Closing the Gender Wage Gap: Adversarial Fairness in Job Recommendation

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GOAL

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Have a fair job recommendation system

→ does not discriminate against gender, race, religion etc.

$$F(X, S = 0) = F(X, S = 1) = Y$$

THINGS CAN GO WRONG...

Facebook's ad delivery system still has gender bias, new study finds

Women are excluded from seeing some job listings 'beyond what can be legally justified'

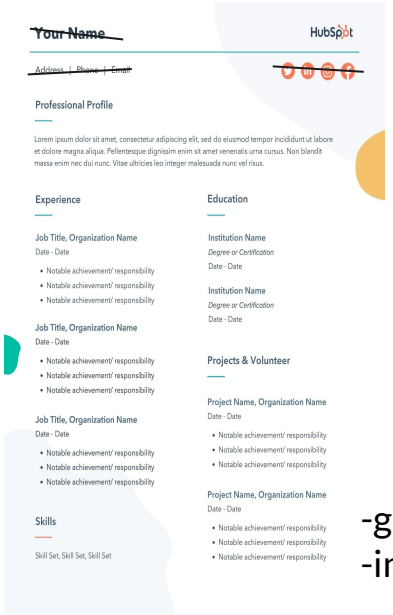
Man is to Computer Programmer as Woman is to Homemaker

Amazon Scraps Secret AI Recruiting Engine that Showed Biases Against Women

AI Research scientists at Amazon uncovered biases against women on their recruiting machine learning engine

Twitter taught Microsoft's AI chatbot to be a racist

DATA



media dpg

nationale vacaturebank

-gender
-industry group

-salary

Resumes

Vacancies

SOLVING THE PROBLEM

Goal: Obtain vector representation that lead to fair predictions

Solutions:

(1) Word Substitution Method
(2) Adversarial Method

WORD SUBSTITUTION METHOD

Senior Software Tester

Nh1816 Verzekeringen – Oudkarspel Gem Langedijk 14 dagen geleden

Financial Accountant

DPG Media – Hoofddorp 24 dagen geleden

Functieomschrijving

Warehouse employee fulltime day shift (English)

Tempo-Team – Son en Breugel 46 dagen geleden

Functieomschrijving

In the beautiful town of Son en Breugel, Rhenus is looking for warehouse employees who are available for the day shift. It's a place where growth opportunities are encouraged, you are well paid and you have the chance of a permanent contract. What more could you want? Read on quickly!

What we offer

- A good salary of €11,38 per hour;
- Growth opportunities such as coordinator;
- Chance of permanent contract, whoop whoop;
- Fun company parties;
- Working in day shift;
- Fulltime work.

Who you are

For the position of Warehouse employee at Rhenus we only ask the following:

- You are available for 40 hours a week, Monday to Friday 07:00-18:00 (8 hours per day);
- You are willing to drive an EPT (Electric Pallet Trolley);
- You speak the Dutch or English language;
- You can apply for a VOG (certificate of good conduct).

What will you do

As a warehouse employee at Rhenus, you make sure that the right products get to the right customers. Where do you work? That depends on the department where you fit best! Rhenus has various customers for whom they carry out the logistical process. From electronic cigarettes to medical MRI scans! So the hippies can keep vaping and the doctors can keep scanning! Because of you people stop smoking and new hospitals are provided with MRI equipment. You are a topper! You have various tasks such as; receiving goods, order picking, quality checks, and preparing orders for shipment.

