Week 5

MORPH Algorithmic Fairness

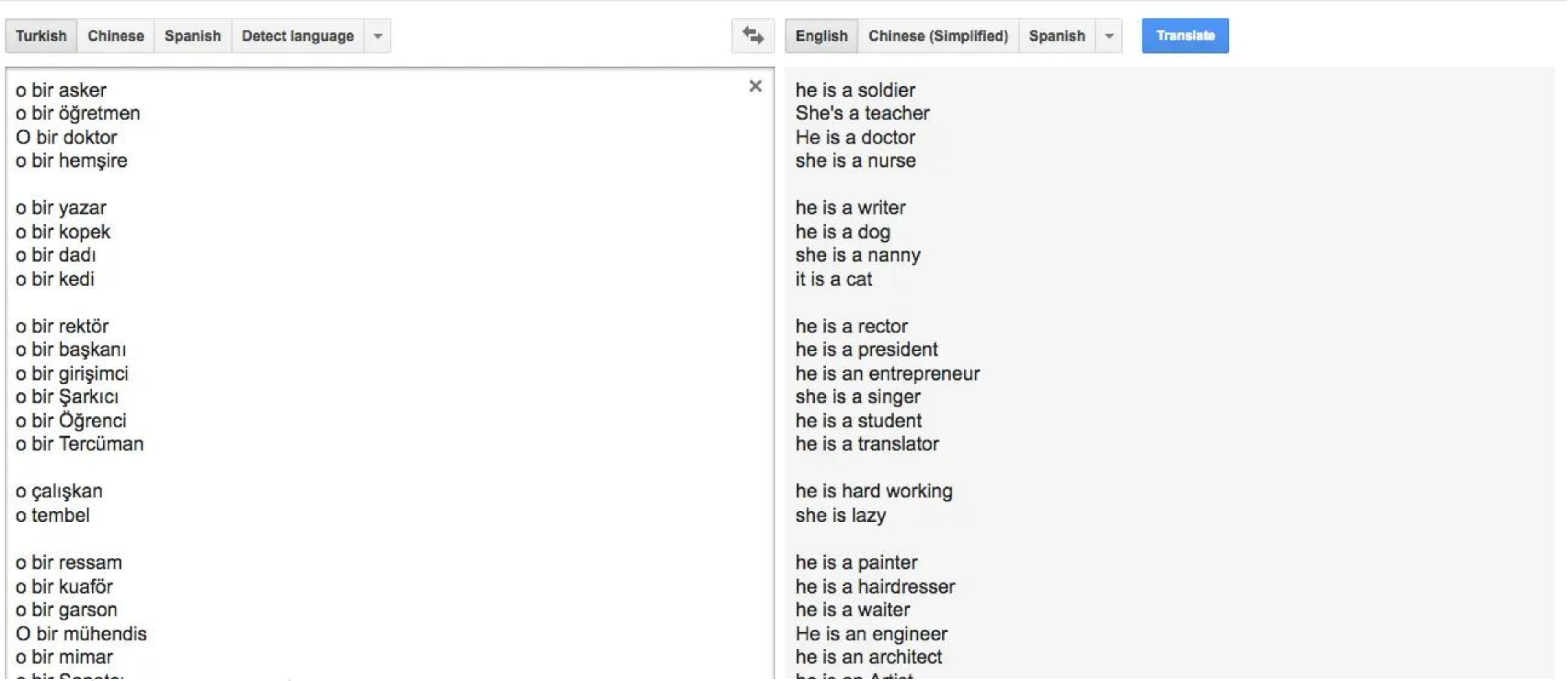
Agenda:
Applying Fairness to Algorithms II

- This Week in Fairness
- Fairness in NLP coding demo
- Fairness in Computer Vision
  - Discussion
- Week 6 preview

This Week in Fairness

Google

- Spoke at a conference recently about how they address ML fairness in their products
- Google Translate has a huge impact
  - ~50% of the content on the internet is in English, but only 20% of the world speaks English
  - “Google translates **140 billion words** every single day by **150 billion active users**, including 95% outside the U.S.”



