A Context-Aware System for Bias Identification in Job Advertisements using Natural Language Processing (NLP)

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Agenda

- Recap
- Pipeline
- Data
    - Preparation
    - Annotation
    - Augmentation
    - Difficulties
- BERT
    - What is BERT?
    - BERT for Classification
    - Suggestion
- Phase 3

Recap

Taxonomy of Gender Bias

- Five parent bias types
  - Generic Pronouns
  - Stereotyping Bias
  - Sexism
  - Exclusionary Terms
  - Semantic Bias

- Two subtypes each

Bias Type	Bias Subtype	Example	Methodology
Generic Pronouns	Generic He	A programmer must carry his laptop with him to work.	Supervised Learning
	Generic She	A nurse should ensure that she gets adequate rest.	Supervised Learning
Stereotyping Bias	Societal Stereotypes	Senators need their wives to support them throughout their campaign.	Supervised Learning
	Behavioural Stereotypes	The event was kid-friendly for all the mothers working in the company.	Supervised Learning
Sexism	Hostile Sexism	Women are incompetent at work.	Supervised Learning
	Benevolent Sexism	They're probably surprised at how smart you are, for a girl.	Supervised Learning
Exclusionary Terms	Explicit Marking of Sex	Chairman, Businessman, Manpower, Cameraman	Lexicon-Based
	Gendered Neologisms	Man-bread, Man-sip, Man-tini	Lexicon-Based
Semantic Bias	Metaphors	"Cookie": lovely woman.	Supervised Learning
	Old Sayings	A woman's tongue three inches long can kill a man six feet high.	Supervised Learning

Figure 2: Overview of the taxonomy and link to detection methodology ([2])

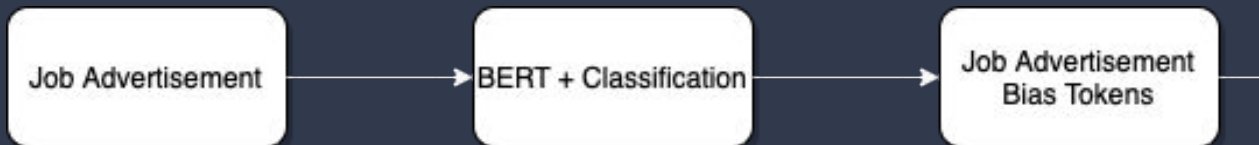# Recap

Taxonomy of Gender Bias

- Three parent bias types
  - Generic Pronouns
  - Stereotyping Bias
  - Exclusionary Terms

- Subtypes
  - Generic He
  - Generic She
  - Societal Stereotypes
  - Behavioural Sterotypes
  - Explicit Marking of Sex

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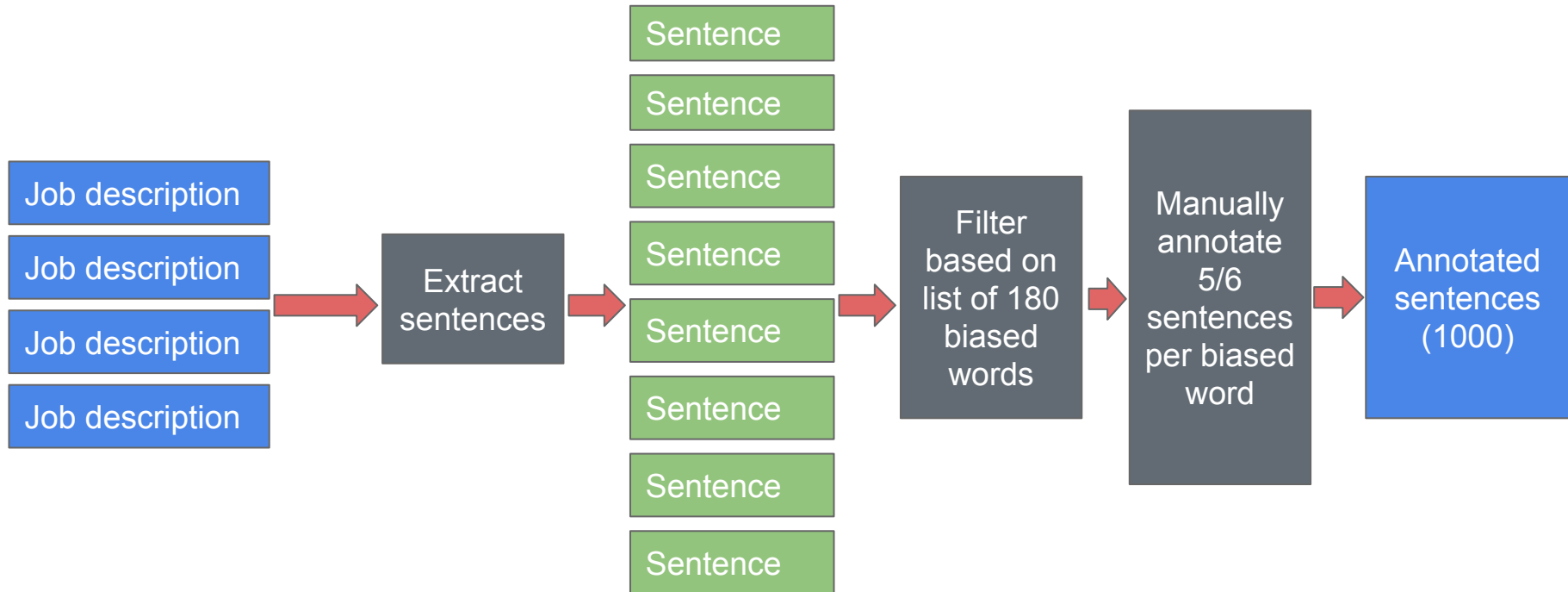Figure 2: Overview of the taxonomy and link to detection methodology ([2])