Vacancies

She/He, Hers/His, Woman/Man

Replace

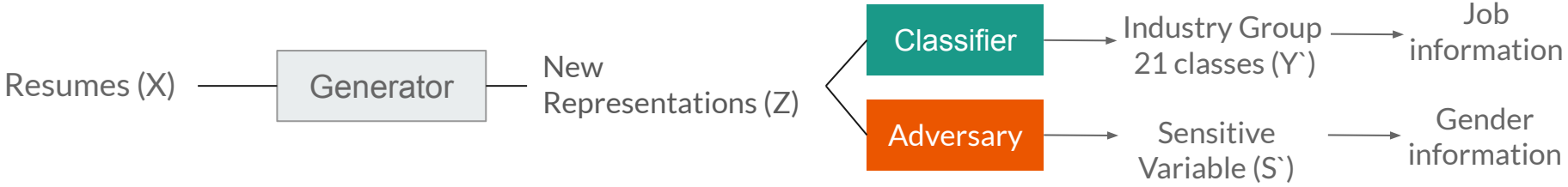
They, Theirs, Person

Text

Word2Vec

Vector Representations

ADVERSARIAL METHOD



$$L = \alpha L_{cla}(Z, Y') + \beta L_{adv}(Z, S')$$

EVALUATION

Performance

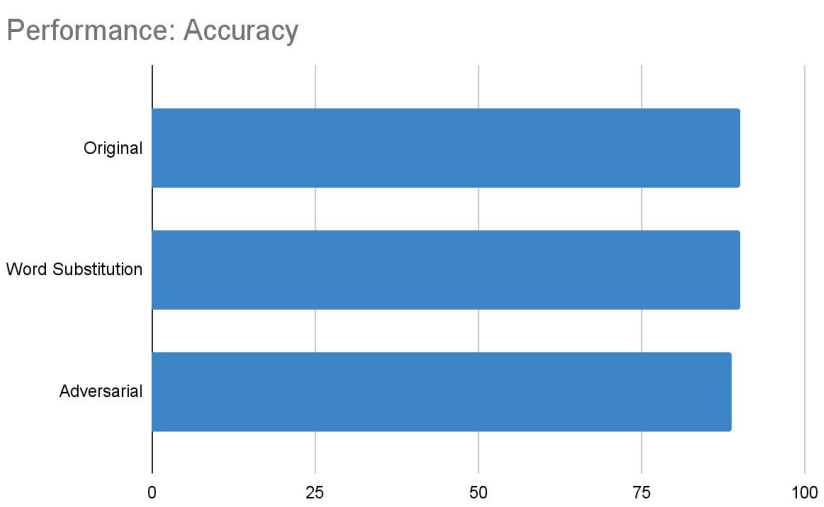
$$\text{Accuracy} = \frac{\text{TP+TN}}{\text{TP+FP+FN+TN}}$$

Fairness: Statistical Parity

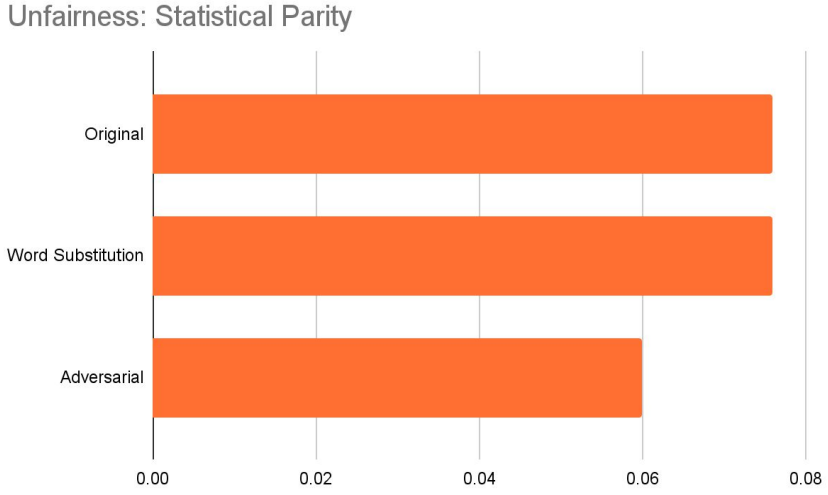
$$P(cla(Z) = 1|S = 1) - P(cla(Z) = 1|S = 0) < \epsilon$$

PREDICTION OF INDUSTRY GROUP

PERFORMANCE FAIRNESS TRADE-OFF



Higher is better



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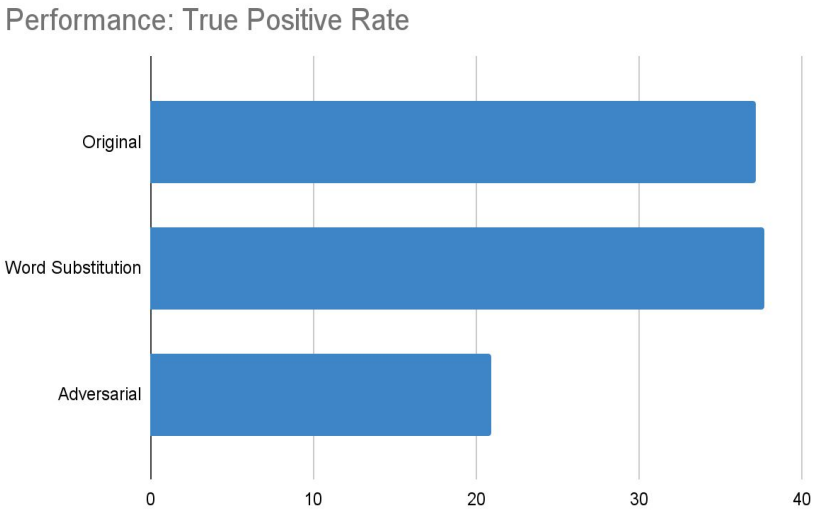