o bir asker
o bir öğretmen
O bir doktor
o bir hemşire

o bir yazar
o bir kopek
o bir dadı
o bir kedi

o bir rektör
o bir başkanı
o bir girişimci
o bir Şarkıcı
o bir Öğrenci
o bir Tercüman

o çalışkan
o tembel

o bir ressam
o bir kuaför
o bir garson
O bir mühendis
o bir mimar
o bir Sanatçı

he is a soldier
She's a teacher
He is a doctor
she is a nurse

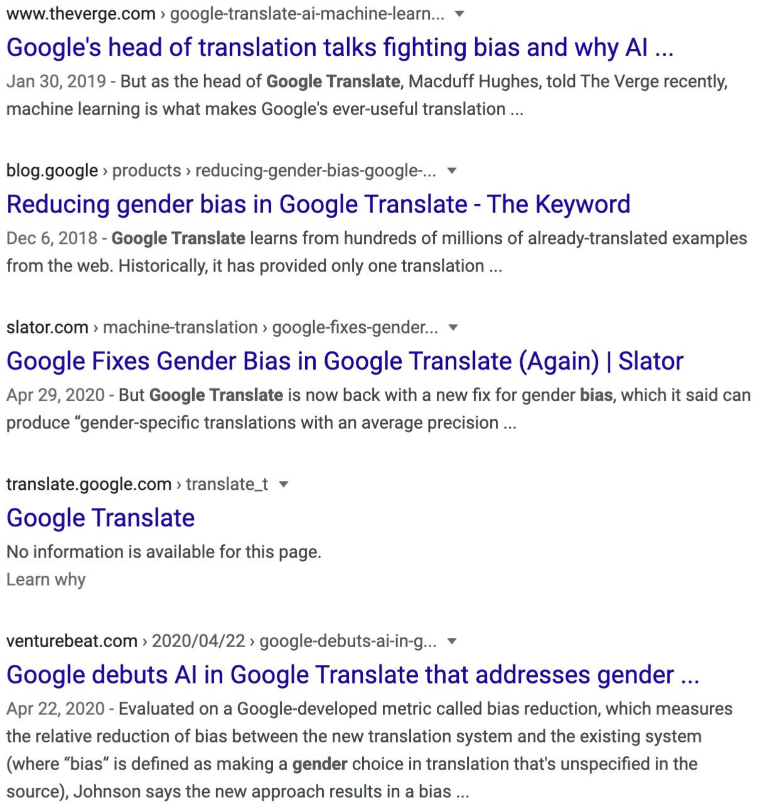
he is a writer
he is a dog
she is a nanny
it is a cat

he is a rector
he is a president
he is an entrepreneur
she is a singer
he is a student
he is a translator

he is hard working
she is lazy

he is a painter
he is a hairdresser
he is a waiter
He is an engineer
he is an architect
he is an Artist

Google Translate (2017)



www.theverge.com › google-translate-ai-machine-learn... ▾

Google's head of translation talks fighting bias and why AI ...

Jan 30, 2019 - But as the head of **Google Translate**, Macduff Hughes, told The Verge recently, machine learning is what makes Google's ever-useful translation ...

blog.google › products › reducing-gender-bias-google-... ▾

Reducing gender bias in Google Translate - The Keyword

Dec 6, 2018 - **Google Translate** learns from hundreds of millions of already-translated examples from the web. Historically, it has provided only one translation ...

slator.com › machine-translation › google-fixes-gender... ▾

Google Fixes Gender Bias in Google Translate (Again) | Slator

Apr 29, 2020 - But **Google Translate** is now back with a new fix for gender **bias**, which it said can produce “gender-specific translations with an average precision ...

translate.google.com › translate_t ▾

Google Translate

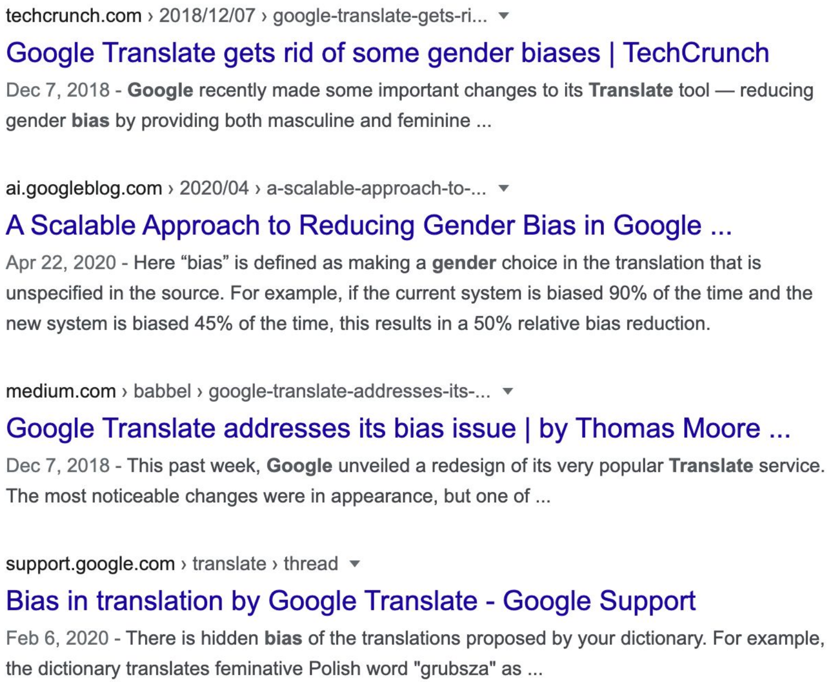
No information is available for this page.

