

Abstracting Terms of Service

Nicholas Lin, Sophie Chance, Yoni Nackash

DATASCI 266 – Natural Language Processing

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- 03 Full Orchestration Pipeline
- 04 Stage 1 - Classification
- 05 Stage 2 - Paraphrasing

01

Problem Statement

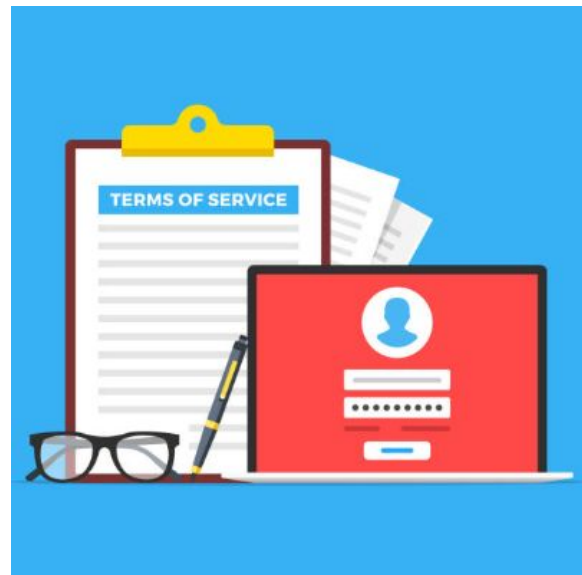
Background

Problem Statement

- Nearly all online services have a ToS agreement
- ToS documents are long and difficult to understand
- People often agree without fully understanding it

Goal

- Identify important sentences (highlights)
- Paraphrase (highlights)



02

Data Collection +
Preprocessing

DATA – Terms of Service; Didn't Read (ToS;DR)

Terms of Service Document

Highlighting

Paraphrasing

ToS;DR Annotate a service Cases Topics Annotate About Menu

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ToS;DR Annotate a service Cases Topics Annotate About Menu

Private messages can be read [Add Comment](#)

Service: GrubHub **Status:** ✓ APPROVED **Case:** Private messages can be read **Changes:** 3 **Source:** [link](#) **Author:** levijneuwirth (32840)

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Final Dataset:

- ToS for 171 Services (companies)
- 50,807 sentences
- 3,617 highlights

DATA - Sentence & Chunk Examples

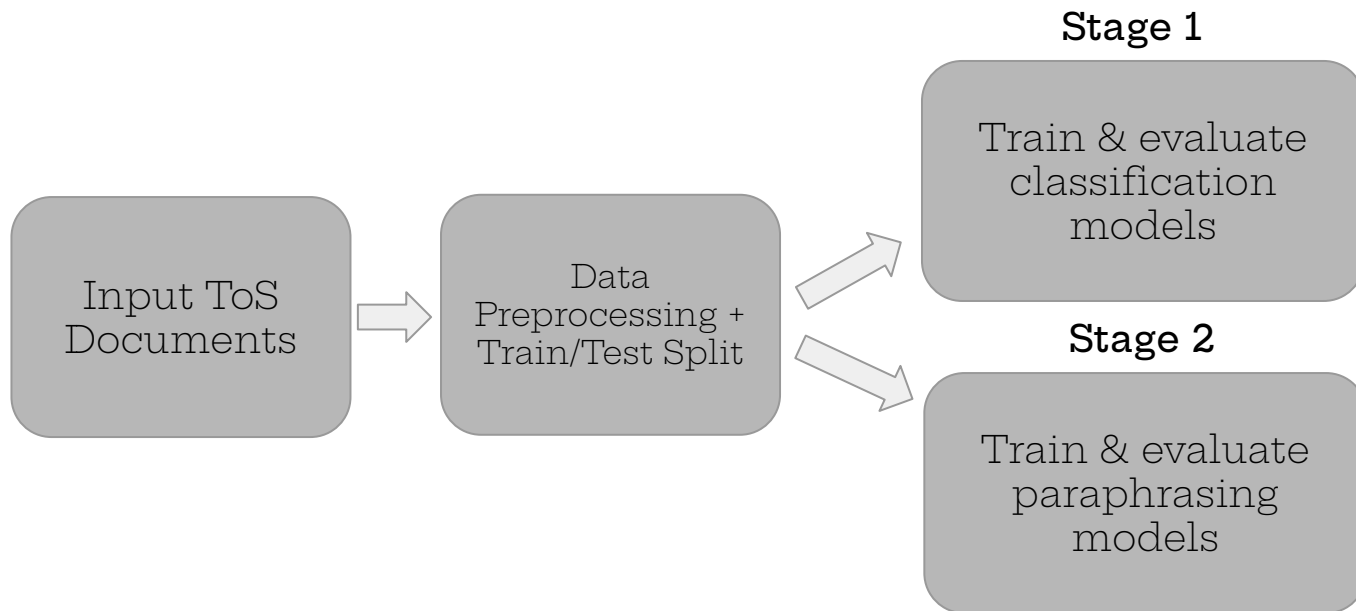
7

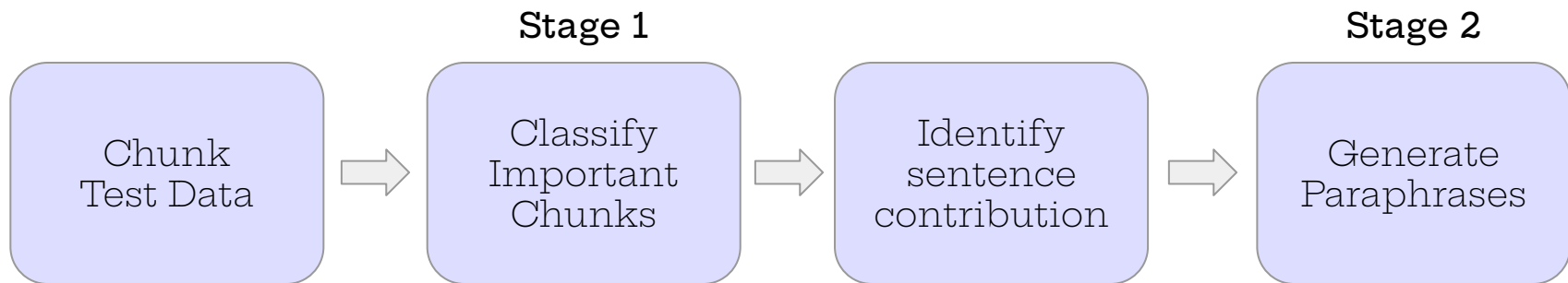
Sentence	Highlight	Paraphrase
Telegram is a messaging app with a focus on speed and security, its superfast, simple and free.	NA	NA
We do not use cookies for profiling or advertising.	We do not use cookies for profiling or advertising.	The service does not use third-party analytics or tracking platforms

Chunk	Highlight	Paraphrase
Telegram is a messaging app with a focus on speed and security, its superfast, simple and free. You can use Telegram on all your devices at the same time your messages sync seamlessly across any number of your phones, tablets or computers. With Telegram, you can send messages, photos, videos and files of any type doc, zip, mp3, etc, as well as create groups for up to 200,000 people or channels for broadcasting to unlimited audiences.	NA	NA
The only cookies we use are those to operate and provide our Services on the web. We do not use cookies for profiling or advertising. The cookies we use are small text files that allow us to provide and customize our Services, and in doing so provide you with an enhanced user experience.	We do not use cookies for profiling or advertising.	The service does not use third-party analytics or tracking platforms

03

Full Orchestration Pipeline





04

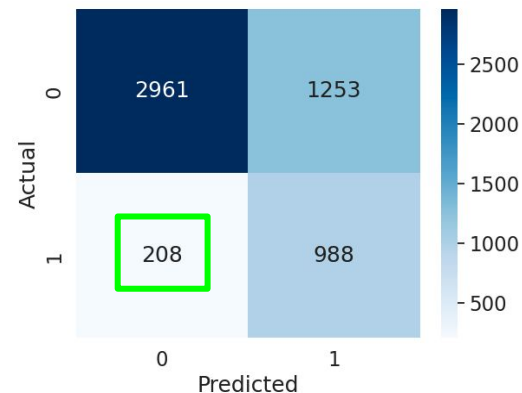
Stage 1 - Classification

Stage 1 Classification - Model Experiments

Model	Train Accuracy: Sentence	Test Accuracy: Sentence	Train Accuracy: Chunk	Test Accuracy: Chunk
Baseline - Logistic Regression	0.805	0.646	0.822	0.704
CNN	0.768	0.641	0.820	0.727
T5	0.570	0.306	0.545	0.490
BERT Classification	0.553	0.333	0.868	0.729