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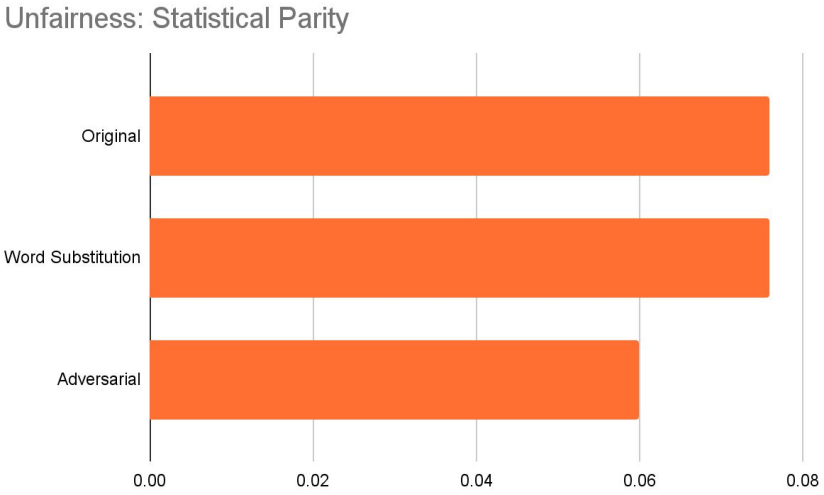

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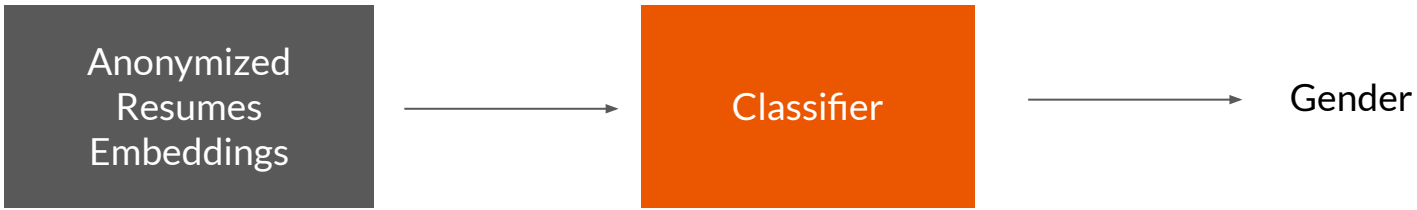
PREDICTION OF SENSITIVE VARIABLE