Learn why

venturebeat.com › 2020/04/22 › google-debuts-ai-in-g... ▾

Google debuts AI in Google Translate that addresses gender ...

Apr 22, 2020 - Evaluated on a Google-developed metric called bias reduction, which measures the relative reduction of bias between the new translation system and the existing system (where “bias” is defined as making a **gender** choice in translation that's unspecified in the source), Johnson says the new approach results in a bias ...



techcrunch.com › 2018/12/07 › google-translate-gets-ri... ▾

Google Translate gets rid of some gender biases | TechCrunch

Dec 7, 2018 - **Google** recently made some important changes to its **Translate** tool — reducing gender **bias** by providing both masculine and feminine ...

ai.googleblog.com › 2020/04 › a-scalable-approach-to-... ▾

A Scalable Approach to Reducing Gender Bias in Google ...

Apr 22, 2020 - Here “bias” is defined as making a **gender** choice in the translation that is unspecified in the source. For example, if the current system is biased 90% of the time and the new system is biased 45% of the time, this results in a 50% relative bias reduction.

medium.com › babbel › google-translate-addresses-its-... ▾

Google Translate addresses its bias issue | by Thomas Moore ...

Dec 7, 2018 - This past week, **Google** unveiled a redesign of its very popular **Translate** service. The most noticeable changes were in appearance, but one of ...

support.google.com › translate › thread ▾

Bias in translation by Google Translate - Google Support

Feb 6, 2020 - There is hidden **bias** of the translations proposed by your dictionary. For example, the dictionary translates feminative Polish word "grubsza" as ...

Look at the dates!

Google Translate

- They collect data from many historical sources, such as the Bible
- Historical literature has many stereotypes/biases embedded in their data (as we’ve seen with the Bolukbasi paper)

How to resolve?

Flip a coin

Decide based on what users select or how they react to a translation

Provide multiple responses

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Flip a coin

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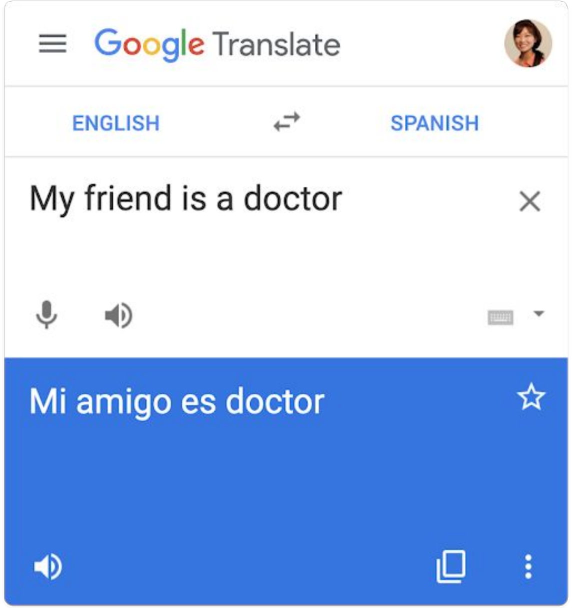
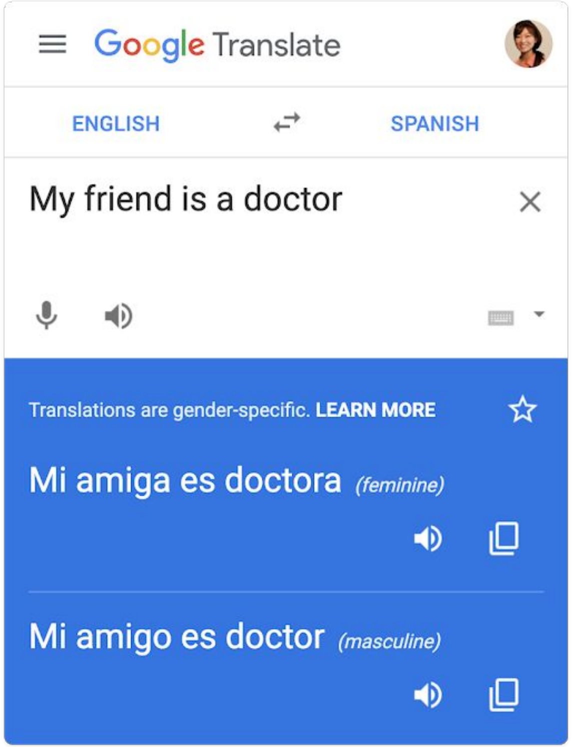
Before



