Translation vs. Text Translation – Interpretation Based Approach. Tsujii, J.-I. And M. Nagao
 - 21. Translation by Structural Correspondences. Kaplan, R. *et al.*
 - 22. Pros and Cons of the Pivot and Transfer Approaches in Multilingual Machine Translation. Boitet, C.
 - **31. A Framework of a Mechanical Translation between Japanese and English by Analogy Principle. Nagao, M.**
 - 32. A Statistical Approach to Machine Translation. Brown, P. F. *et al.*

Trekkie communicator ready to go

If you have ever wanted to emulate Star Trek and talk to colleagues via a lapel communicator, then now is your chance.

US firm Vocera has created a wireless voice communicator just like they use in Star Trek: The Next Generation.



The gadget clips to a lapel

Similar to the TV series, all you do to contact someone is press the talk button on the lapel badge, say their name, and you will be put through.

The gadget is proving popular in hospitals to make it easier for nurses to find and get advice from doctors.

Talk time

The Vocera communications system channels voice calls via a wi-fi network to recognise who someone is trying to reach and then to connect them.

Servers do the job of decoding speech to recognise names, find out if the person is available and then a portion of the wireless network is reserved so the people can speak to each other.

"It's pretty futuristic," said Keerti Melkote, co-founder of Aruba Networks that is a partner of Vocera.

"It's very neat, smaller than a cell phone and very lightweight," he told BBC News Online.



Although the voice recognition system needs a bit of training to match names with the way people pronounce them, the system can be working well within a few days, said Mr Melkote.

Early customers for the Vocera communicator were hospitals who like the fact that it lets nurses talk directly to doctors.

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802.11b Freedom of Speech instant voice communication

Vocera provides in-building mobile workers the ability to talk with the staff or resource they need instantly – hands-free, wirelessly, in real time.



News

March 16, 2004 –
Vocera featured in
Forbes, *Your Trekkie
Communicator is
Ready.*



ROI Report

Study shows Vocera
saved each healthcare
unit an average of 3,400
hours per year, equal to
a cost savings of
\$74,000 per unit.



Paper 31. A Framework of a Mechanical Translation between Japanese and English by Analogy Principle. Nagao, M.

- Time: Early to mid-80s, took off in the 90s
- First cited paper in the popular Example-Based Machine Translation (EBMT) framework
- Prototypical Consideration
 - Motivated by experience of 2nd Language Learners
 - Starting from canned sentences/constructions in English/Japanese
 - Then proceeding to sentences that are slight variants of the initial examples
 - Case frame (ditransitive verbs)
 - (English) S verb O C
 - (Japanese) S'-topic O'-direct-object C'-indirect-object verb'
 - Slow learning process, lots of data needed

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- A Modified Approach
 - Replacement strategy
 - Use a thesaurus (e.g. WordNet)
 - Example
 - Given
 - (English) A man eats vegetables
 - (Japanese) man-topic vegetable-object eat
 - Find translation for
 - (English) He eats potatoes
 - Correspondences
 - Man ~ he
 - Vegetable ~ potato
 - Translation
 - (Japanese) he-topic potato-object eat

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- WordNet
 - Potato and Vegetable
 - potato/n is in [potato,white_potato,Irish_potato,murphy,spud,tater]
 - [potato,white_potato,Irish_potato,murphy,spud,tater] is an instance of [root_vegetable]
 - [root_vegetable] is an instance of [vegetable,veggie]
 - vegetable/n is in the synset [vegetable,veggie]
 - OK

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- WordNet
 - Man and he
 - man/n is in [world,human_race,humanity,humankind,human_beings,humans,mankind,man]
 - [world,human_race,humanity,humankind,human_beings,humans,mankind,man] is an instance of [group,grouping]
 - [arrangement] is an instance of [group,grouping]
 - [ordering,order,ordination] is an instance of [arrangement]
 - [word_order] is an instance of [ordering,order,ordination]
 - [word_order] is a part holonym of [text,textual_matter]
 - [letter,missive] is an instance of [text,textual_matter]
 - letter and letter/n related by noun.communication
 - [he] is an instance of [letter,letter_of_the_alphabet,alphabetic_character]
 - No good

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- Example 2
 - (English) Acid eats metal
 - Correspondences
 - Acid - man
 - Metal - vegetable
 - WordNet
 - acid/n is in [lysergic_acid_diethylamide,LSD,acid]
 - [lysergic_acid_diethylamide,LSD,acid] is an instance of [drug_of_abuse,street_drug]
 - [drug_of_abuse,street_drug] is an instance of [drug]
 - [drug] is an instance of [agent]
 - [agent] is an instance of [causal_agent,cause,causal_agency]
 - [person,individual,someone,somebody,mortal,human,soul] is an instance of [causal_agent,cause,causal_agency]
 - [man] is an instance of [person,individual,someone,somebody,mortal,human,soul]