BERT Evaluation	Value
Accuracy	0.729
Recall	0.826
Precision	0.441
F1 Score	0.575

- **Chunk-level breakout consistently outperformed sentence-level**
- **BERT – capture the contextual meaning of the text**
 - Include/exclude [SEP] token between sentences within chunks
 - Architecture: CLS token → dense layers → classification
 - Best improvement over baseline
- **Optimize for recall**
 - Preferable to over highlight unnecessary text (false positives), rather than miss true important text (false negatives)



Stage 1 Classification - Model Experiments

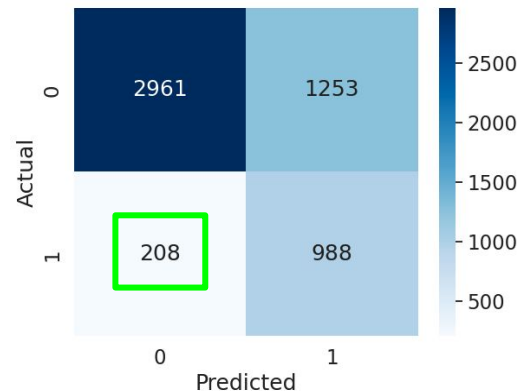
Model	Train Accuracy: Sentence	Test Accuracy: Sentence	Train Accuracy: Chunk	Test Accuracy: Chunk
Baseline - Logistic Regression	0.805	0.646	0.822	0.704
CNN	0.768	0.641	0.820	0.727
T5	0.570	0.306	0.545	0.490
BERT Classification	0.553	0.333	0.868	0.729

- Chunk-level breakout consistently outperformed sentence-level
- Fine-tuned BERT had greatest improvement over baseline

Stage 1 Classification - BERT Model

- **Architecture:** CLS token → dense layers → classification
- **Optimized recall**
 - Preferable to over highlight unnecessary text (false positives), instead of missing true important text (false negatives)

BERT Evaluation Metrics	Value
Accuracy	0.729
Recall	0.826
Precision	0.441
F1 Score	0.575

