

# Chapter 8

## Gender Biasness – A Victim of Artificial Intelligence-Based Development



Sonal Pathak, Vijender Kumar Solanki, and Nguyen Thi Dieu Linh

### 8.1 Introduction

Today we are living in a world of high possibilities and smart work styles. Only hard work cannot pay off these days. The time has come when a human is working with machines or vice versa to increase productivity and long-term profits. The involvement of machines is not new, simple computer has already made their place a long way back. Knowingly or unknowingly Information Technology industry had become dependent on Artificial Intelligence technologies. Gradually when dependencies increased, biases entered into decision models. As per the researchers, there are three major category types of Artificial Intelligence bias – negative legacy, algorithm prejudice, and underestimation. Negative legacy means biases that are the result of tempered or errors in the data input. Algorithm prejudice means the biases due to statistical dependencies of information on protected features which has been used to make final decisions. UNESCO Report, 2019 [1] discloses that gender bias has been found in training data sets of Artificial Intelligence. Unambiguously biases have been found in algorithms and this bias has replicated itself and spread reinforced gender stereotypes. These risks of gender biases minimized the role of women on a global scale and stigmatized it. This ubiquity of society has put less percentage of women in all fields – be it political, economic, or social life. In the recent past, this has hindered the progress of gender equality at the country level.

---

S. Pathak

Manav Rachna International Institute of Research and Studies, Faridabad, India

V. K. Solanki (✉)

CMR Institute of Technology, Hyderabad, India

N. T. D. Linh

Hanoi Institute of Technology, Hanoi, Vietnam

e-mail: [nguyen.linh@hau.edu.vn](mailto:nguyen.linh@hau.edu.vn)

Many steps have been taken to remove bias from learning algorithms but they have ignored studies on how the ideology of gender has been entrenched in the language. Biased algorithms can be amended by incorporating results of decades' studies into approaches to machine learning from the text can help in removing gender biases.

Leading thinkers in the emerging research addressing bias in Artificial Intelligence are also primarily female, suggesting that those who are potentially affected by bias are more likely to see, understand, and attempt to resolve it. Gender balance in machine learning is, therefore, crucial to prevent algorithms from perpetuating gender ideologies that disadvantage women. People were using critical theory to avoid biases in personal experiences and finalized decisions. However, observing data that is present initially should be given significant importance because machine intelligence works on this initial data only. As machine learning processes big volume data, if this data would have been laden with the stereotype framework of gender, technology would generate a biased resulting application.

## 8.2 Gender Biases

If a person is being treated or receiving a behavior on the person's identity based on gender. All the aspects and concerns related to men's and women's lives and the societal situation can be summarized by the gender of an individual. In a society, how a person interrelates, differences in access, use of resources, reaction to change, policies and interventions, and their activities. In society, each gender has a significant role in access to privilege, power, and possibilities that one gender has, and not given to the other gives birth to gender biases. It escalates discrimination and gender inequality. An example of gender biases can be the specification of a person by seeing their occupation of doctor or engineer as "Male". Similarly, a teacher profile can be assumed to be "Female". This stereotype mentality is common to see in any society. Generally, female has restricted admittance to the labor market. Especially in countries like India, a very less percentage of female youth enjoy the privileges given to youth males. Women have admitted that they suffer this gender discrimination from their families only by getting the lesser opportunity for education, freedom from household chores, etc. Moreover, female youth is not aware that they are underprivileged due to their gender as well.

## 8.3 Women and the Industry

In the Industrial sector, the percentage of female workers' participation varies not only in different industries but also in different states of India. Research studies by Fajimi and Omonona [2] reveal that because of poverty, the proportion of women workers increases in the workforce. This study reveals that a high proportion of poor people in a state can be estimated by a higher proportion of women in the workforce

in that state. Gender differences can be highlighted in terms of wage differences of each gender as well.

Perinelli and Beken [3] found that female workers are getting lesser wages as compared to male workers irrespective of geographical regions and sectors. Even sectors like manufacturing and services sectors and agriculture sectors are revealing this fact about female workers.

Swift [4] report depicts that though a high number of women graduates are there in Europe, there are less number of female workers in the market which is associated with labor. Even with the same education, male workers are getting more wages than female workers which leads to a “gender wage gap”.