Pipeline

Dataset Preparation

Annotation (Doccano)

Create and support applications using Visual Studio 2013, MVC 5, Entity Framework 6,
•Non-biased

Dependency Injection and Web API 2, MS SQL 2012.
•Non-biased

Progress

Total   202

Complete   1

1%

Label Types

Non-biased 1

Societal Stereotypes e

Behavioural Stereotypes f

Explicit Marking of Sex k   Generic He

Generic She

Key	Value
word_in_sentence	[['dependency', 'F'], ['support', 'F']]

Data Augmentation

- replace random words in original sentence with synonyms
- replace random / insert words using contextual word embeddings

Original Sentence:

Our CTO decided to leave NY and go remote.

Augmented Sentences:

our current cto decided just to leave upstate ny and belong remote.

our one time cto finally decided to just leave ny and go away remote.

recently our new cto had resolve to leave downtown ny and go remote.

Difficulties

Dataset
- not enough samples (around 1000 after annotation)

Data Augmentation
- not suitable for generating labels
- not all the generated senteces make sense

Original Sentence:

You may be required to take a brief driving assessment dependent on experience.
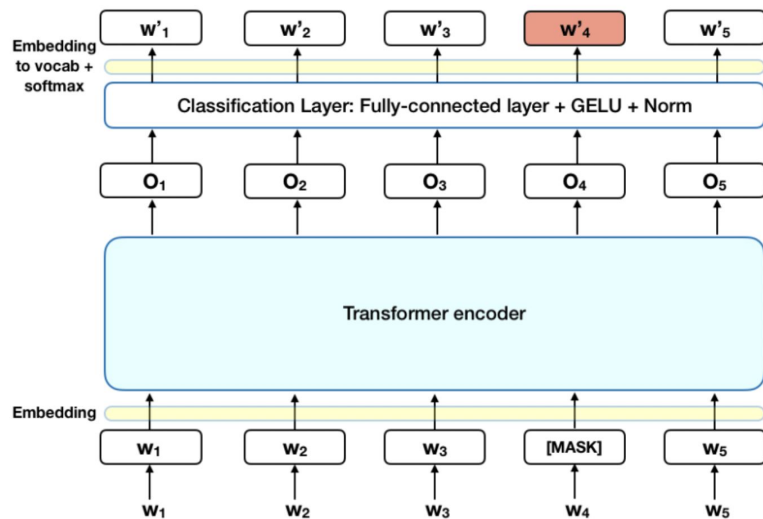
Augmented Sentences:

you may be physically required beforehand to take a brief driving accomplishment assessment qualified upon on driver experience.

