NLP in Creative Idea Generation

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Introduction to Computational Creativity
Week 2, Wednesday

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Introduction

- NLP in creative systems
- Example system: the **What-If Machine**
- Self-evaluation: narrative potential
- Many uses of NLP: knowledge sources
- Information extraction
- Simple generative component using IE
Natural Language Processing

NLU

Language understanding

Knowledge representation

NLG

generation
Some uses of NLP in CC

**Interaction**
- Dialogue, user modelling,
- collaboration, ...

**Linguistic creativity**
- *Metaphor*,
- word play, ...

**Realisation**
- Poems, stories, ...

**World knowledge acquisition**
- *Information extraction*,
- *common sense*,
- *reasoning*, *cognition*...
• Simple creative fictional ideas
• May take “what if...?” form
• At the heart of many stories, paintings, etc
• Knowledge-hungry process
What if...a boy never grew up?
...and could fly?

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WHIM: A typical CC system

• Typical CC system:
  • Many small components
  • Not (or barely) creative separately

• **Key idea:**
  Evaluation of *ideas* by *narrative generation*
  • Try generating stories from idea
  • Many / varied / unusual stories → good idea

• **Key idea:**
  Simple generative component(s)
  • One small part of architecture
  • Don’t necessarily need to be very good!
  • Generate many ideas, evaluate, filter, use
What if there was a little girl whose dad was an accountant?

What if there was a little girl whose dad was a robber chief?

Evaluation by narrative generation

Knowledge bases
Semantic resources

Realization

Story, poem, game...

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Input
User, social media, news...

World view formation

Fictional idea generation

Evaluation by narrative generation + machine learning

Realization

Output
Story, poem, game...

What if there was a little girl whose dad was a robber chief?

Knowledge bases
Semantic resources

girl, robbers, gang, medieval

robbers work in gangs
medieval robbers attacked travellers

X is born
X grows up with robbers
X meets Y
X and Y jump across chasm...

robber: person who robs
burglar, mugger, thief
criminal gang members prove loyalty...

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Applications of NLP

Input
User, social media, news...

Knowledge bases
Semantic resources

World view
formation

Fictional idea
generation

Evaluation by
narrative generation
+ machine learning

Realization

Output
Story, poem, game...

Idea generation:
What if there was a little girl whose dad was a robber chief?
More today!

NLP output:
stories, scripts, plots, idea descriptions, ...

Narrative generation (NLP-heavy), typicality/surprisingness measures

KB-building, expansion
Input processing, interpretation

KB-querying, query expansion, relevant info, world-view building

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Some requirements

- Event knowledge
- Relations, facts, world knowledge
- Narrative devices
- Plausibility measures

Bill drops glass $\rightarrow$ glass breaks
Bill orders food $\rightarrow$ Bill drinks
Some requirements

- Event knowledge
- Relations, facts, world knowledge
- Narrative devices
- Plausibility measures

Bill Clinton was president of the US
Cows eat grass
Some requirements

- Event knowledge
- Relations, facts, world knowledge
- Narrative devices
- Plausibility measures

\[ \text{Someone goes missing} \Rightarrow \text{Villain deceives victim} \Rightarrow \text{Hero leaves on mission} \Rightarrow \ldots \]
Some requirements

- Event knowledge
- Relations, facts, world knowledge
- Narrative devices
- Plausibility measures

Father is an accountant → high
Father is a robber chief → medium
Father is a plant pot → low
Some requirements

Event knowledge
Relations, facts, world knowledge
Narrative devices
Plausibility measures
Information extraction

- Many tasks require facts, world knowledge, commonsense knowledge
- **Broad-domain** knowledge: *lots*, many different subjects
- Available in text corpora (e.g. Wikipedia, newspapers)
- **Information extraction (IE):** analyse text to extract knowledge in a computationally useable form

(antibiotics, kill, bacteria)
(tolstoy, wrote, War and Peace)
Information extraction


Tolstoy had thirteen kids and wrote *War and Peace*.

In order for a book (or any project or enterprise) to hold our attention for the length of time it takes to unfold itself, it has to plunge into some integral mystery.

(tolstoy, had, thirteen kids)
(tolstoy, wrote, war and peace)

Sentence extraction, tokenization, POS tagging, NP chunking, extraction rules, constraints
Simple generation of ideas

*Baseline Methods for Automated Fictional Ideation.* Llano et al. (2014)

- Use output from IE (e.g. ReVerb)
- Idea: generate *fictional* idea by changing a fact

\[
\begin{array}{ccc}
 X & p & Y \\
 \downarrow & & \downarrow \\
 \text{E.g. (tolstoy, wrote, war and peace)} & \rightarrow & (tolstoy, wrote, a hit single)
\end{array}
\]

Ideally, new ‘alternative fact’ should

1. be fictional;
2. make sense;
3. lead to new narratives
Simple generation of ideas

E.g. (tolstoy, wrote, war and peace) → (tolstoy, wrote, a hit single)

1. be fictional;
2. make sense;
3. lead to new narratives

Approximation 1 & 2. Choose \((X, r, Y')\) such that

- \((X, r, ?)\) is common – \(r\) is a common thing \(X\) does
- \((?, r, Y')\) is common – \(r\) is a common thing done to \(Y'\)
- \((X, r, Y')\) is rare or unseen \(\simeq\) it’s fictional
Simple generation of ideas

\[
\begin{align*}
X & \quad p & \quad Y \\
\downarrow & & \downarrow & & \downarrow \\
\text{E.g. (tolstoy, wrote, war and peace)} & & & & \rightarrow \text{(tolstoy, wrote, a hit single)}
\end{align*}
\]

Choose \((X, r, Y')\) such that

1. \((X, r, ?)\) is common – \(p(r|X)\) high
2. \((?, r, Y')\) is common – \(p(Y'|r)\) high
3. \((X, r, Y')\) is rare or unseen – \(p(X, r, Y') = 0\)
Example output: cattle

- Cattle evolved to eat meat
- Cattle occupy a unique role in Israelite history
- Cattle occupy a unique role in modern distributed systems
- Cattle were bred for speed
- Cattle are not primarily for printing purposes
- Cattle are not primarily for sexual intercourse

← Cattle evolved to eat grass
← Cattle occupy a unique role in human history
← Cattle occupy a unique role in human history
← Cattle were bred for meat
← Cattle are not primarily for food
← Cattle are not primarily for food

What if...
Using generated ideas

Why do this?

• Generate lots of ideas, automatic self-evaluation
  E.g. use in WHIM with *narrative generation*

• Generator for MASs

• Seeds for further generation, e.g. Markov models

• Component of more complex process
  E.g. choose *topics or entities* as input
Discussion: WHIM and the Ventura model

- Input
  - World view formation
  - Fictional idea generation
  - Knowledge bases
    - Semantic resources
  - Evaluation by narrative generation + machine learning
- Realization
  - Output
    - Story, poem, game...

Discuss!
Conclusions: NLP in CC

• Uses of NLP in creative systems
• The What-If Machine
• Self-evaluation using narrative generation
• Many uses of NLP in WHIM: incl. knowledge resources
• Required knowledge resources
• **Information extraction** for broad-domain knowledge bases
• Simple generative component using IE

Exercises:

*implement IE-based idea generator for poetry machine*