RE to Avoid Gender Bias

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Outline

- Background

- Research Questions

- Problem

- Detection

- RE as a Solution

Biased Computer System

- A computer systems that systematically and unfairly discriminate against certain individuals or groups of individuals in favor of others

- Example: An automated credit advisor

Unbiased System	Biased System
• Denies credit to individuals with consistently poor payment records • Appropriate for a credit company to want to avoid extending credit privileges to people who consistently do not pay their bills	• System that systematically assigns poor credit ratings to individuals with ethnic surnames • Discriminates on grounds that are not relevant to credit assessments and, hence, discriminates unfairly

Types of Bias

- Pre-existing Bias

  - has its roots in social institutions, practices, and attitudes

  - can enter a system

    - explicitly and conscious efforts of individuals or institutions, or

    - implicitly and unconsciously, even despite the best of intentions

  - Individual

  - Societal

Types of Bias

- Technical Bias

  - Arises from technical constraints or technical considerations

  - Caused due to

    - Computer Tools - limitation of the computer hardware, software or peripherals

    - Decontextualized Algorithms – an algorithm that fails to treat all groups fairly

    - Random Number Generation - imperfections in or misuse pseudorandom number generation

    - Formalization of Human Constructs - Bias that originates from attempts to make human constructs

Types of Bias

- Emergent Bias

  - This bias typically emerges some time after a design is completed, as a result of changing societal knowledge, population, or cultural values

  - UIs are mostly prone to this

  - Caused due to

    - New Societal Knowledge

    - Mismatch between Users and System Design

Gender Bias

Unfair differences in the way a person is treated because of their gender

Research Questions

- RQ1

  - A systematic study of gender bias in software engineering

    - What leads to introduction of gender bias in a software?

    - How to detect gender bias in pre-existing system?

- RQ2

  - RE to avoid gender bias

    - How can RE prevent/avoid gender bias in software?

Problem of Gender Bias

Study 1(a): Graphical Software

- *City County Opposites* by Random House

- Animals were used to make it gender neutral

- Male Animals – doctors, Policemen

- Female Animals – Cooking, cleaning

Study 1(b): Linguist Software

- *Streets* by Microcomputer Workshops

- Story telling for young kids

- Female character – Crazy old witch, less frequent

- Male character – Working and earning, more frequent

Problem of Gender Bias

- Study 2: Amazon's AI recruiting tool

- Global workforce is 60% male

- Men hold 74% of the company's managerial positions

- Dataset used was based on resumes submitted over 10-year period – mostly white male

- Software penalized any resume that contained the word "women's" in the text and downgraded the resumes of those who attended women's colleges

Problem of Gender Bias

- Another example, AI based targeted ads show better paying jobs to men

- Gartner predicts that by 2022, 85% of AI projects will deliver erroneous outcomes

- This will be caused due to bias in

  - data

  - algorithms

  - the teams responsible for managing them

What leads to introduction of gender bias in a software?

- No software is intentionally designed to be sexist

- Key component - Pre-existing bias in society
  - Lack of awareness

- Bias can creep in during all phases of a project
  - Problem Description
  - Considering an insufficiently rich set of factors
  - Lack of diverse data

- Lack of strict code towards gender neutrality starting from requirement gathering phase

- No focus on countering the issue which leads to further growth

Detecting Gender Bias

- Study 1(a) and 1(b) (Cont.)

- A study with 2 sections
  - Section A : 11 Students (1 male, 10 Female)
  - Section B: 7 Students (All female)

- Evaluation method
  - Expanded Sexism Checklist (ESC)– Supported characters, title, subject matter etc
  - Computers, Reading and Language Arts (CRLA) – yes/no

- Both sections chose 2 software and evaluated using both the methods

Detecting Gender Bias

- Most accurate method would be - Manual Method
  - High accuracy
  - Time consuming
  - Cannot be done for every piece of software
  - Prone to pre-existing bias

- Automated detection
  - Can be less accurate than manual
  - Fast
  - Prone to technical bias
  - Mostly successful for language issues

- Compare outputs for different groups

RE as a Solution

- Inclusive Design

  - Expanded sexism checklist should be included in each user manual

  - Requirement engineer should be made aware of gender bias issue so that it is continuously countered

  - UI design should be carefully defined as it directly impacts user psychology, including attitudes and intentions

  - Test cases specified during requirement gathering phase should include all minority cases

RE as a Solution

- Inclusive Design Method: The GenderMag Project

- Evaluates a system's gender inclusiveness

- Specialized personas

- Method
  - Group of software professionals walk through a scenario in their system, step by step, through the eyes of one of the GenderMag personas
  - At each step, they decide whether their persona (e.g., "Abby") will
    - know what to do and,
    - if Abby performs the action, whether she will know that she is progressing toward her goal

RE as a Solution

- Problem Description
  - Clearly worded
  - Preference should be given to gender neutral terms
  - Should be defined in a way that acknowledges different classes and how they will be impacted

- Dataset Description
  - Flawed data is a big problem!
  - Recognize and address statistical bias
  - Data should represent all groups
  - Sufficient data should be gathered (What do you call "sufficient"?)

RE as a Solution

Source:Metaxa-Kakavouli, D., Wang, K., Landay, J. A., & Hancock, J. (2018). *Gender-Inclusive Design. Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18.* doi:10.1145/3173574.3174188

Future Work

- Extend the work on Cause, Detection and Solution of gender bias

  from

  - Standard SE Perspective

    - Inclusive Design focusing on RE

  - AI & ML perspective

    - NLP

- Work can be extended to other issues such as racism

References

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Thank You!