Goal: Have a model make predictions independent of the gender

If a model can learn to predict the gender → not independent of the gender



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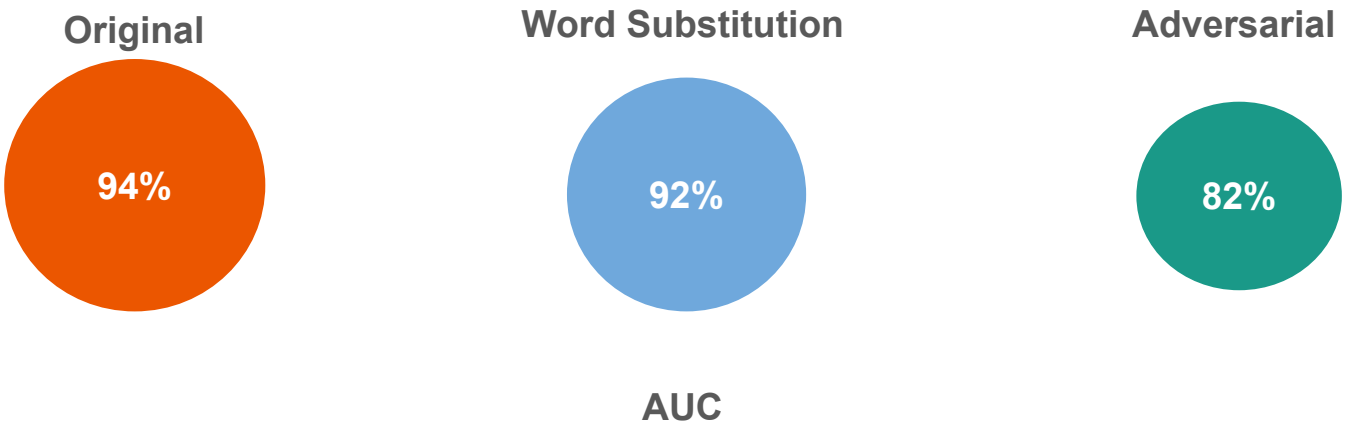
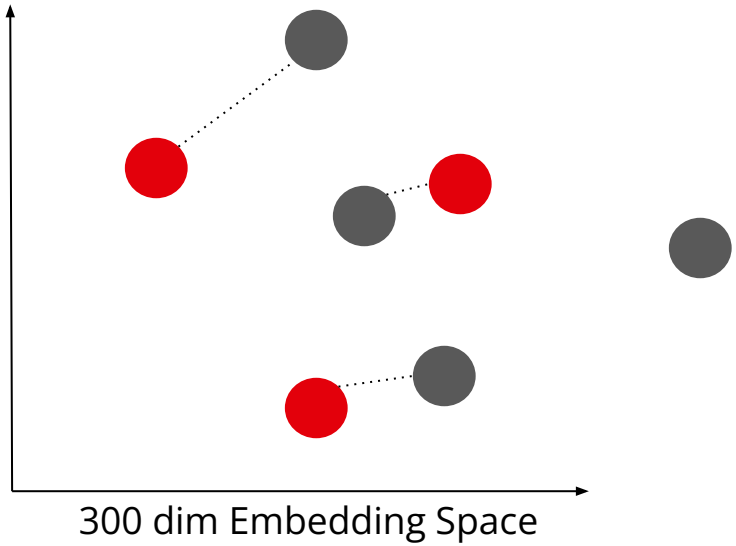


SALARY ASSOCIATION TEST

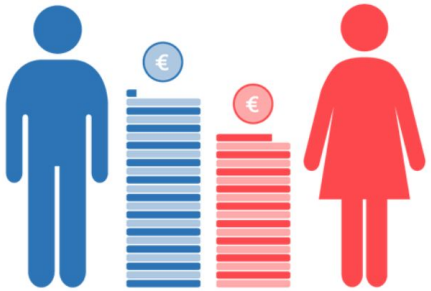
For each resume find the most similar job description.



Resumes

Vacancies

Euclidean Distance



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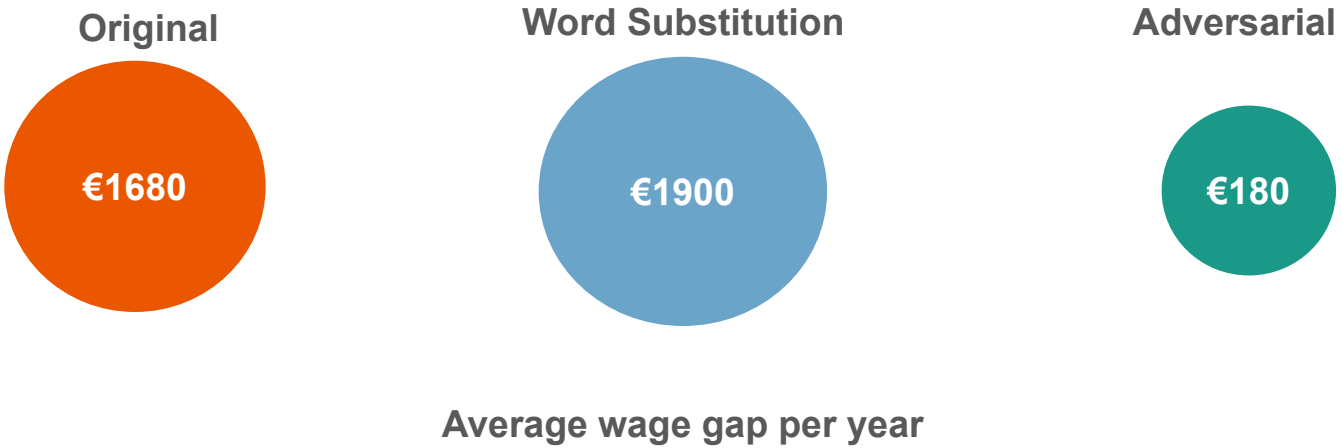