My friend is a doctor

Mi amigo es doctor

After

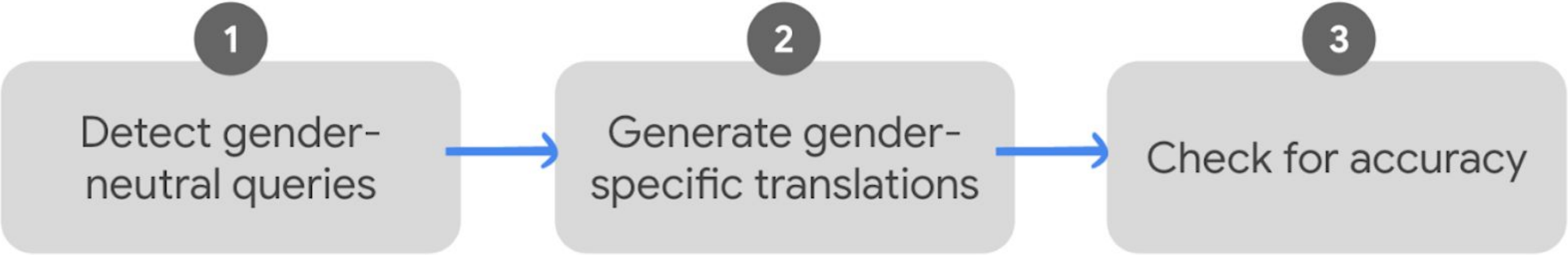


My friend is a doctor

Translations are gender-specific. **LEARN MORE**

Mi amiga es doctora *(feminine)*

Mi amigo es doctor *(masculine)*

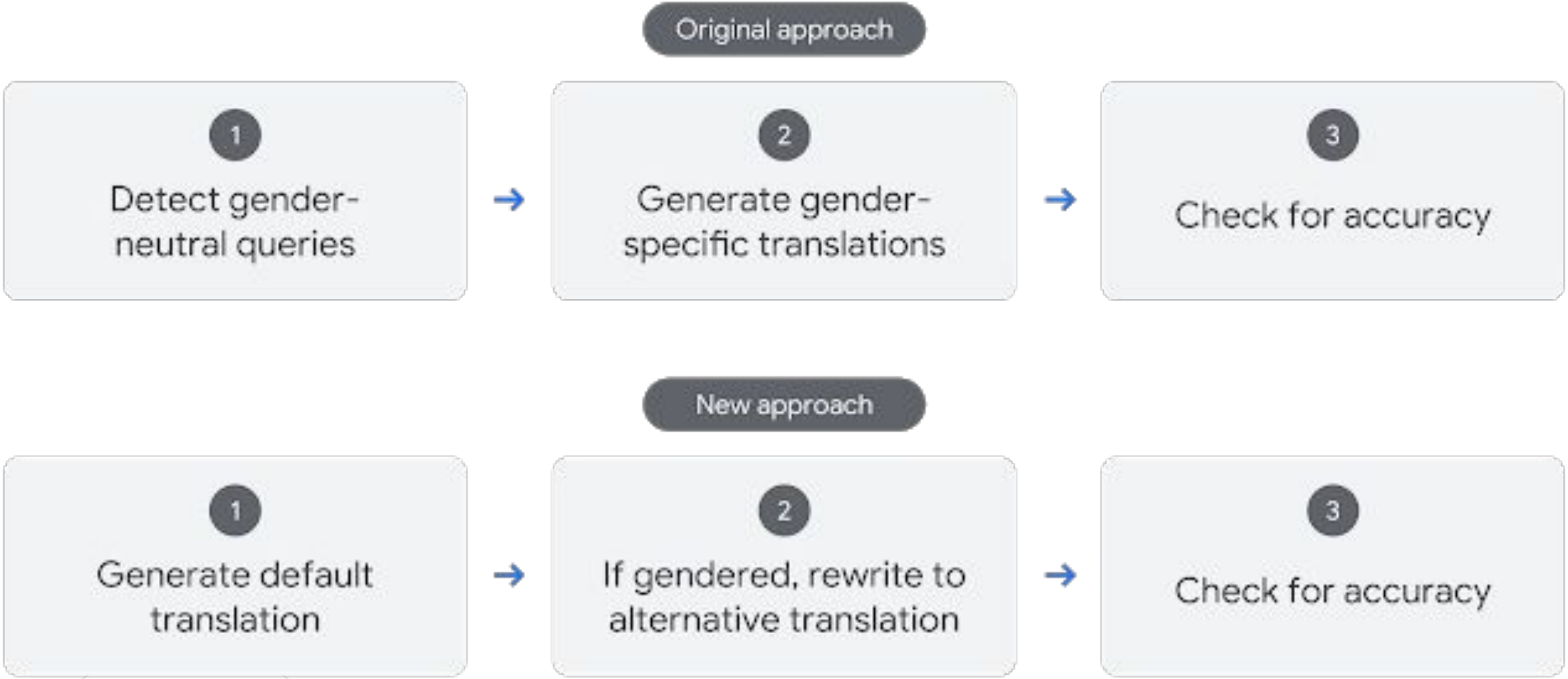


1 Detect gender-neutral queries

2 Generate gender-specific translations

3 Check for accuracy

Google had to create 3 new models for this 2018 approach



Original approach

1. Detect gender-neutral queries
2. Generate gender-specific translations
3. Check for accuracy

New approach

1. Generate default translation