Machin and Puhani [5] found that differences in the geographical regions cannot change the gender wage gap analysis. Countries like Pakistan lag far behind in terms of gender equality. Women are more focused on lower-level or middle-level work where mostly unskilled workers are required.

One of the other reasons for the lesser participation of women in the workforce is directly related to their dependencies on family for their day-to-day decisions, their mobility from one place to another place, and restricted access to money as shown in Fig. 8.1. Despite household practices that favored male youth over female youth, mobility, independent decision-making, and access to money were not universal among male youth. Fewer than half of male youth could express their opinion to elders (aside from parents) or confront others who had wronged them. Most male youths did not have access to money. Thus, there is considerable room for improving independent behavior among male youth as well.



Fig. 8.1 Workforce diversity by gender

Shidhaye [6] found that females adopt labor-saving technologies at a slower pace in comparison to men. They concluded that reducing female's work is the effect of technologies in both domestic and productive tasks. Affordability, physical accessibility, and cultural appropriateness are the major reasons for gender differences in industries, especially the IT industry. As informal sectors are growing faster in this economic development phase, the engagement of females is more in the informal sectors. Another sector in which more percentage of women is the service sector jobs.

Linden et al. [7] The share of women employees is very low in the emerging services of IT sectors. The share of women workers in the software industry is 27%. More percentage of women's workers lie in the lower-skilled and lower-end jobs. One of the fields where the share of female employment is more is Agriculture.

Dastin [8] reveals through a report that more women are employed in silk-sericulture and taking care of their families through this employment. They are helping their husband in their occupation and educating their kids but in IT sectors, this percentage is very low.

Vincent [9] explored that 72.70% of women was the part of employment which was generated by the establishment of a mulberry garden to cultivate and rearing of silkworms for the production of cocoons to produce raw silk. More women labor can be observed in egg incubation, sewing, and, cocoon cutting but a very less percentage of women is observed in the IT-industry, electronics, cyber security and such sectors. One more factor that exists in the IT industry is that women do not opt for night shifts. Special arrangements or measures have to be provided to enable safe working environment for women in the night shifts.

### ***8.3.1 Women in the Field of Cybersecurity***

If we look for the industries wherein the gender gap persists, no doubt "Cybersecurity" is one of such fields. Historically and currently, males are dominating the field of cybersecurity. There is no surprise to know that in cybersecurity jobs, women are underrepresented as information technology has been considered stereotypically male-dominated. To fill this gap more women-dominated positions in the cybersecurity field and finally leadership position is required. For this misconceptions about the cybersecurity field should be rectified. Those who have succeeded in this field reveal that cybersecurity is not only about technology but also it's about tracking the data and giving protection to people who have compromised their data. Those people who see thing differently and wants to do something different and look for success in this fast-paced environment should enter this field of cybersecurity – Be they Female or Male!

### 8.3.2 Present Scenario

As per a recent study, only 14% of the total cybersecurity workforce are female employees. Surprisingly only 1% of these 14% female cybersecurity workforce possess any senior position or leadership authority. This shows that the new outlook workforce in cybersecurity pertaining pay disparity between male and female employees because counting of men outnumbered the counting of women. ISC report says that though women’s participation in the cybersecurity field is growing gradually still women make up a very lesser percentage of the workforce and this increment is not enough. Cybercrime Magazine (March 2021) discloses that women now make up approximately 20% of the global Infosys payrolls. This is, of course, an encouraging improvement from six years ago, but still woefully shy of the 50% range that would represent parity.

According to Cybersecurity Ventures, in comparison to 10% in 2013 and 20% in 2019, women are holding now approx. 25% of cybersecurity jobs in 2021 at the global level as shown in Fig. 8.2. The research is considering corporate network jobs and includes IIOT and ICS security, OT security, aviation cybersecurity, automotive cybersecurity, medical device security, and other market categories. Though now a day, women are making their place in the cybersecurity service provider ecosystem very well which also include digital forensics and small business owned by women. A prediction made by cybersecurity ventures reveals that women are going to represent 30% of the global cybersecurity workforce by 2025 and in 2031 it will reach 35%.