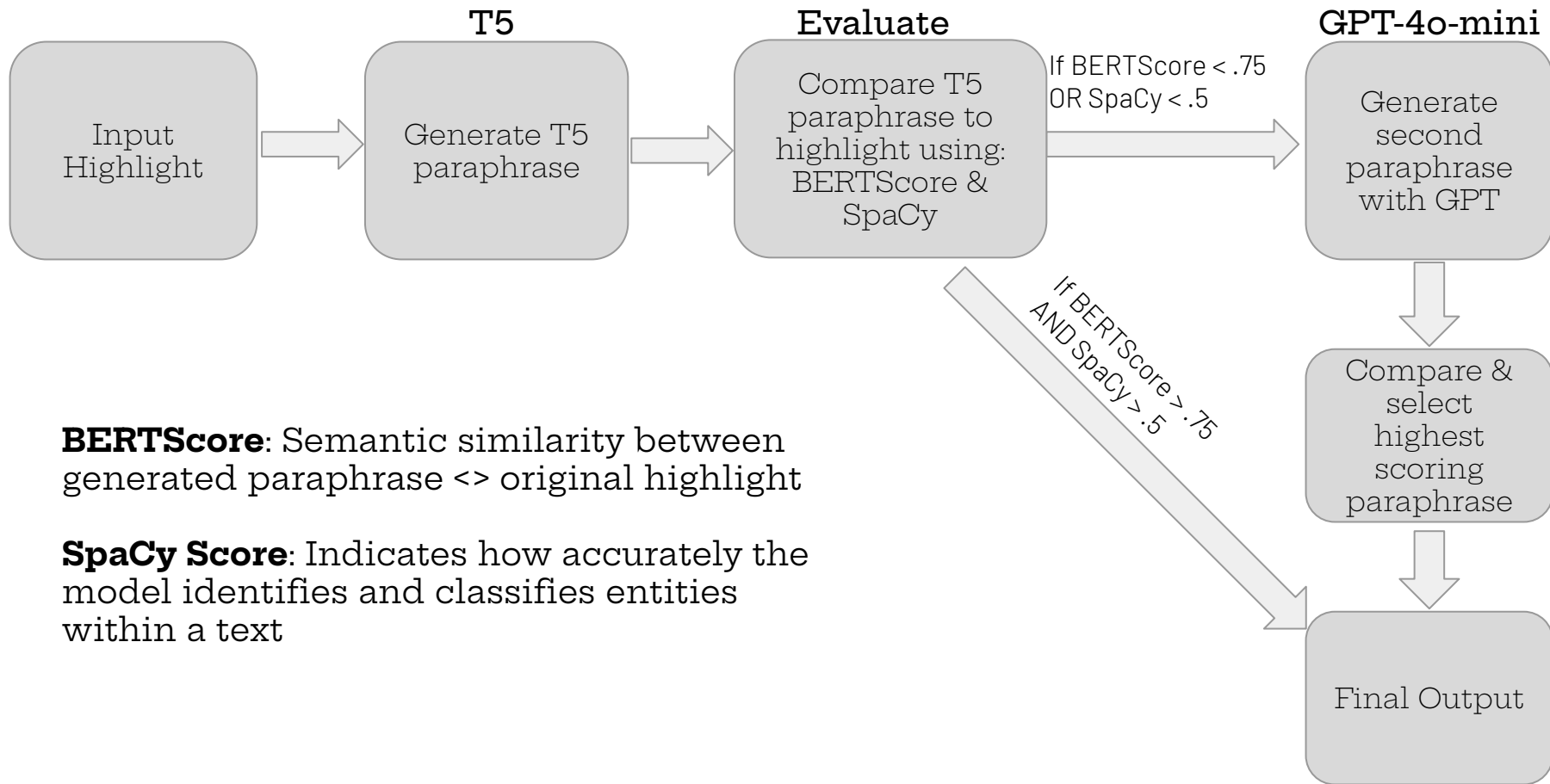


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Stage 2 - Paraphrasing

Stage 2 Waterfall Architecture

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Highlight

Legal age depends on the national legislation applicable to the User probably you need to be 18 years old.

Paraphrase

This service is only available to users over a certain age

Generated Paraphrase

This service is only available to users over 18 years of age

Highlight provided by Stage 1	Paraphrase	Generated Paraphrase	BERT Score	SpaCy Score
Such information is intrinsically fluctuant and may be inaccurate, incomplete or outdated. Waze does not provide any warranties to such informations credibility or reliability. Location based Service.	The service does not guarantee accuracy or reliability of the information provided	The service does not guarantee accuracy or reliability of the information provided	1	1
Legal age depends on the national legislation applicable to the User probably you need to be 18 years old.	This service is only available to users over a certain age	This service is only available to users over 18 years of age	.961	.895
Allscripts reserves the right to restrict who is eligible for an account. Allscripts reserves the right in its sole discretion to determine who may qualify for an account and reserves the right to reject or revoke any account at any time without liability. Allscripts may enable you to create accounts for minors or other members of your family over whom you have legal authority.	Your account can be deleted without prior notice and without a reason	The service can delete your account without prior notice and without a reason	.958	.930

Over complication

Paraphrase

The service has a no refund policy

Generated Paraphrase

This service assumes no liability for any losses or damages resulting from any matter relating to the service