2. If gendered, rewrite to alternative translation
3. Check for accuracy

Updated 2020 approach

Fairness in NLP Coding Demo

Debiasing Word Embeddings: Part 1

Bolukbaski et al. “Man is to Computer Programmer as Woman is to Homemaker.” (2016)

Main idea: Word embeddings embed sexism. In fact, we can identify the gender subspace g.

Debiasing Word Embeddings: Part 1

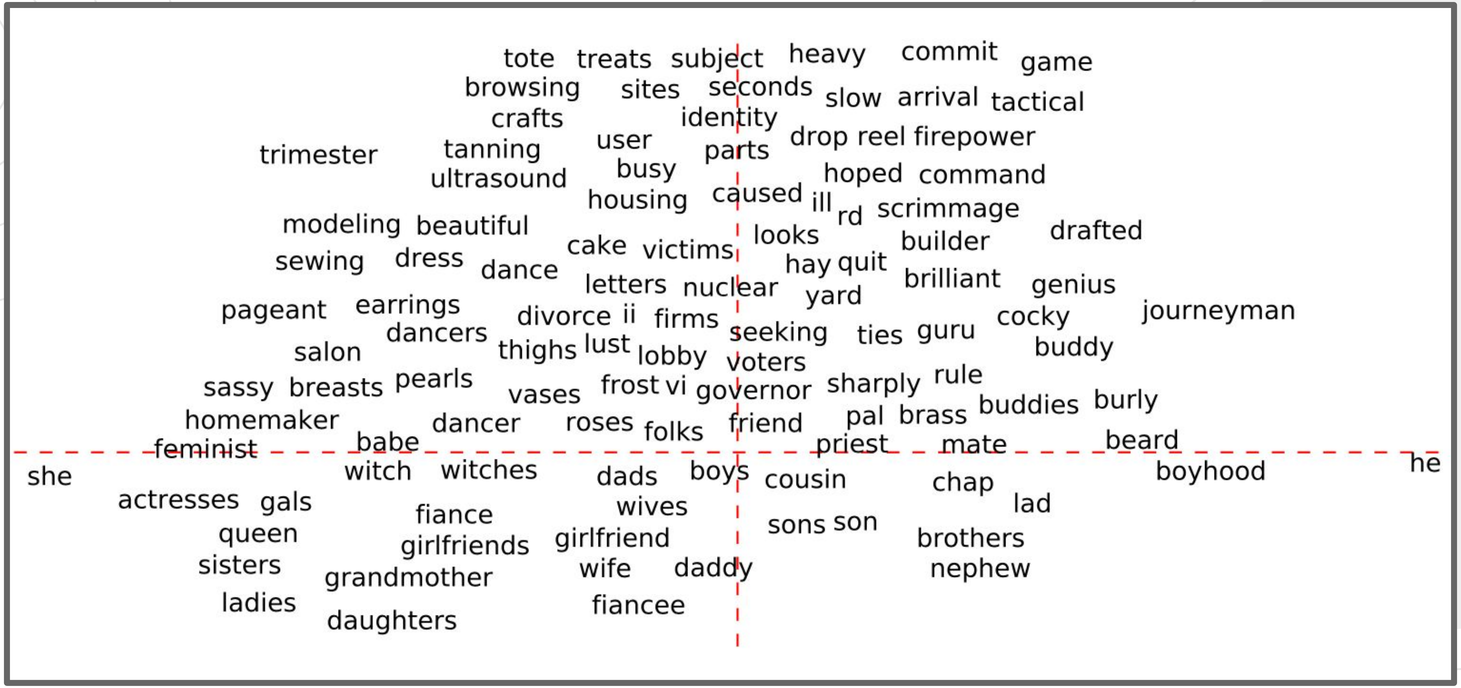
Finding *g*, the gender subspace:

$$\overrightarrow{\text{grandmother}} - \overrightarrow{\text{grandfather}} \quad = \quad \overrightarrow{\text{gal}} - \overrightarrow{\text{guy}} = g$$

