Announcements

- Sudoku homework due in one week. It’s a bit hard!
- Medical Leave: I will be out on leave for two weeks
  - Sri Kurniawan: Assistive Tech. Feb 28th
  - Charlie McDowell: Sorting, Algorithms, Complexity
  - Arnav Jhala: Computational Cinematography
  - Charlie McDowell: AI & NLP. IBM’s Watson
- Start thinking about your final project: 10% of the final grade
- I will be back to do the final review.

Expressive Language in Conversation

- Expresses Speaker’s Personality & Identity
  - culture, style, origin, class
- Dynamically Adapts to Conversational Partner
  - Convergent: Matching, e.g. two friends (extraverts) talking
  - Divergent: Tailoring, e.g. parent to baby
- Controlled by generation parameters
  - Content: Who is interested in what, who knows what
  - Linguistic: Lexical and Syntactic Choice
  - Pragmatic: Personality & Social Relationship
  - Acoustic: Speaking Rate, Amplitude, Prosody

Personality in Language: People do it

<table>
<thead>
<tr>
<th>Introvert</th>
<th>Extravert</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't know man, it is fine I was just saying I don't know.</td>
<td>Oh, this has been happening to me a lot lately. Like my phone will ring. It won’t say who it is. It just says call. And I answer and nobody will say anything. So I don’t know who it is. Okay. I don't really want any but a little salad.</td>
</tr>
<tr>
<td>I was just giving you a hard time, so.</td>
<td></td>
</tr>
<tr>
<td>I don't know.</td>
<td></td>
</tr>
<tr>
<td>I will go check my e-mail.</td>
<td></td>
</tr>
<tr>
<td>I said I will try to check my e-mail, ok.</td>
<td></td>
</tr>
</tbody>
</table>

From Mehl et al., 2006. Mairesse et al. 2007.

Film Characters: Crafted Personalities

Does personality matter for dialogue systems?

- Yes. Achieving communicative goals in dialogue often relies on engaging user affect:
  - persuasion, motivation, increase in self-efficacy beliefs, learning
  - People react socially to computational agents, thus social norms such as liking people like yourself often hold (Nass & Lee, 2001)
  - People make attributions beyond social level: task competence
  - Personality matching in a robotic exercise coach increased the time that stroke victims spent on their medically recommended exercises (Tapus & Mataric 2008)
  - Tutoring oriented to the student’s ‘face needs’ improved learning in training and tutoring (Porayska-Pomsta & Mellish 2004; Wang et al., 2004)
Need a general purpose generation technology that can be easily ported from one domain/task to another. Expressive but also for mixed initiative dialogue (any branching dialogue).

Outline of my talk

- Expressive natural language generation
- Generating nonverbal expression of personality (Ben, Pollack, Andre’ & Walker IVA 2010; Neff, Wang, Abbott & Walker IVA 2010, Neff, Toehrman, Grant, Walker IVA 2011)
- Generation by learning models of film characters from corpora (Lin & Walker AIIDE 2011, Walker, Lin, Wardrip-Fruin, Buell, Grant ICIDS 2011)

Procedural Language Generation: A Key Technology

- Wide range of generation parameters
- Different methods for creating models that control the parameters
  - Dynamic Real-Time Adaptation
  - Trainable: Machine Learning Techniques
  - Individual Personalization

Variation controlled by the Language Generator

- vary content and form easily depending on any factor (context, personality, social relationship)
Expressivity?: Which parameters and models?

- Model Human Dialogue Behavior
- Psychology: Big Five Theory of Personality
- Sociolinguistics: Politeness Theory
- Learn from Film Character Dialogue

PERSONAGE Generator: BIG FIVE Theory

- Conscientiousness: Dutiful vs. impulsive
- Emotional stability: Calm vs. anxious
- Openness to experience: Imaginative vs. conventional
- Agreeableness: Kind vs. unfriendly
- Extraversion: Sociable, assertive vs. quiet

### Linguistic Reflexes of Personality: 50 yrs of studies

<table>
<thead>
<tr>
<th>Personality Dimension</th>
<th>Extraversion (Furnham, 1990)</th>
<th>Neuroticism (Pennebaker &amp; King, 1999)</th>
<th>Conscientiousness (Pennebaker &amp; King, 1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Talk more, faster, louder and more repetitively</td>
<td>Fewer 1st person singular pronouns</td>
<td>Fewer negations and negative emotion words</td>
</tr>
<tr>
<td></td>
<td>Fewer pauses and hesitations</td>
<td>Lower but significant correlations</td>
<td>Low but significant correlations</td>
</tr>
<tr>
<td></td>
<td>Less formal, more references to context (Heylighen &amp; Dewaele, 2002)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>More positive emotion words (Pennebaker &amp; King, 1999)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PERSONAGE Architecture: 67 Parameters

