Automatic Detection of Scenes in Narrative Text

By: Dr. Tarfah Alrashid
University of Jeddah

Research Focus

Explore the idea that narrative **scenes** are divisions found in all narratives which amongst other things have to do with physical setting.

Motivation

- **Why do automatic scene segmentation?**

- To support:
  - narratives studies
  - automatic text illustration/story picturing
  - aligning text and movies
  - automatic image description
  - automatic narrative generation

جامعة جدة
University of Jeddah

SceneML

SceneML

- A **scene** is a unit of a story in which the elements: **time**, **location**, and main **characters** are constant
- Any **change** in these elements indicates a change of **scene**
- **Entities:**
  - scenes – the main element in SceneML – abstract discourse elements
  - SDSs (scene description segments) – the actual strings of text that comprise a scene – one or more per scene
  - STs (scene transition segments)
  - characters
  - times
  - locations

جامعة جدة
University of Jeddah

SceneML

جامعة جدة
University of Jeddah

SceneML

- **Scene-Scene Narrative Progression Relations:**
  - **Sequence:** a scene change happens because of a change in location or characters, but the action follows directly on from the preceding scene
  - **Analepsis:** when there is a flashback in the scene, e.g. memory of the past
  - **Prolepsis (or flashforward**): when we are taken forward in time
  - **Concurrence:** when the transition happen because there is another **thread** of the story happening **at the same time**, so the transition take us to different characters and different places at the same time

SceneML

جامعة جدة
University of Jeddah

SceneML

- Other relational links
  - character – scene
  - time – scene
  - location - scene
- Updated Guideline: added **Same Scene As** relation

SceneML

SceneML

- **non-scene segments** categorizing them into three types:
  - general philosophizing or opinion segments,
  - background information segments,
  - and narrative summary or catchup segments.

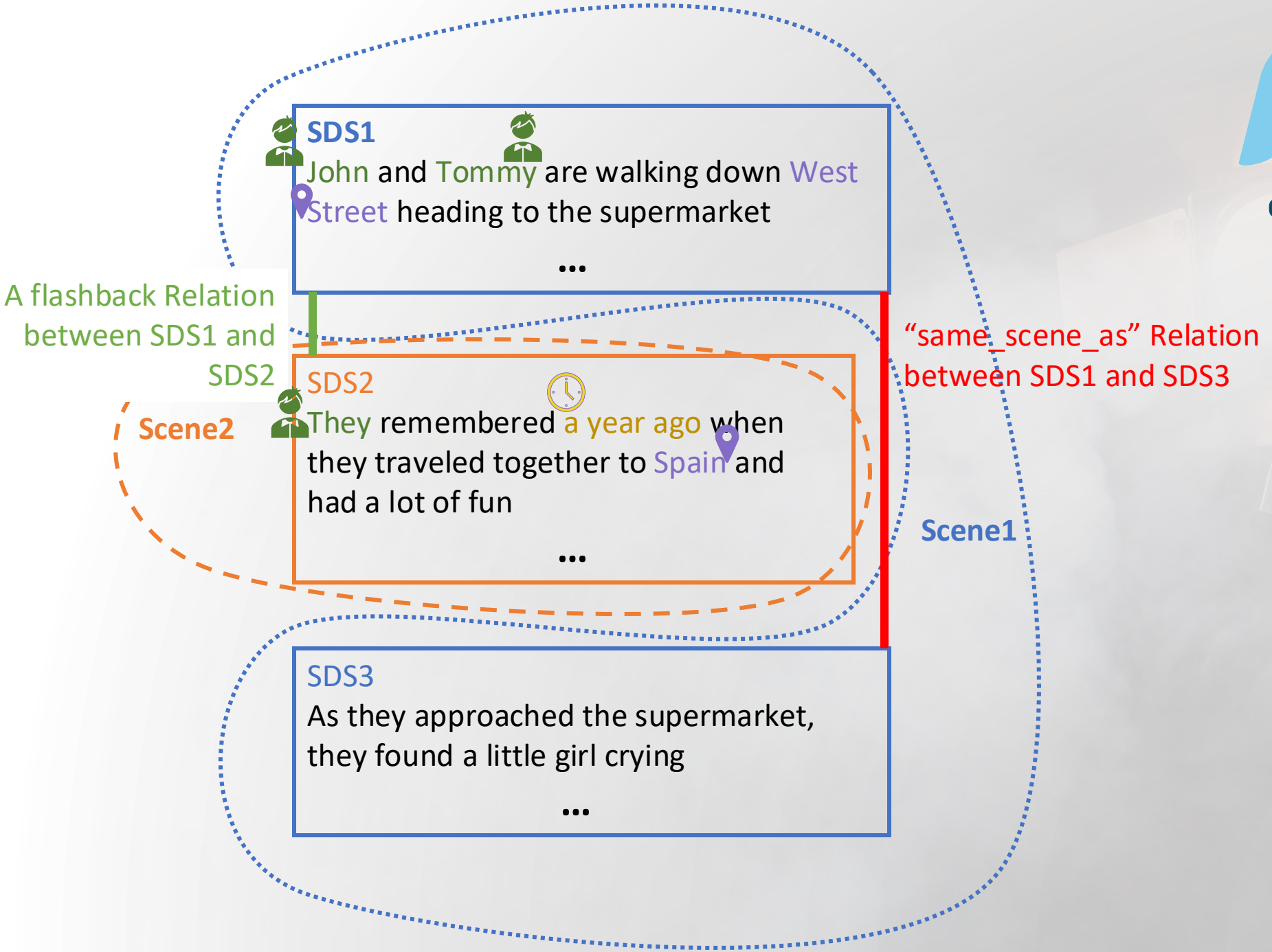
- Example:

