EXCITEMENT: EXploring Customer Interactions through Textual EntailMENT

Short project introduction

FP7-ICT-2011-7 (Objective 4.2b, STREP)

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Partners

**Academic Partners:**
- Bar-Ilan University, Ramat Gan, Israel (I. Dagan)
- DFKI, Saarbrücken, Germany (G. Neumann)
- Fondazione Bruno Kessler, Povo, Italy (B. Magnini)
- University of Heidelberg, Germany (S. Pado)

**Industrial Partners:**
- NICE, Ra'anana, Israel (English analytics provider, **coordinator**)
- German company (OMQ, German IT support company)
- AlmaViva, Roma, Italy (Italian analytics provider)

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What is *reasoning/inference*?

From *dictionary.com*:

- **reasoning**: the process of *forming conclusions*, judgments, or *inferences from facts* or *premises*.

- **inferring**: to *derive* by reasoning; *conclude* or judge *from premises* or *evidence*.

  ➔ *Inferring new from the old* (given)

- **Textual inference**: Inferring new *textual expressions* from given ones
Applied Textual Entailment

- A directional relation between two text fragments: Text \((t)\) and Hypothesis \((h)\):

\[ t \text{ entails } h \quad (t \Rightarrow h) \text{ if humans reading } t \text{ will infer that } h \text{ is most likely true} \]

- Operational (applied) definition:
  - Aims to mimic human inference
  - Assuming common background knowledge
Example Application: Question Answering

Question: Who attacked Cyprus?

... The Ottoman Empire invaded Cyprus...

\[ X_{\text{country}} \text{ invade } Y_{\text{country}} \rightarrow Y_{\text{country}} \text{ attack } X_{\text{country}} \]

... Cyprus was seized by Antiochus...

\[ X_{\text{country}} \text{ be seize by } Y_{\text{leader}} \rightarrow Y_{\text{leader}} \text{ attack } X_{\text{country}} \]

... After Tudhaliya iv captured Cyprus...

\[ X_{\text{leader}} \text{ capture } Y_{\text{country}} \rightarrow X_{\text{leader}} \text{ attack } Y_{\text{country}} \]

Answer: Ottoman Empire, Antiochus, Tudhaliya iv
Example Application: Multi-document Summarization

Barack Obama’s AIPAC address yesterday ...

In his speech at the American Israel Public Affairs Committee yesterday, the president challenged ...

Hypothesis

Obama gave a speech last night in the Israeli lobby conference
Genesis of the Project Proposal

- Textual inference collaborations and visions by academic partners
- Collaboration between BIU and NICE developed in 2009/10
  - Semantic inference for business/speech analytics
  - Smaller scale, national Israeli funding

- Idea for a larger-scale project, early 2010
- Consortium formed at ACL 2010 conference (July)
Two goals

- **Scientific goal (Goal A)**: Develop and advance an open platform for *multi-lingual textual inference*

- **Industrial goal (Goal B)**: Inference-based *processing of customer interactions* across languages and interaction channels
Goal A: Multi-lingual Textual Inference

- Identification of semantic inference relations between texts

- Challenges to address:
  - Majority of work for English – reusability for other languages problematic
  - No sharing of algorithms or resources across individual systems

- Sub-goals:
  - A Generic Multilingual Architecture
  - Algorithmic Progress in Textual Inference
  - An open-source multi-lingual textual inference platform
Goal B: Customer Interaction Analytics

- Customer interaction analytics is large and growing
  - Multiple channels: Call centers, email contacts, web forums
  - Substantial **added value** for companies:
    - (dis)advantages of products, typical customer problems, typical problems in customer handling, …

- Analysts need systems that represent interactions in a compact, expressive form
  - State-of-the-art: Keyword-based analysis

- Our proposal: Structure info by **textual inference**
  - Focus: Statement level (as opposed to keyword level)

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Use case 1: Exploration via entailment graphs

- own a computer
- we got another PC
- got a laptop
- bankruptcy
- i couldn't download
- just installed the computer
- haven't used the service
- TV broke
- i have a nokia e61 now
- i don't use it
- i'm gonna be moving
- decided to buy an iphone

CAUSES

- break
- acquire a device
- move
- bankruptcy

buy a device

- install a computer

buy a computer

- buy a smartphone

laptop computer

PC

iphone

nokia e61
Churn Business Case

- **Customer Interaction 1**
  - I need to stop my subscription.
  - and instead of that you do wish to cancel this service.
  - yes
  - what am i mean i see what the reason what they . yes
  - it was just it's very slow and it was just it's not what i had intended for it to be .

- **Customer Interaction 2**
  - mentality is avoiding it sent to me to provide excellent customer service what is it we can do for you to do . and
  - under to cancel my service
  - is there any particular reason was you know
  - i had see i'm not at that location the more that's the welcome week locating briefly probably several months . and especially the first month or two i don't have access to a computer so i'm not gonna be using it it just wouldn't be beneficial to keep it going okay
Reason Analysis – Semantic Inference

- "the interface was so complicated"
- "found a cheaper service"
- "don't use it much"
- "the UI is not user friendly"
- "installation problems"
- "found less expensive service"
- "the UI is not user friendly"
- "found a different solution with more features"
- "closing my business"
- "found another service that is half of the cost"
- "don't use it much"
- "the interface was so complicated"
- "not making much use"

Lack of Usage
Relevancy
Price
Features
Installation
Interface
Product
Competition
Usage

Usage: 40%
Competition: 15%
Product: 25%
Other: 20%

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Use case 2: Entailment-driven query expansion
## Language-Channel Matrix

**Evaluation on Domain Benchmarks (Open Platform)**

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<thead>
<tr>
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**On-Field Evaluation (Industrial Systems)**

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Summary

- Textual inference platform
- Inference-powered business analytics
- Adopted to speech and other noisy channel data