**INPUT:** DialogAct, Content Pool

**OUTPUT UTTERANCE**

<table>
<thead>
<tr>
<th>Syntactic Template Selection</th>
<th>Pragmatic Marker Insertion</th>
<th>Lexical Choice</th>
<th>Realization</th>
</tr>
</thead>
<tbody>
<tr>
<td>VARIETY</td>
<td>EXPLANATION</td>
<td>FREQUENCY OF USE</td>
<td></td>
</tr>
<tr>
<td>RELATIONSHIPS</td>
<td>EXPLANATION</td>
<td>BROKEN LENGTH</td>
<td></td>
</tr>
<tr>
<td>CONVERSATIONAL</td>
<td>EXPLANATION</td>
<td>PREDICTED</td>
<td></td>
</tr>
<tr>
<td>SELF-REFERENCE</td>
<td>EXPLANATION</td>
<td>PHRASE LENGTH</td>
<td></td>
</tr>
</tbody>
</table>

**Example of Pragmatic Transformation**

Negation insertion

"X has awful food" → "X doesn’t have good food"
Recommendation: A Persuasive Task

<table>
<thead>
<tr>
<th>Utterance</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>… it seems to me that Le Marais isn't as bad as the others.</td>
<td>1.65</td>
</tr>
<tr>
<td>… it has nice atmosphere. It has friendly service. It seems to me</td>
<td></td>
</tr>
</tbody>
</table>
So where are we?

- A flexible, real-time, generator
- Personality parameters
- Methods for automatically training
- Personalize both content and form
- Standard meaning representations: DB Relations, Content Plan, AI planner

There are also findings in psychology about how VOICE and FACE and GESTURE express personality. Can we use them?

Psychological Correlates Between Extraversion and Movement

<table>
<thead>
<tr>
<th></th>
<th>Introversion</th>
<th>Extraversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body attitude</td>
<td>backward, leaning, turning, away</td>
<td>forward leaning</td>
</tr>
<tr>
<td>Gesture amplitude</td>
<td>narrow</td>
<td>wide, broad</td>
</tr>
<tr>
<td>Gesture rate</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Gesture speed, response time</td>
<td>slow</td>
<td>fast</td>
</tr>
<tr>
<td>Gesture direction</td>
<td>more inward, self-contact</td>
<td>more outward, table plane and horizontal spreading gesture</td>
</tr>
<tr>
<td>Gesture connection</td>
<td>low smoothness, rhythmic disturbance</td>
<td>smooth, fluent</td>
</tr>
<tr>
<td>Body part</td>
<td>shoulder erect, limbs spread, elbows away from body, hands away from body, legs apart</td>
<td></td>
</tr>
</tbody>
</table>

(References in Neff et al., 2010, 2011)

Alfred: Facial Dominance Behaviors & Personality

Hypothesis: Persuasiveness could be increased by expressing dominance with personality (Marwell, 1967, Mehrabian, 1995)

Extravert, Hi Dominance

Introvert, Low Dominance

Bossy or Wimpy: Expressing Social Dominance by Combining Gaze and Linguistic Behaviors

So where are we now?

- Voice realization maintains personality perceptions
- Methodology of mining social psychology literature for parameters extends to gaze, head position, body and arm gestures

Character Creator: Author creativity

- Learn models of character voice (linguistic style) from film screenplays
- Use the learned models to control the parameters of PERSONAGE
- Apply the learned models to character dialogue in the SpyFeet story domain
  - A Different! Domain
- Test human perceptions of the resulting generated utterances
Scene from Annie Hall: Lobby of Sports Club

ALVY: Uh ... you wanna lift?

ANNIE: Turning and aiming her thumb over her shoulder
Oh, why-uh ... y-y-you gotta car?
ALVY: No, um ... I was gonna take a cab.

ANNIE: Laughing: Oh, no, I have a car.

ALVY: You have a car?

ANNIE smiles, hands folded in front of her

So ... Clears his throat.  I don't understand why ... if you have a car, so then-then why did you say “Do you have a car?” ... like you wanted a lift?

Scene from The Terminator: Cigar biker

TERMINATOR: I need your clothes, your boots, and your motorcycle.