  It is a truth universally acknowledged, that a single man in possession of a good fortune, must be in want of a wife. However little known the feelings or views of such a man may be on his first entering a neighbourhood, this truth is so well fixed in the minds of the surrounding families, that he is considered the rightful property of some one or other of their daughters.
  (Pride and Prejudice. p. 1)

SceneML

Example of SceneML annotation:

John and Tommy are walking down West Street heading to the supermarket. They remembered a year ago when they traveled together to Spain and had a lot of fun. As they approached the supermarket, they found a little girl crying


SDS1
John and Tommy are walking down West Street heading to the supermarket
...
A flashback Relation between SDS1 and SDS2
"same_scene_as" Relation between SDS1 and SDS3
SDS2
Scene2
They remembered a year ago when they traveled together to Spain and had a lot of fun
...
Scene1
SDS3
As they approached the supermarket, they found a little girl crying
...

Corpus Sources

1. *Bunnies from the Future*, a middle grade children's story by Joe Corcoran
2. *The Wonderful Wizard of Oz*, originally released as part of the **Brown Corpus**
3. *Pride and Prejudice*, *A Tale of Two Cities*, *The Adventures of Sherlock Holmes* and *The Great Gatsby* from **Project Gutenberg**

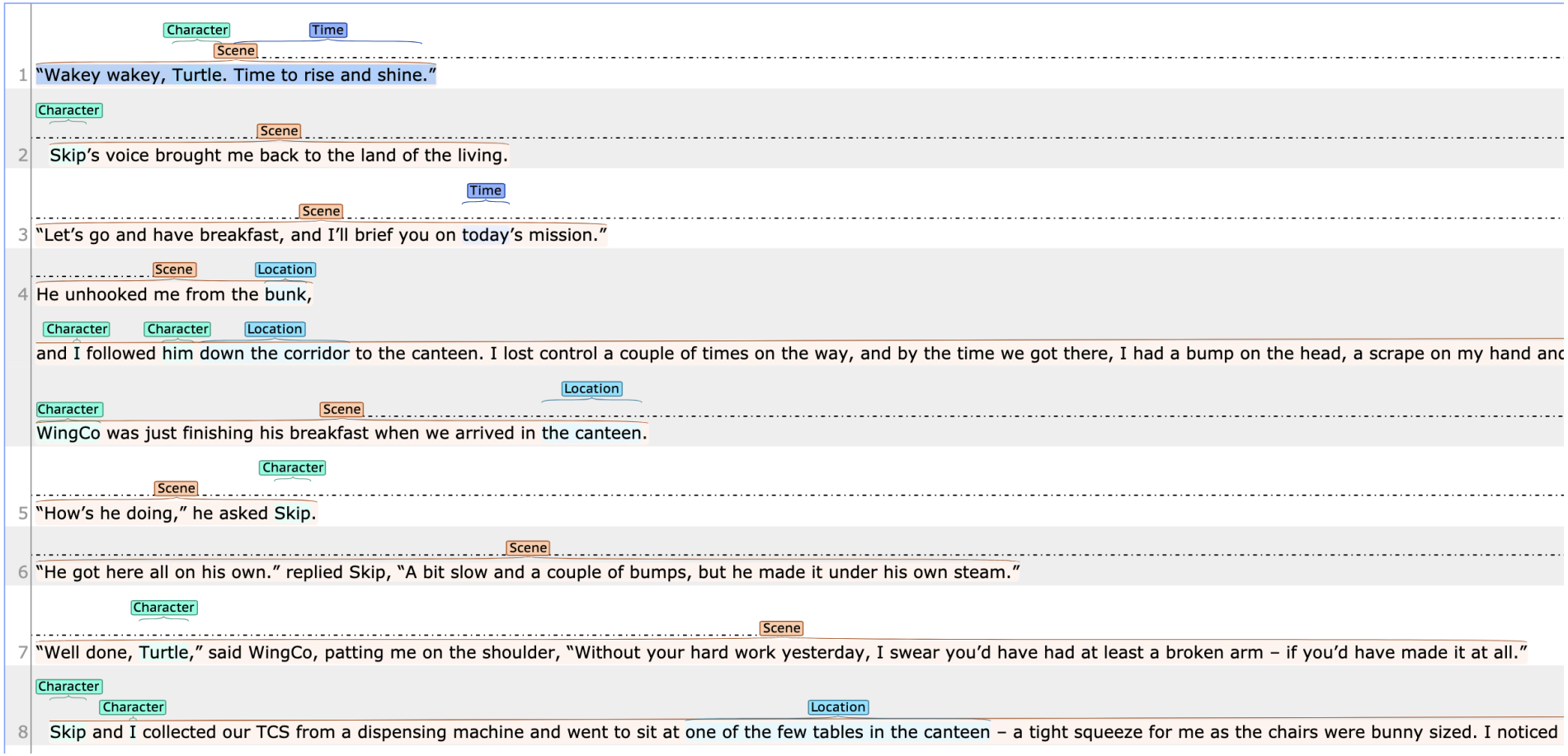
The Annotation Process

- Training process:
  - initial training session with a presentation,
  - demonstration and
  - hands-on exercise for the trainees,
