Integrating natural language understanding with applications

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A conversational system: package tracking

“what is the status of tracking number 12345?”

Natural language understanding

Intent: delivery status

Tracking#: 12345

Code

http://production.shippingapis.com/ShippingAPI.dll?API=TrackV2&XML=<xml version="1.0" encoding="UTF-8" ?>
<TrackRequest USERID="xxxxxxxx">
<TrackID ID="12345"></TrackID>
</TrackRequest>
# NLP toolkits

## Purpose

Map language to
- User intents: track package, find locations, check address
- Entities and values:
  - Address: 1234 Main Street
  - City: San Jose

## Examples

- Microsoft LUIS
- Amazon Alexa Skills Kit
- Google DialogFlow
- Facebook Wit.ai
- IBM Watson Conversation
- Nuance Mix
- Apple SiriKit
A more realistic conversational system

“where’s my laptop?”

Natural language understanding

Intent: delivery status?
Tracking#: ??

http://production.shippingapis.com/ShippingAPI.dll?API=TrackV2&XML=<xml version="1.0" encoding="UTF-8" >
<TrackRequest USERID="xxxxxxxx">
<TrackID ID="12345"></TrackID>
</TrackRequest>

Back end
Alignment of user’s mental model with system capabilities

User’s intents → NLP → Application logic → Other information sources

Backend functions
Example: US Postal Service Web Service

**Application functions**
- Track package
- Find zip code
- Postage calculator

**Website**
<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical user intents</td>
</tr>
<tr>
<td>What are my delivery options?</td>
</tr>
<tr>
<td>Has my package been delivered?</td>
</tr>
<tr>
<td>Who signed for my package?</td>
</tr>
<tr>
<td>What is the status of my package?</td>
</tr>
<tr>
<td>When will my package arrive?</td>
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</tbody>
</table>
Graphical interfaces constrain input to avoid mismatches
Mismatches

Vague:
• “Where’s my package?” “How much will it cost to mail my letter?”

Subjective:
• “Will tracking number 12345 be here soon?”

Multiple intents:
• Has my package arrived and did anyone sign for it?

Comparisons:
• “What is the cheapest way to send a package that will get there within a week?”

Intent without entities:
• “I want to mail a package”

Information not in back end:
• “Where’s the nearest post office?”

Somewhat out of domain:
• “How can I get started in stamp collecting?”

Way out of domain:
• “Where is the nearest Chinese restaurant?”
One strategy: Map user concepts to back end concepts in NLP training

<table>
<thead>
<tr>
<th>User concept</th>
<th>Backend concept</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>TrackID</td>
<td>TrackID</td>
<td>Same!</td>
</tr>
<tr>
<td>Tracking number</td>
<td>TrackID</td>
<td>Same mapping but different word</td>
</tr>
<tr>
<td>Proof of delivery, Delivery confirmation</td>
<td>Proof of delivery</td>
<td>Synonyms</td>
</tr>
</tbody>
</table>
So far, misalignment can be handled in NLP but... let’s look at this box

What goes in here?
Back ends are up to the developer

• “A *cloud-based service* that accepts these intents as structured requests and then acts upon them.”
Beyond basic NLP: some strategies

Vague or missing slots: “How much does it cost to mail a package?”

- Clarify with user in a dialog: “How much does your package weigh?”

Subjective or qualitative questions: “Will my package get there soon?”

- Make the subjective objective: “soon” → “within one day”
- Overinform: “Your package will arrive tomorrow”

Comparisons: “Which is more expensive, first class mail or overnight mail?”

- Multiple calls to back end, one for each item

Information not in the back end: “Where is the nearest post office?”

- Find another service and present its results

Multiple intents: “Has my package arrived and did anyone sign for it?”

- Preprocessing to separate intents
Summary

- Natural language inputs may not align directly with backend capabilities
- Potential for queries that are hard to answer directly
- User-friendly systems should handle these
- Strategies within NLP and within back end can compensate