Use *g* to identify bias of embeddings: cos(v, g) (or, equivalently, the dot product)

- Project word vectors onto gender dimension to get a quantitative bias score

Bolukbasi et al. (2016)



Bolukbasi et al. (2016)

Debiasing Word Embeddings: Part 1

- Proposed debiasing methods (hard and soft) essentially subtracts gender direction from gender-neutral words to remove bias
- Happens in the postprocessing step
- After debiasing, these analogies should have a lower bias score

Bolukbasi et al. (2016)

Google Colab (Jupyter notebook):

Link sent in Zoom

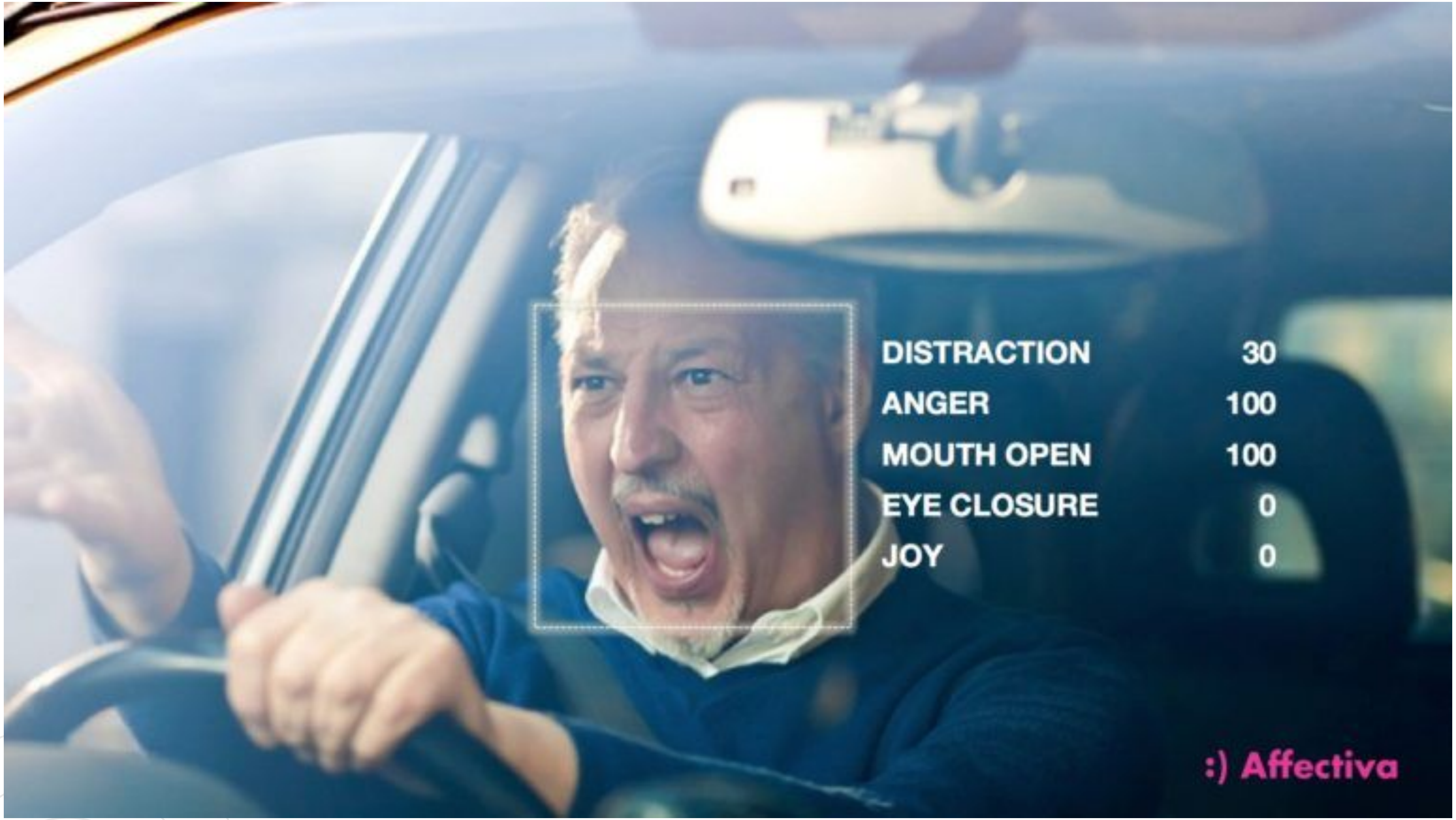
Google Colab (Jupyter notebook):

https://colab.research.google.com/drive/1D2zBeDkhro9-ncukcb48FXsNp9GQChEe?usp=sharing