  - A follow-on take-away exercise that was scored against gold-standard annotations produced by the authors and then discussed with the trainees
- **Improvement** of the initial **guidelines** to remove sources of confusion revealed in the earlier pilot
- Annotators:
  - native English-speaking annotators
  - two PhD students, one in English Literature and one in Computational Linguistics

The Annotation Process

- Brat Annotation Tool
  - swipe and click web-based interface
  - annotate SDSs and STs
  - Multiple SDSs that are part of the same scene were linked using the Brat relation annotation
  - The annotated data is stored and made available in BRAT standoff annotation format
- The corpus consists of fourteen chapters from six different narrative sources

Annotation Example



The ScANT Corpus: Statistics

			SDSs		STs		Scenes		NSS	
Text	Sents	Words	A1	A2	A1	A2	A1	A2	A1	A2
Bunnies Ch3	124	2756	8	10	1	0	8	9	0	0
Bunnies Ch4	65	1775	10	8	0	0	9	7	0	0
Bunnies Ch5	173	3514	10	7	0	3	10	7	0	0
Bunnies Ch6	117	2911	10	10	0	6	10	10	0	0
WOZ CH2	132	2449	4	8	0	2	4	8	0	1
WOZ CH3	123	2361	9	8	1	7	9	8	1	1
Sherlock Holmes Ch1 P1	268	4200	11	10	0	4	11	10	17	0
Sherlock Holmes Ch1 P2	277	4784	23	11	1	6	20	11	0	0
Sherlock Holmes Ch1 P3	93	1333	8	6	0	5	8	6	2	0
Sherlock Holmes Ch6	561	10974	31	34	2	15	26	34	8	0
Pride and Prejudice Ch1	60	1018	1	3	0	2	1	3	6	0
Pride and Prejudice Ch3	86	1984	12	10	0	5	12	10	0	0
A Tale of Two Cities Ch1	19	1140	0	5	0	4	0	5	19	0
A Tale of Two Cities Ch3	73	1920	4	13	0	4	4	13	11	0
The Great Gatsby Ch1	337	7209	19	43	1	12	19	43	52	0
The Great Gatsby Ch3	288	5307	31	24	0	10	29	24	13	0
Total	2796	55635	191	210	6	85	180	208	129	2