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- Example 2
 - WordNet
 - metal/n is in [alloy,metal]
 - [alloy,metal] is an instance of [mixture]
 - [mixture] is an instance of [substance,matter]
 - [solid] is an instance of [substance,matter]
 - [food] is an instance of [solid]
 - [produce,green_goods,green_groceries,garden_truck] is an instance of [food]
 - [vegetable,veggie] is an instance of [produce,green_goods,green_groceries,garden_truck]
 - vegetable/n is in the synset [vegetable,veggie]
 - Different verb is used
 - Okasu - {eat, invade, attack}

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- Example 3 (Closest Match)
 - Given
 - Same verb (yabureru) - be defeated/broken
 - (Japanese) he-topic election-dative be defeated
 - (English) He was defeated by the election
 - (Japanese) paper bag-topic weight-by be broken
 - (English) The paper bag was broken by the weight
 - Translate
 - (Japanese) president-topic vote-dative yabureta
 - Correspondences
 - President ~ man vs. paper bag
 - Vote ~ election vs. weight
 - (English) The president was defeated by the vote

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- Example 3 (Closest Match)
 - WordNet
 - Man ~ president
 - president/n is in [president,chairman,chairwoman,chair,chairperson]
 - [president,chairman,chairwoman,chair,chairperson] is an instance of [presiding_officer]
 - [presiding_officer] is an instance of [leader]
 - [leader] is an instance of [person,individual,someone,somebody,mortal,human,soul]
 - [man] is an instance of [person,individual,someone,somebody,mortal,human,soul]
 - Man ~ paper_bag
 - man/n is in [man,piece]
 - [man,piece] is an instance of [game_equipment]
 - [game_equipment] is an instance of [equipment]
 - [equipment] is an instance of [instrumentality,instrumentation]
 - [container] is an instance of [instrumentality,instrumentation]
 - [bag] is an instance of [container]
 - [sack,poke,paper_bag,carrier_bag] is an instance of [bag]
 - paper_bag/n is in the synset [sack,poke,paper_bag,carrier_bag]

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- Example 3 (Closest Match)
 - WordNet
 - Vote ~ election
 - vote/n is in [vote]
 - [election] is an instance of [vote]
 - Vote ~ weight
 - vote/v is in [vote]
 - [vote] is an instance of [choose,take,select,pick_out]
 - [choose,take,select,pick_out] is an instance of [decide,make_up_one's_mind,determine]
 - determine and determine/v related by verb.cognition
 - [predetermine] is an instance of [determine,shape,mold,influence,regulate]
 - predetermine and predetermine/v related by verb.cognition
 - [slant,angle,weight] is an instance of [bias,predetermine]
 - weight/v is in the synset [slant,angle,weight]

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- Machine Translation by Analogy
 - Fundamental ideas
 - Man does not translate a simple sentence by doing deep linguistic analysis
 - Instead, decompose input into case frame, translate each item of the frame, and compose the result into one sentence
 - Transfer is done by the analogy translation principle using a database of examples
 - European languages
 - Translation will be possible without great structural changes
 - English/Japanese a different matter
 - Advantage of EBMT is that it bypasses detailed syntactic analysis and correspondence
 - (BTW, what natural language would be a good interlingua for English/Japanese?)

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- Machine Translation by Analogy

- Example

- | | | | | |
|----------------|-------------|----------------|--------|-----|
| regret | though | tomorrow-topic | go | not |
| disappointment | in spite of | | visit | |
| | while | | attend | |
| | with | | | |

- To my regret, I cannot go tomorrow
 - I am sorry I cannot visit tomorrow
 - It is a pity that I cannot go tomorrow
 - Sorry, tomorrow I will not be available

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- Machine Translation by Analogy
 - Example

- | | | | | |
|---------------------------|-----------|-------|-------|--------|
| international politics of | matter | about | write | book |
| | thing | of | draw | volume |
| | affair | on | | work |
| | situation | with | | |
| | event | | | |

- A book in which the affairs of international politics is written
- A book in which (someone) wrote about the events of international politics
- A book written about the events of international politics
- **A book on international politics**

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- Machine Translation by Analogy
 - Need
 - Database of example sentences
 - Mechanism of finding analogical example sentences
 - Learning/Acquisition
 - Easy to add new words and new examples
 - Data is solid and does not change
 - Does not require linguistic theory
 - Theories come and go
 - Does not require deep syntactic analysis
 - Pre-processing stage
 - Input can be simplified in some cases to get a better match