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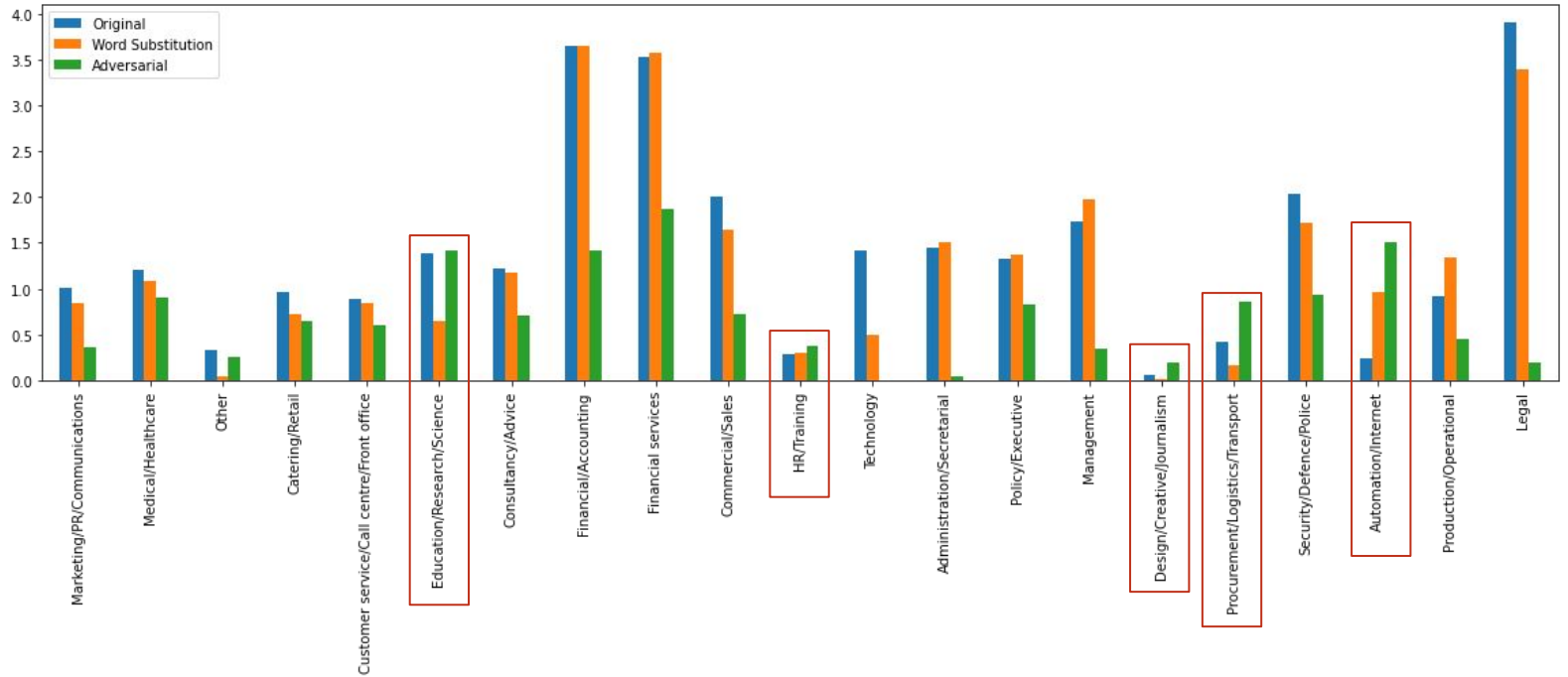

FUTURE WORK

- Evaluate the quality of the matches
- More complex matching system for the Salary Association Test
- Include non-binary genders
- Use other types of embeddings

MAIN CONTRIBUTIONS

(1) Applied adversarial debiasing methods on large scale real text data

(2) Trade-off between fairness and performance on a multi-label classification task

(3) The Salary Association Test: showing the impact on a real business case scenario

(4) Provided open-source software

CONCLUSIONS

- Ignoring the bias in the data can lead to unwanted discriminatory behaviour
  —> producing a wage gap

- The adversarial method:
  - improved fairness with the cost of lowering the performance
  - reduced the wage gap by 89%

THANK YOU!