Applications
of
Natural Language Understanding

Practical Tips

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What is NLU anyway?
HOW DOES SIRI WORK?

OH WE HAVE THESE TINY WOMEN WHO FIT IN YOUR IPHONE
Just a rough guide:

- Automatic Speech Recognition
- Text-to-Speech

NLP:
- Named Entity Recognition
- Part-of-Speech Tagging
- Syntactic Parsing
- Text Categorization
- Machine Translation

NLU:
- Relation Extraction
- Paraphrase & Natural Language Inference
- Semantic Parsing
- Dialogue Agents
- Sentiment Analysis
- Question Answering
- Summarization
YOU KEEP USING THAT WORD
I DO NOT THINK IT MEANS WHAT YOU THINK IT MEANS
EXAMPLE 1.

Relation Extraction
The second sign of the Zodiac is Taurus.

Strokes are the third most common cause of death in America today.

No study would be complete without mentioning the largest rodent in the world, the Capybara.
“domestic animals other than dogs such as cats”

2.5M facts
Ultimate goal

Stress is associated with migraines
Stress can lead to loss of magnesium
Calcium channel blockers prevent some migraines
Magnesium is a natural calcium channel blocker
Spreading cortical depression is implicated in some migraines
High levels of magnesium inhibit spreading cortical depression
Migraine patients have high platelet aggregability
Magnesium can suppress platelet aggregability

Lack of magnesium causes migraine

Swanson 1987
I've never been happier.
Dick's Sporting Goods

Seller rating: 4.4 / 5 - Based on 10,544 reviews

What people are saying

- Customer service: "Terrible customer service."
- Shipping: "Over all delivery speed was good."
- Price: "Great price, fast shipping, great product."
- Selection: "Fairly good selection of parts."
- Return policy: "Horrible return/exchange policy."
- Ordering process: "Really great transaction."
- Communication: "Quick shipping, great shipping communication"
EXAMPLE 3.

Chat Bot
I SHOULD MAKE A
CHAT BOT
Chat Bots

Platform

AI / NLU

Wit.AI
natural language UI

one task

conversation about anything
Understanding = Semantics
TIP 1

Plenty of clever algorithms. Many free of charge! Make them work for you!
Open source libraries

**Machine Learning**
- Scikit Learn
- H2O
- Weka
- Moa
- Apache Spark

**Deep Learning**
- Theano
- Torch
- Caffe
- DeepLearning4J
- TensorFlow

**NLU**
- Word2vec
- StanfordNLP
- Gensim
- Chatterbot
- Maui
Which library should you use?
Which algorithm should you use?
When to use a commercial API?
<table>
<thead>
<tr>
<th>Commercial API</th>
<th>vs</th>
<th>Open-source</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solves specific business problem</td>
<td></td>
<td>• Often requires customisation</td>
</tr>
<tr>
<td>• Guaranteed support and tools to get</td>
<td></td>
<td>• Requires in-house expertise to</td>
</tr>
<tr>
<td>get started</td>
<td></td>
<td>integrate properly or consultants</td>
</tr>
<tr>
<td>• Costs</td>
<td></td>
<td>• Freely available</td>
</tr>
<tr>
<td>• IP stays with the vendor</td>
<td></td>
<td>• Helps build your IP</td>
</tr>
</tbody>
</table>
Build or buy?

- Is there end-to-end solution that fits your requirements? What’s its quality?
- Will implementing this in-house increase my competitive advantage?
- Do I have the right people to implement / can I afford them?
- Is this a hot topic in academia?
TIP 2

Domain knowledge is more important than the best algorithm
natural language query + salesforce
WINNER
$1 MILLION HACKATHON
from Kim and Fossett Group
You probably already have enough data to build accurate language models of your business.
Possible sources of company language data

- support forum
- corporate email
- call centre logs
- product description
- complaints
- open-ended responses
- website copy
- interview transcriptions
- support notes
- faqs
- chat logs
- company wiki
- social media comments
- chat logs
- community pages
- catalogue
- user feedback
Language Modelling = Word Embeddings

aka word2vec
& extensions: lda2vec, doc2vec, sense2vec
Applications of Language Modelling

• Which FAQ is the closest to user’s question?
• Does a forum post with this title already exist?
• Which previous support tickets may contain the answer?
STITCH FIX
YOUR PARTNER IN PERSONAL STYLE

Clothing and accessories hand-selected by a personal stylist, delivered to your door.

GET STARTED
Nearby regions are consistent ‘closets’


2012

github.com/cemoody/Lda2vec
TIP 4

Deep Learning isn’t always the answer
Deep Learning

What society thinks I do
What my friends think I do
What other computer scientists think I do
What mathematicians think I do
What I think I do
What I actually do
Application of traditional Machine Learning

- Which support person is best to answer this email?
- Which forum posts are from most frustrated people?
- What’s the product ID for this name?
When to use Deep Learning for NLU
Collaborative Open Computer Science

Convolutional Neural Networks for Sentence Classification
CNN trained on top of pre-trained word vectors for sentence-level classification task
DEEP LEARNING (DL), NATURAL LANGUAGE PROCESSING (NLP), CONVOLUTIONAL NEURAL NETWORKS (CNN)
samim 4 points 9 months ago 0 Comments

Language Understanding for Text-based Games using Deep Reinforcement Learning
Learning control policies for text-based games
NATURAL LANGUAGE PROCESSING (NLP), DEEP REINFORCEMENT LEARNING (DRL)
samim 2 points 5 months ago 0 Comments

Convolutional-Recursive Deep Learning for 3D Object Classification
RGB CNN & Depth CNN each fed into a tree structured RNN for 3D Object Classification
DEEP LEARNING (DL), RECURRENT NEURAL NETWORKS (RNN), NATURAL LANGUAGE PROCESSING (NLP), CONVOLUTIONAL NEURAL NETWORKS (CNN)
graphfinite 5 points 3 months ago 0 Comments

Recursive Neural Tensor Network (RNTN) for sentiment analysis
“Recursive Deep Models for Semantic Compositionality Over a Sentiment Treebank” by Socher et. al
DEEP LEARNING (DL), RECURRENT NEURAL NETWORKS (RNN), NATURAL LANGUAGE PROCESSING (NLP)
graphfinite 1 point 9 months ago 0 Comments

Towards AI-Complete Question Answering: A Set of Prerequisite Toy Tasks
QA with a MemNN with Adaptive Memories and Nonlinear Sentence Modeling on FB babi dataset
DEEP LEARNING (DL), RECURRENT NEURAL NETWORKS (RNN), NATURAL LANGUAGE PROCESSING (NLP)
graphfinite 5 points 9 months ago 1 Comments

Natural Language Processing (almost) from Scratch (SENNA)
Natural Language Processing with neural network.
NATURAL LANGUAGE PROCESSING (NLP), SHALLOW WINDOW-BASED METHODS
Robert Dione 1 point 9 months ago 0 Comments
A Neural Attention Model for Abstractive Sentence Summarization
EMNLP 2015

Example: Abstractive text summarization

Input \( (x_1, \ldots, x_{38}) \). First sentence of article:
russian defense minister ivanov called sunday for the creation of a joint front for combating global terrorism
Output \( (y_1, \ldots, y_8) \). Generated headline:
russia calls for joint front against terrorism \( \iff g(\text{terrorism}, x, \text{for}, \text{joint}, \text{front}, \text{against}) \)
Tip 1
Plenty of clever algorithms freely available

Tip 2
Knowledge of domain > accurate algorithm

Tip 3
You have more data than you think

Tip 4
Deep Learning isn’t always the answer
Predicting the future
They were right.

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