- The variation between annotators **A1** and **A2** is relatively **small** in terms of **SDSs** and **Scenes**
- They are **far apart** regarding both **scene transition** segments **(ST)** and **non-scene** segments

The ScANT Corpus: Inter-annotator Agreement

Chapter	SDS Medians	N (30%)	N = 0	N = 1	N = 3	N = 5
Bunnies Chapter 3	7	0.79	0.74	0.74	0.79	0.79
Bunnies Chapter 4	5.5	0.60	0.60	0.60	0.60	0.60
Bunnies Chapter 5	14.5	0.45	0.29	0.29	0.45	0.45
Bunnies Chapter 6	5.75	0.68	0.47	0.47	0.72	0.76
WOZ Chapter 2	19.75	0.47	0.11	0.11	0.27	0.41
WOZ Chapter 3	11	0.77	0.57	0.57	0.72	0.77
Sherlock Holmes Chapter1 part 1	10.5	0.16	0.07	0.07	0.16	0.16
Sherlock Holmes Chapter1 part 2	8	0.53	0.42	0.42	0.53	0.53
Sherlock Holmes Chapter1 part 3	8.75	0.75	0.75	0.75	0.75	0.75
Sherlock Holmes Chapter 6	8.5	0.37	0.25	0.25	0.37	0.40
Pride and Prejudice Chapter 1	16	0.65	0.65	0.65	0.65	0.65
Pride and Prejudice Chapter 3	6.25	0.65	0.43	0.43	0.65	0.65
Tale of Two Cities Chapter 1	1.5	0.00	0.00	0.00	0.00	0.00
Tale of Two Cities Chapter 3	6.5	0.21	0.01	0.01	0.30	0.39
The Great Gatsby Chapter 1	7.5	0.34	0.22	0.22	0.34	0.39
The Great Gatsby Chapter 3	6	0.49	0.38	0.38	0.58	0.66
Average	8.94	0.53	0.40	0.40	0.53	0.56

- Inter-annotator agreement results for **SDSs** using **Cohen's Kappa**
- **Tags:** 1 for sentences on the boundary of an SDS, 0 otherwise

Automatic Scene Segmentation – Model Overview

- **Task formulation**: Sentence-level classification — label sentence as SDS-boundary (1) or not (0)
- **Models tested**:
  - **CRF** (sequence labeling using custom linguistic features)
  - **BERT** (fine-tuned transformer for classification)
  - **Sentence-Pair BERT** (sentence + 2 sentences before/after for richer context)
- **Baseline**: Most Common Class (MCC)

BERT-based Models

Model 2 – BERT Classifier

- Treats each sentence **independently**
- Fine-tuned using HuggingFace Transformers
- Tested with both **BERT-cased** and **BERT-uncased** versions

BERT-based Models

Model 3 – Sentence-Pair Classification with BERT

- Incorporates **broader context** around the target sentence
- Input format: a pair
  - Sentence s_i
  - Context window: $s_{i-2} + s_{i-1} + s_i + s_{i+1} + s_{i+2}$