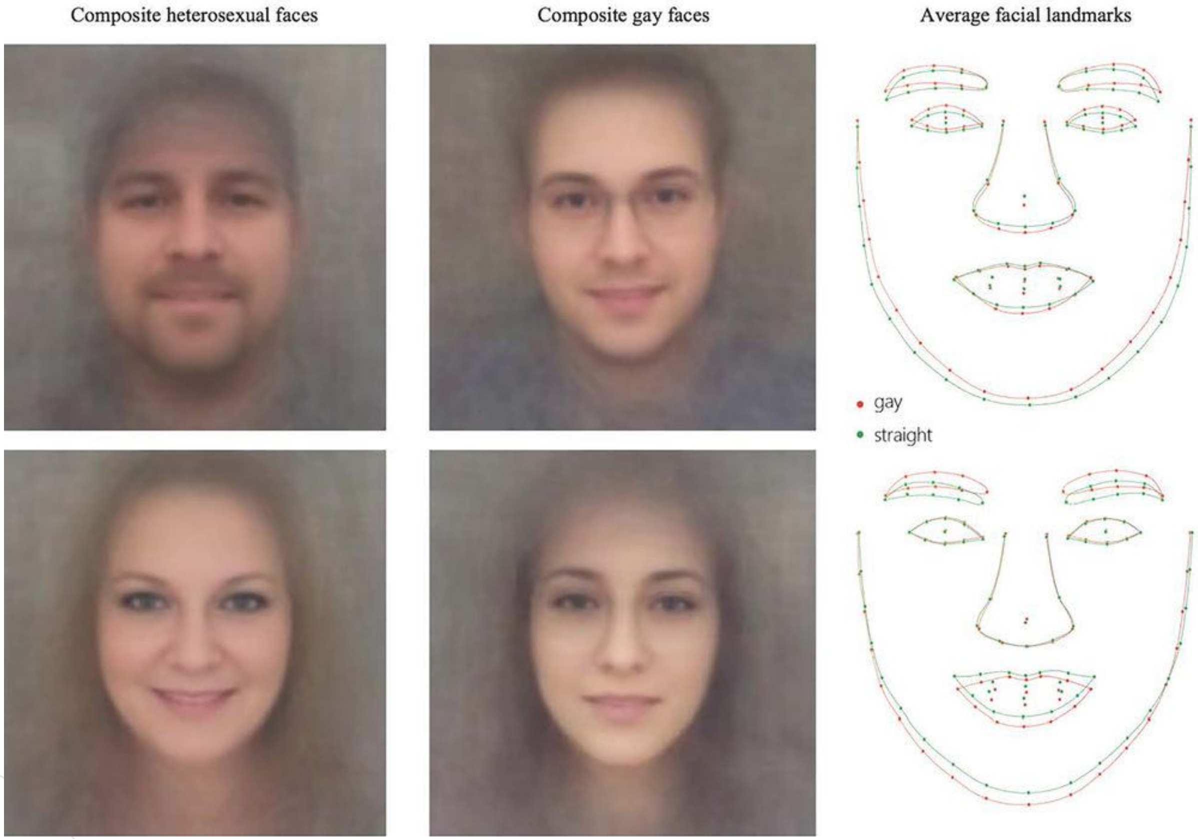
Fairness in Computer Vision

Facial Analysis

- Face recognition softwares are rampant
  - FaceID in iPhones
  - Surveillance cameras
  - Affectiva (founded 2016), born out of MIT Media Lab, identifies emotions from images of faces
  - Research determining sexuality of white male based on Facebook and dating sites photos (Kosinski & Wang, 2017)


DISTRACTION 30
ANGER 100
MOUTH OPEN 100
EYE CLOSURE 0
JOY 0
:) Affectiva

Affectiva



Composite heterosexual faces

Composite gay faces

Average facial landmarks

“Why Stanford Researchers Tried to Create a ‘Gaydar’ Machine” — NYT link

“This Person Does Not Exist” — AI generated faces

https://thispersondoesnotexist.com/

Gender Shades

- Compared facial recognition systems across different gender and skin tones
- Intersectional benchmark: dark/light — male/female pairings
- Used existing metrics of skin type comparison and labeling