you driving may to boot be also required to take a abbreviated impulsive assessment exam dependent solely on experience.
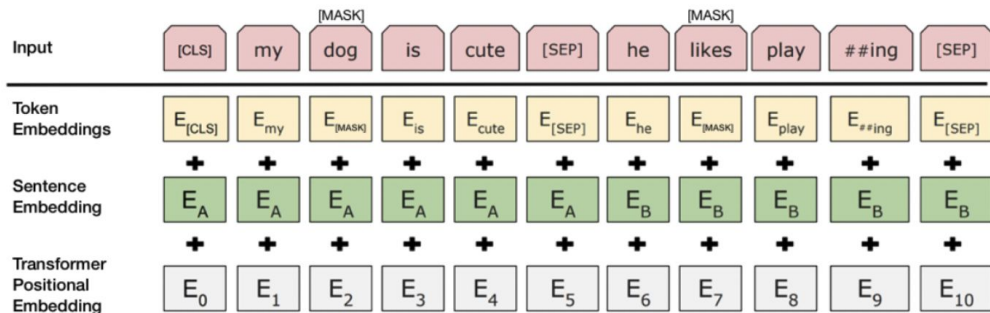
thank you drivers english hawthorn be required beforehand to take a sufficiently brief driver driving assessment dependent on experience.

What is BERT ?

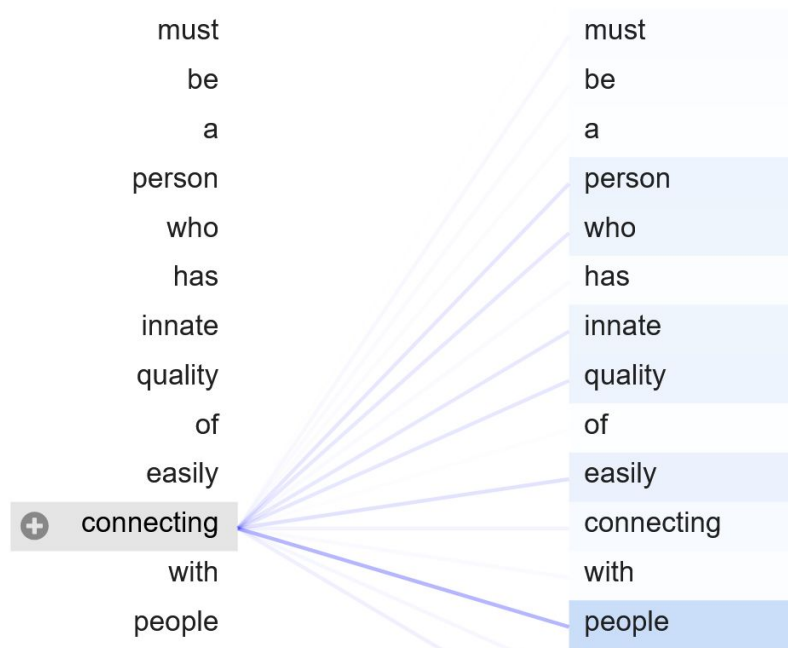Maskes LM

Next Sentence Prediciton

BERT (Attention)

Must be a person who has innate quality of easily connecting with people!

Model (Training) – 1

"connecting" - used in biased context

Must be an extrovert who has an innate quality of <u>easily connecting with people!</u>

•Behavioural Stereotypes

"connecting" - used in non-biased context

This is accomplished primarily by <u>connecting</u> your client(s) with potential customers of

•Non-biased

theirs for an initial phone call.

Model (Training) – 2

- 800 training sentences
- 200 testing sentences
- 6 Labels (Non-Biased, Generic He, Generic She, Behavioura Stereotypes, Societal Stereotypes, Explicit Marking of Sex)

Example of training sentence and label

Sentence
You're self-motivated and decisive, but willing to make changes with minimal grumbling when the client demands it.

Label
[O, O, O ,Behavioural Stereotypes, O, O, O, O, O, O, O, O, O, O, O, O, O, O]

Model (Prediction)

O - Non-biased
BS - Behavioural Stereotypes
i - Shows that it is inside a phrase

Example 1

Must be an extrovert who has innate quality of easily connecting with people !
O   O O   O   O   O   O   O   O   BS   i-BS   i-BS i-BS O

Example 2

Ideal candidates will be caring, compassionate, adaptable, flexible, committed to high standards of care
O   O   O O BS   BS   BS   BS   BS   O O   O   O   O

and possess excellent communication skills both verbal and written .
O   O   O   O   O   O   O   O   O   O

BERT (Suggestion)