$$[s_1, s_2, \ldots, s_N]$$

$$\downarrow$$

$$[(s_1, c_1), (s_2, c_2), \ldots, (s_N, c_N)]$$

where $c_i = s_{i-2} + s_{i-1} + s_i + s_{i+1} + s_{i+2}$

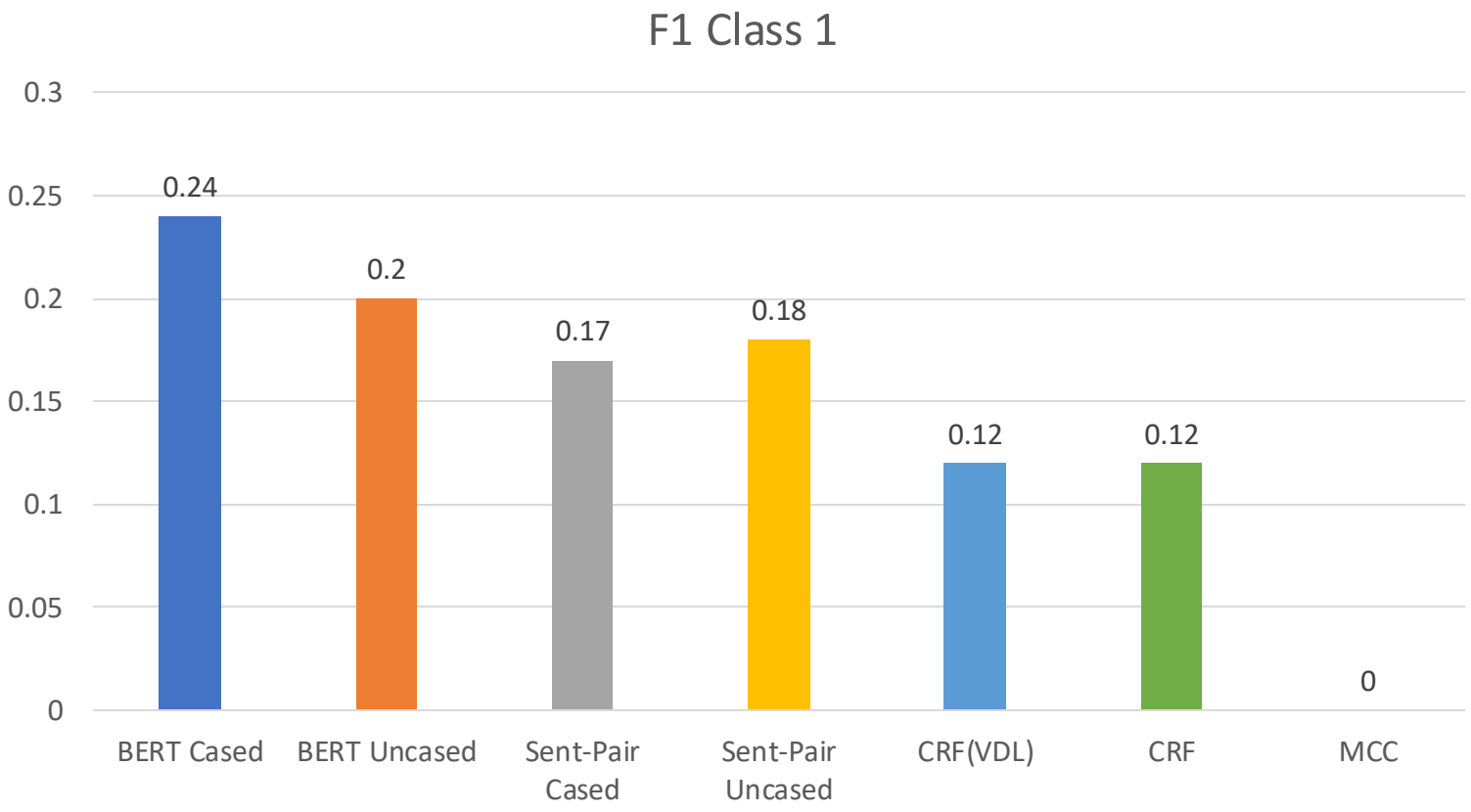
CRF Model – Feature Engineering

- Transition phrases (e.g., "later", "after")
- Position (beginning/end of paragraph or chapter)
- POS tags (current, ±2 sentences)
- Named Entities
- Contextual features (±2 sentences included)

Results

Model	Accuracy	Balanced Acc	P (W)	R (W)	F1 (W)	P (M)	R (M)	F1 (M)	F1 (Class 0)	F1 (Class 1)
BERT Cased	0.92	0.58	0.88	0.89	0.87	0.64	0.58	0.59	0.94	**0.24**
BERT Uncased	0.92	0.56	0.87	0.89	0.88	0.61	0.56	0.57	0.94	0.20
Sent-Pair Cased	0.90	0.51	0.86	0.85	0.84	0.56	0.55	0.54	0.91	0.17
Sent-Pair Uncased	0.90	0.55	0.87	0.85	0.84	0.55	0.53	0.51	0.92	0.18
CRF (VDL)	0.90	0.52	0.85	0.88	0.85	0.59	0.52	0.52	0.93	0.12
CRF	0.87	0.52	0.86	0.89	0.86	0.64	0.52	0.53	0.91	0.12
MCC (Baseline)	0.92	0.50	0.84	0.92	0.88	0.46	0.50	0.48	0.96	0.00

Model Performance (F1 Score)



Thank you