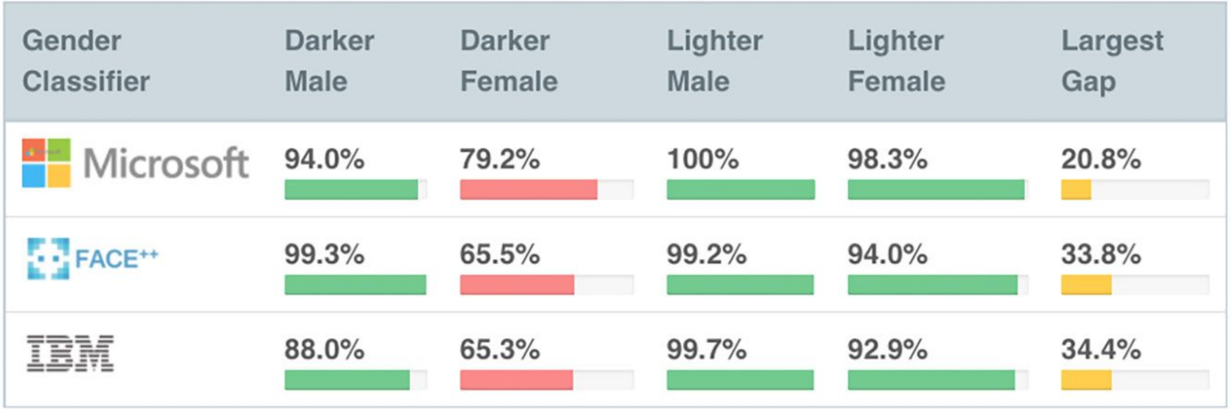
(Buolamwini and Gebru, 2018)

Buolamwini analyzed 1000+ faces of different genders
and skin tones with 3 facial recognition systems

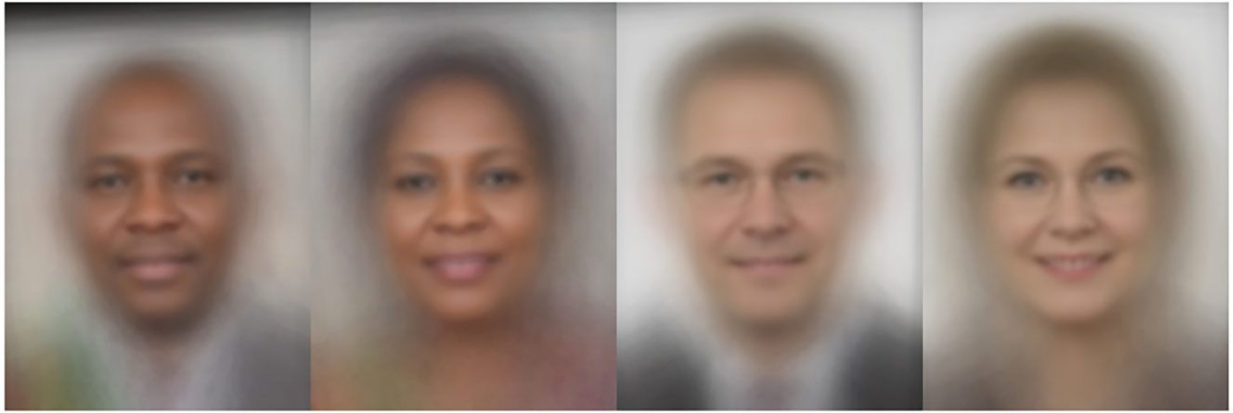
Results

- All classifiers performed better on **male** faces than **female** faces
- All classifiers performed better on **lighter** faces than **darker** faces
- All classifiers performed worst on **darker female** faces
- Max error rate for darker females = 34%
- Max error rate for lighter males = < 1 %

(Buolamwini and Gebru, 2018)



Gender Classifier	Darker Male	Darker Female	Lighter Male	Lighter Female	Largest Gap
Microsoft	94.0%	79.2%	100%	98.3%	20.8%
FACE++	99.3%	65.5%	99.2%	94.0%	33.8%
IBM	88.0%	65.3%	99.7%	92.9%	34.4%



Gender Shades Project

http://gendershades.org/overview.html

Discussion

- Society should never completely halt innovation. But where do we draw the line between innovation and dangers?
- Many companies sell their facial recognition to law enforcement. Should the police use facial recognition AIs?
    - Is it ethical for them to?
    - Even if it is “unbiased”, should law enforcement use them?
    - Helping keep society more secure vs. Protecting privacy?