To be considered for this position you must be energetic, friendly, compassionat and detail oriented.
BERT output: creative, patient, practical, athletic, intelligent

We are looking for a young and driven candidate who can bring innovation into the organization.
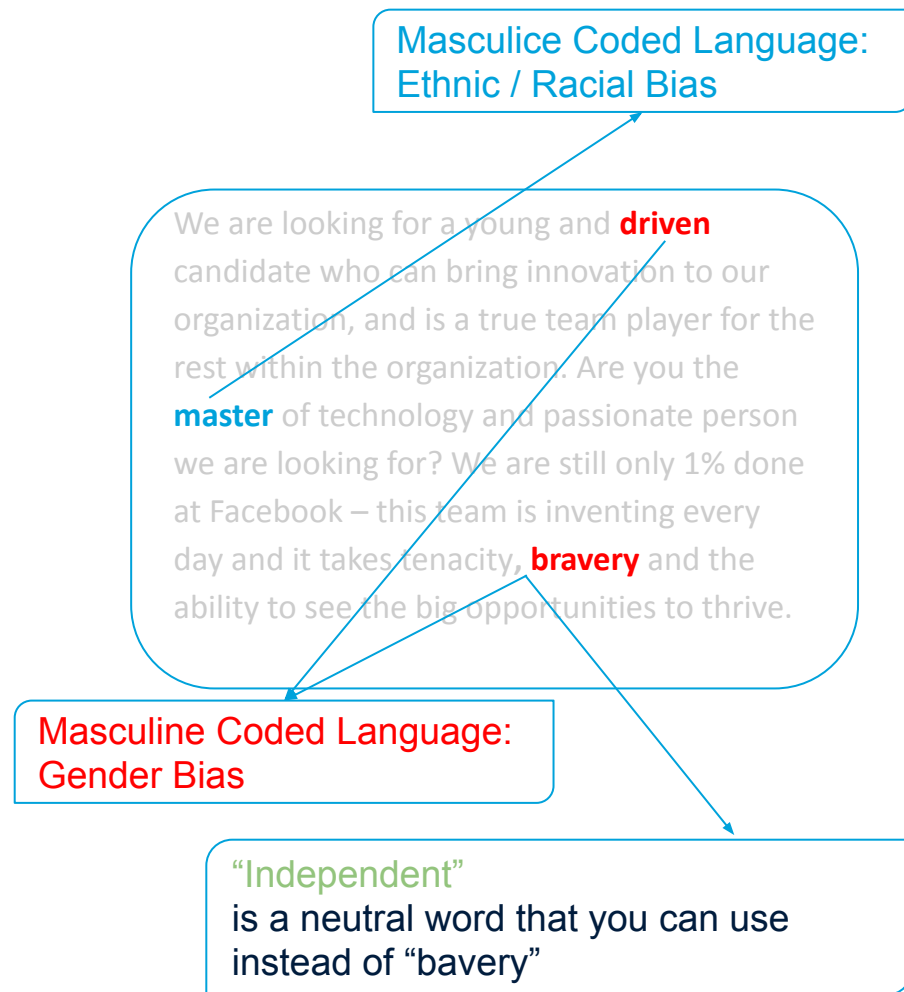BERT output: talented, promising, experienced, innovative, strong

Are you the master of technology and passionate person we are looking for?
BERT output: father, genius, king, voice, prince

Phase 3

- improvement of dataset
- implementation of suggestion system
- investigate key predictors
- demo of our application

Masculice Coded Language: Ethnic / Racial Bias

We are looking for a young and **driven** candidate who can bring innovation to our organization, and is a true team player for the rest within the organization. Are you the **master** of technology and passionate person we are looking for? We are still only 1% done at Facebook – this team is inventing every day and it takes tenacity, **bravery** and the ability to see the big opportunities to thrive.

Masculine Coded Language: Gender Bias

"Independent" is a neutral word that you can use instead of "bavery"

References

[1] R.Frissen.A-machine-learning-approach-to-recognize-bias-and-discrimination-in-job-advertisements, 2021

[2] J.Doughman and W.Khreich.Gender bias in text:Labeled datasets and lexicons.CoRR, abs/2201.08675, 2022

[3] Jacob Devlin, Ming-Wei Chang, Kenton Lee, Kristina Toutanova. BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. 2019

[4] Rani Horev. BERT Explained: State of the art language model for NLP. 2019. Accessed 19.05.22

Thanks!