RE to Avoid Gender Bias

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Outline

- Background
- Research Questions
- Problem
- Detection
- RE as a Solution
Biased Computer System

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

- Example: An automated credit advisor

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

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


- https://gendermag.org/index.html
Thank You!