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Using Natural Language Processing to Automate the Bechdel Test

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Bechdel Test

- Bechdel test first introduced by Alison Bechdel in a comic strip in 1985
- Movie must meet three criteria:
  - T1: Are there at least two named female characters?
  - T2: Do these female characters have a conversation with one another?
  - T3: Is there at least one conversation between female characters about something other than a man?
- Bechdel score between 0 and 3
- Types of texts analysed for this thesis:
  - Screenplays
  - Novels

Screenplays

Screenplay - Structure

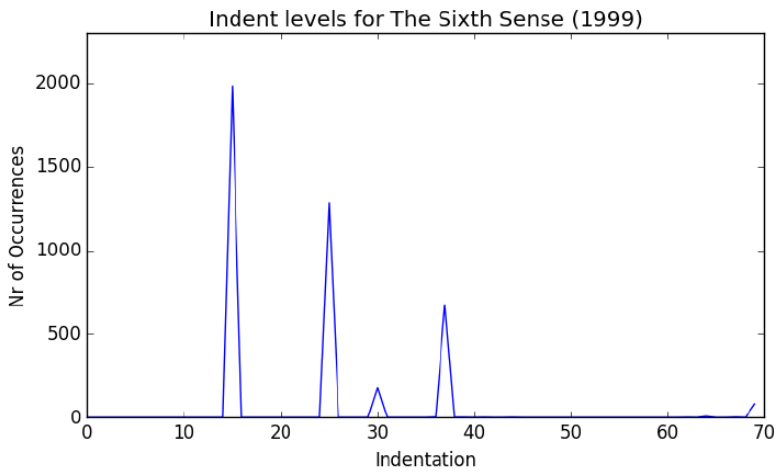
```
M|                                                          CUT TO:
 |
S|              EXT. PALANTINE HEADQUARTERS - ANOTHER DAY
 |
N|              Traffic passes.
 |
S|              INT. PALANTINE HEADQUARTERS
 |
N|              Tom and Betsy are talking. She takes out a cigarette. He
N|              takes out matches to light it.
 |
C|                                   BETSY
D|                        Try holding the match like this.
 |
C|                                   TOM
D|                        This is gotta be a game, right?
 |
C|                                   BETSY
M|                              (putting on glasses)
D|                        This I gotta see.
 |
C|                                   TOM
M|                              (burning fingers)
D|                        Ouch!
 |
C|                                   BETSY
M|                              (giggling)
D|                        Oh, are you all right?
 |
C|                                   TOM
D|                        I'm great. Always set my fingers on
D|                        fire. If you want to see another
D|                        trick. I do this thing with my nose.
```

(1) Excerpt from “Taxi Driver” screenplay

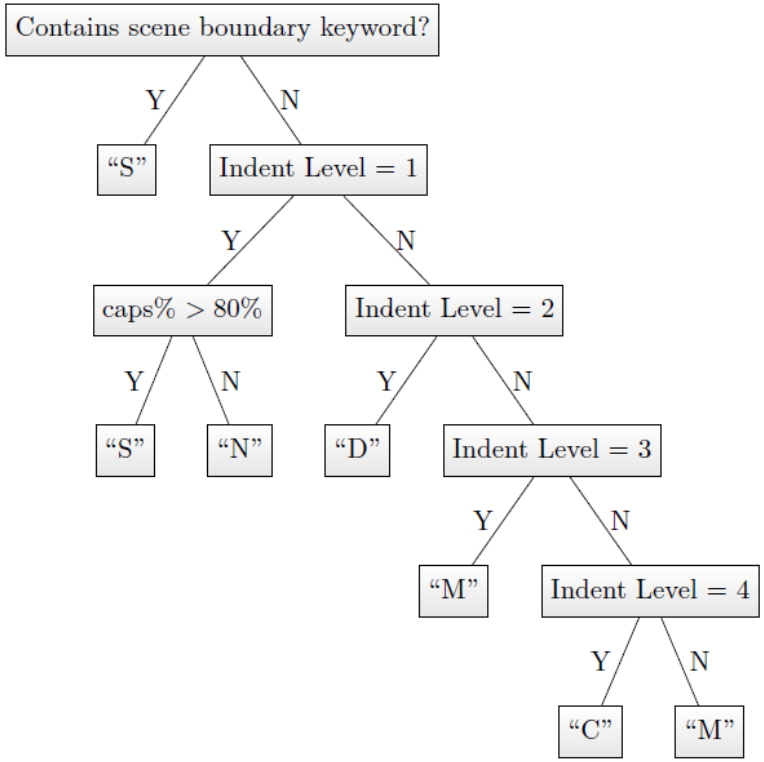
- Labels:
  - “S” – Scene Boundary
  - “N” – Scene Description
  - “C” – Character
  - “D” – Dialogue
  - “M” – Meta-Data
- Defining characteristics:
  - Capitalization
  - Keywords
  - Indentation