CIGAR BIKER: You forgot to say please.

Terminator hurls Cigar, all 230 pounds of him, clear over the bar, through the serving window into the kitchen, where he lands on the big flat GRILL. We hear a SOUND like SIZZLING BACON as Cigar screams, flopping jerking. He rolls off in a smoking heap.

What can we learn from a corpus?

- **Reveal Subtext:** The way a character says something is one way to reveal subtext and character emotion
  - Short vs. Long turns/sentences => friendliness, formality
  - Word choice => level of education, anxiety, hesitation
  - Direct forms vs. indirect forms => extraversion, aggression

- **Character Voice:** Learning to model specific characters or sets of characters should produce individual character voices

**Method**

1. Collect movie scripts from IMDB
2. Extract utterances for each character
3. Select leading roles (dialogue > 60 turns)
4. Generate features reflecting linguistic behaviors
5. Learn models of character (z-scores)
6. Generate new utterances using learned models to control parameters of our dialogue generator

**Method (cont)**

Generated features

PERSONAGE generator (ENLG engine)

Story domain: SpyFeet utterances

Jules in SpyFeet utterances

Vincent in SpyFeet utterances

Others in SpyFeet utterances

Jules’ Tag Question Ratio

Vincent’s Overall Polarity

Jules’ Overall Polarity

Vincent’s LIWC results

Jules’ Dialogue

Vincent’s Dialogue

Other’s Dialogue
Learning Character Models: Z-Scores

- What this does is to find out in what ways this character differs from the average (female) character.
- Think of facial caricature: emphasizes what is distinctive.

\[ z_a = \frac{x_a - \mu_f}{\sigma_f} \]

Annie’s vector \( z_a \) is calculated relative to the average female population \( \mu_f \) and standard deviation \( \sigma_f \).

Example: Model Learned for Annie

Map character model to PERSONAGE parameters: weighted average of features. Parameters either binary, or scalar range 0…1.

<table>
<thead>
<tr>
<th>PERSONAGE parameter</th>
<th>Description</th>
<th>Sample mapped features from character model</th>
<th>Annie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbosity</td>
<td>Control # of propositions in the utterances</td>
<td>Number of sentences per turn, words per sentence</td>
<td>0.78</td>
</tr>
<tr>
<td>Content polarity</td>
<td>Control polarity of propositions expressed</td>
<td>Polarity-overall, LIWC-Posemo, LIWC-Negemo, LIWC-Negate</td>
<td>0.77</td>
</tr>
<tr>
<td>Polarization</td>
<td>Control expressed polarity as neutral or extreme</td>
<td>1 if polarity-overall is strong negative or positive</td>
<td>0.72</td>
</tr>
<tr>
<td>Concessions</td>
<td>Emphasize one attribute over another</td>
<td>Category-concession</td>
<td>0.83</td>
</tr>
<tr>
<td>Positive content</td>
<td>Determine whether positive propositions -- including the claim -- are uttered first</td>
<td>Accept-ratio, Accept-first-ratio</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Original and Generated Utterances

**Annie (Annie Hall)**

Original dialogue sample:

> "'m well
> That's, uh... that's pretty serious stuff there. Reporting is really... really tough.
> Uh... Hi, Hi, Hi.
> Well, bye.
> Oh, yeah? So do you. Oh, God, what a dump, thing to say, again? I mean, you say it. "You play well."
> "And right away... I have to say well. Oh, uh... God, Annie. Well... uh... well... I da-da-da, I da-da-da, lo la-

**Annie’s Learned Z-Score Model for our NLG engine**

- Verbosity=0.78
- Content polarity=0.77
- Polarity=0.72
- Repetition polarity=0.79
- Concessions=0.83
- Polarity-overall=0.26
- Positive content-fraction=0.50
- First Person in Claim=0.6
- Claim Polarity=0.57
- ... etc.

**Generated dialogue (SpyFeet story domain)**

- "Come on, I don't know. do you? People say Cartmill is strange while I don’t rush to... judgment."
- I don’t know. I think that you brought me cabbage... so I will tell something to you, alright?"
- "Yeah, I'm not sure. would you be? Wolf wears a hard shell but he is really gentle."
- "I saw, I am not sure. Obviously, I respect Wolf. However, he isn’t my close friend, is he?"

Summary

- Personality for dialogue agents can help achieve many conversational goals.
- Current & Future work:
  - Use different personalities for in-vehicle task dialogue demo
  - Test in a long-term companion scenario either phone, car or eldercare robot.