Wrong Audience

This service requires first-party cookies

The service provides information about how they intend to use your personal data

Incorrect

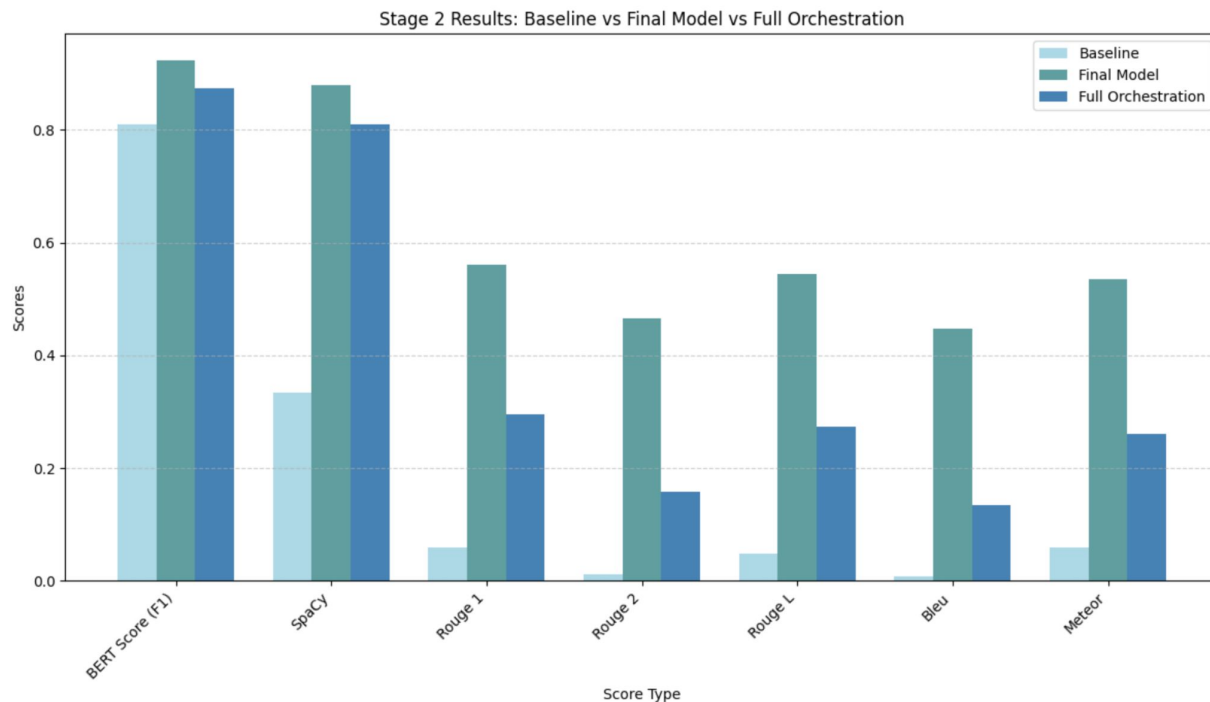
Spidering or crawling is not allowed

The service may use your personal data for marketing purposes

Stage 2 - Errors

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Error Type	Highlight	Found Highlights	Paraphrase	Generated Paraphrase	BERT Score	SpaCy Score
Over Complication	All purchases of Services through the Site are nonrefundable prepayments for Services.	All purchases of Services through the Site are nonrefundable prepayments for Services.	The service has a no refund policy	This service assumes no liability for any losses or damages resulting from any matter relating to the service	.85	.75
Wrong Audience	We call these strictly necessary cookies.	We use them to make sure our digital services work correctly and are meeting audience needs and interests.	This service requires first-party cookies	The service provides information about how they intend to use your personal data	.88	.76
Wrong language	El USUARIO se compromete a hacer un uso adecuado de los contenidos y servicios como por ejemplo servicios de chat, foros de discusión o grupos de noticias que EDICIONES EL PAÍS ofrece a través de su Site y con carácter enunciativo pero no limitativo, a no emplearlos para incurrir en actividades ilícitas, ilegales o contrarias a la buena fe y al orden público.	En dicho registro el USUARIO ser responsable de aportar información veraz y leída.	Users agree not to use the service for illegal purposes	El usuario debe proporcionar información veraz al registrarse	.78	.09
Incorrect	Use or launch any automated system including, without limitation, any robot, spider or offline reader that accesses the Service.	Use or launch any automated system including, without limitation, any robot, spider or offline reader that accesses the Service. Collect or harvest any personal data of any user of the Website or any Service and agree that this shall be deemed to include Prezi account names. Use the Prezi Services including the comments and email features for spamming, advertising, or other solicitation of business in the course of trade or in connection with a commercial enterprise.	Spidering or crawling is not allowed	The service may use your personal data for marketing purposes	.77	.66



- T5 un-trained was very bad
- Highest Scores: Model w/o Stage 1
- Rouge/Bleu Scores dropped when different highlight given

Score Type	Baseline	Final Model	Full Orchestration (limited to only those with a given paraphrase)
BERTScore (F1)	0.810	0.924	0.873
SpaCy	0.334	0.880	0.810
Rouge 1	0.059	0.560	0.296
Rouge 2	0.012	0.465	0.159
Rouge L	0.048	0.545	0.273
Bleu	0.009	0.447	0.134
Meteor	0.059	0.536	0.260
GPT Generated (count)	0	2	71

Thank You!

Questions?