Screenplay - Parsing

- Indentation levels vary widely between screenplays, however usually consistent within the screenplay



- Decision Tree:



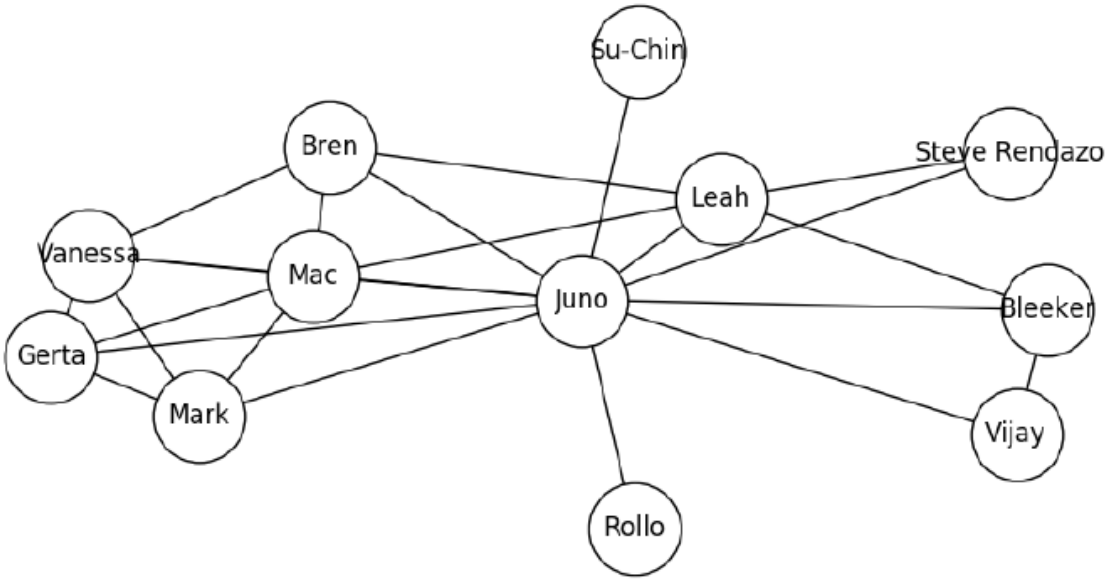
Screenplay – T1

- Assign each character name labeled in “C” lines a gender
- Dictionary
  - Compile database of names and gender
  - Unisex names, for example “Jamie”, are too uncertain
- Internet Movie Database (IMDb)
  - Using IMDb ID and API, retrieve character and actor information from IMDb
- Algorithm first attempts to assign a gender using “Dictionary” approach. If certainty threshold not reached, “IMDb” approach is used
- If no gender could be assigned within certainty threshold, then character cannot be used to pass T1

Screenplay – T2

- Social network analysis (SNA)
  - Create array of all parsing labels, in order of appearance, ignoring redundant entries
  - Example scene:
    - {S, N, C1, D, C2, M, D, C4, D}
- Liberal
  - Characters talk to each other when they appear in a scene together
  - Example: C1 converses with C2 and C4
- Conservative
  - Characters talk to each other, when consecutive
  - Example: C1 converses with C2

- Social network from the movie “Juno”:



Screenplay – T3

- Machine learning
- Features:
  - Bag-of-words (BOW)
    - Words in “D” lines between female characters, binary
  - LING
    - the number of conversations between the pairs of female characters
    - the number of words exchanged during their conversations
    - is there a mention of a male pronoun or male character in any of their conversations?
    - is there a mention of a male pronoun or male character in all of their conversations?
  - FILM
    - Rating, Length, Genre

- SNA
  - degree centrality, or how many other characters are connected to the considered character
  - closeness centrality, or sum of the length from the considered character to all other characters divided by the number of characters
  - betweenness centrality, or a measure of how many of the shortest connections go “through” the considered character
  - the number of men a female character is connected to
  - how many other female characters are connected to this female character
- Normalization
  - LING, SNA: maximum, minimum, mean, standard deviation
  - FILM: one-hot encoding

Screenplay – T3

- Support-Vector Machine (SVM) with radial basis function kernel (RBF)
  - Averaged 5-fold cross-validation
  - Penalized mistake in minority class (films that fail T3) more than majority class
    - To avoid creating a binary classifier that optimizes for accuracy
- Ground truth comes from crowdsourced website:
  - www.bechdeltest.com

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Novels

Novel

- Novels lack defined structure of screenplays
- No direct previous research
- Texts analysed:

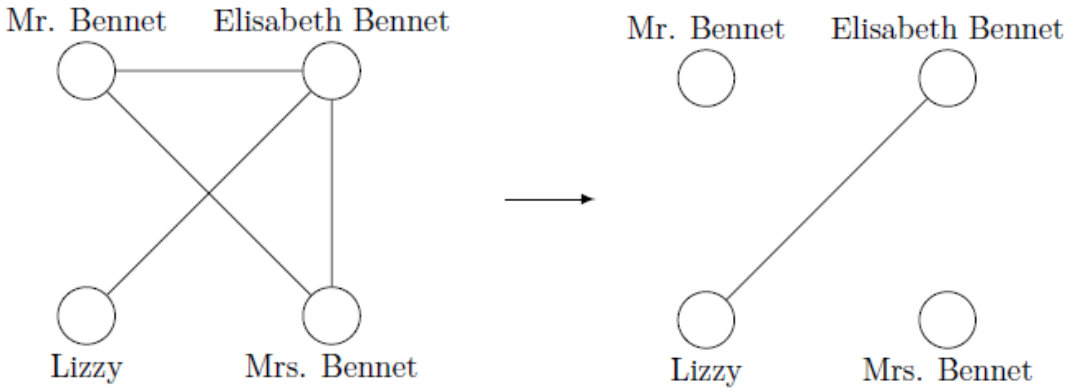
Author	Title	Year	Nr. named speakers	Bechdel score
Jane Austen	*Pride and Prejudice*	1813	18	3
Jane Austen	*Emma*	1815	26	3
Charles Dickens	*A Christmas Carol*	1843	11	3
Sir Arthur Conan Doyle	*A Scandal in Bohemia*	1888	11	1
Sir Arthur Conan Doyle	*The Red-Headed League*	1890	10	0

Novel - Parsing

- Named-Entity Recognition (NER)
  - Stanford implementation (NLTK)
  - Identifies “named-entities” from specific categories
  - “[Christian]$_{\text{Person}}$ went to the [Eiffel Tower]$_{\text{Location}}$ for the first time in [1990]$_{\text{Time}}$.”
- Part-of-Speech (POS) Tagger
  - Stanford POS tagger
- Coreference Resolution
  - Stanford NLP library
  - Coreference: two or more expressions refer to the same character
  - Holmes chuckled and wriggled in his chair, as was his habit when in high spirits. “It is a little off the beaten track, isn’t it?” said he.

Novel – T1

- Previous research on character detection in novels
  - Character names represented as nodes
  - Names belonging to the same character connected by edges
- Algorithm contains 7 steps that first add edges between names that could possibly belong to same character and then erase edges that are illogical
- For example:



Novel – T2

- Attribute each quote to a character
- Different types of quotes, different rules to define speaker
  - Character trigram
    - <TARGET_QUOTE> <SPEECH_VERB> <CHAR_1>
    - “What have you done?” asked **Emma**.
  - Anaphora trigram
    - ... **she** said “I did not know before that you ever walked this way.”
  - Dialogue chain
    - <OTHER_QUOTE by CHAR_1><TARGET_QUOTE>
    - “No more have I,” said **Mr. Bennet**; “and I am glad ...”
  - Single mention
    - Within paragraph of TARGET_QUOTE, only one character is mentioned

- Paragraph final
  - TARGET_QUOTE appears as last part of paragraph. Quote attributed to final mention in same paragraph.
  - ... **Sherlock Holmes**'s quick eye took in my occupation… "Beyond the obvious facts that he has at some time done manual labor,..."
- Conversation

  "What's his name" asked Mrs. Bennet. <OTHER_QUOTE by CHAR_1>

  "Bingley." <OTHER_QUOTE by CHAR_2>

  "Is he married or single?" <TARGET_QUOTE by CHAR_1>

- "Conservative" approach, analogue to screenplays, is then used to determine which characters converse

Novel – T3

- For each quote we determined whether the quote contains a reference to a male character or a male pronoun like “he”, by using the data we acquired for solving T1
- *A Christmas Carol* passes T3 based on this exchange between “Mrs. Cratchit” and her daughter “Martha”:

  “Why, bless your heart alive, my dear, how late you are!” said Mrs Cratchit...

  “We’d a deal of work to finish up last night,” replied Martha, “and had to clear away this morning, mother.”

Results - Novels

- Manually determined ground truth
- Overall:

Author	Title	Bechdel score	Predicted score
Jane Austen	*Pride and Prejudice*	3	3
Jane Austen	*Emma*	3	3
Charles Dickens	*A Christmas Carol*	3	3
Sir Arthur Conan Doyle	*A Scandal in Bohemia*	1	1
Sir Arthur Conan Doyle	*The Red-Headed League*	0	0

Conclusion

- Amount of available text is increasing. Having ways to automatically process this data is vital to getting the most use out of it
  - Make large-scale analyses possible
- Ideas for future research:
  - Use actual video/audio of film
  - Now: screentime male/female characters

References

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Any Questions?