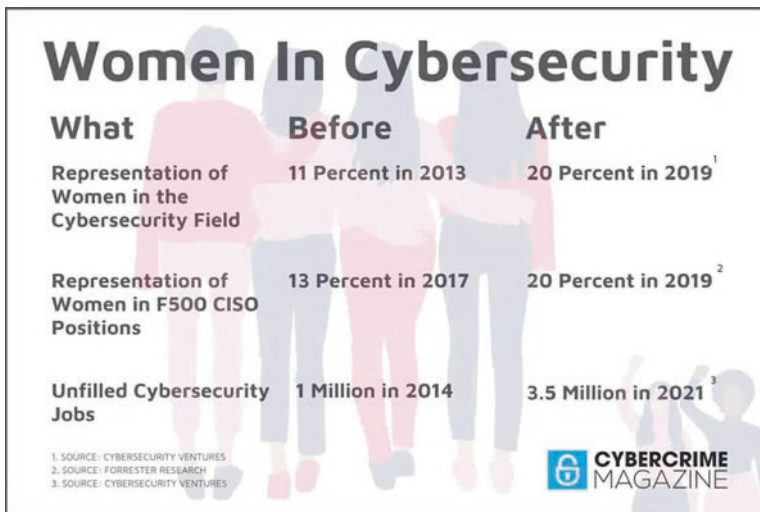


Fig. 8.2 Women in cybersecurity. (Source: Cybercrime Magazine, 2021)

### **8.3.2.1 Reason for Lesser Number of Women Representation**

#### **Gender Stereotype**

The notion that women cannot make their career in the field of cybersecurity may be false but somewhere it influences society and our young girls. They are told that it is very difficult to make and sustain your career as a techie in network security. If, however, girls choose their career in the IT security team by breaking these barriers may find themselves surrounded by men and an unconscious bias makes a woman find opportunities for career advancement. This stereotypical idea that cybersecurity is solely a technical field and men are better suited for a network security job is influencing the entry of women workforce in cybersecurity. because of such baseless notions, women are steered away from the opportunity, classes, and training that can lead to careers in the cybersecurity field. There are a few myths that exist in society about women making a career in the cybersecurity field.

#### **The First Myth-**

American Psychological Association reported that men and women have equal capabilities in dealing with math and science subjects and even in verbal ability. It is a myth that men are more competent in dealing with practical subjects or dealing with technology and network security issues and in the consequences boys are given more opportunities to get exposure to practical ability-based job options and vice versa than girls. Thus if women assume that the cybersecurity field is not for them, it is based on purely stereotypical mindsets and not based on reality.

#### **The Second Myth-**

The notion that only strong technical skills are required in the cybersecurity field needs to be examined once again closely as cybersecurity is a field where a variety of perspectives is required and innovative methods are to protect the data in terms of creating passwords, etc.

## **8.4 Gender Biasness Has a Significant Role in Corporate Sectors**

The corporate sector has been considered as a segment where more liberty is expected for each gender. We believe that women working in the corporate sector are more empowered but empowerment is very difficult to be described in a nutshell as it is a dynamic process. Economic independence, self-reliance, social transformation, power decision-making resources, demanding equality, and knowledge enhancement can be considered as a few parameters of women's empowerment in the corporate sector. Thus the need for hours is the generation of a socio-cultural environment that can help in minimizing gender-biased activities and enhance rational behavior which can balance the role of men and women in the corporate sector. Thus to empower women the corporate sector gender sensitization must be taken as

an essential policy – be it at the senior level or middle level so that policymakers can also take care of gender balance practices while framing new policies on which training data for an algorithm of decision-making model can be dependent. The contribution of men will only be recognized when men change their perception. To remove gender biases from training data, gender sensitization at all vessels of the organization is mandatory. Women’s talents can be nurtured and control over conscious efforts can only be seen if gender sensitization is promoted. Legal, health empowerment of women, social, political, and educational growth of women are only possible in the corporate sector if gender sensitization is promoted.

It can be concluded that women comprise around half of the human population, but Indian society is still male-dominated and women are not considered equal partners, either inside or outside the four walls of the house. They are treated as weak and dependent creatures. Although the government is taking various initiatives to promote women’s empowerment, the actual results were not observed. The required quantum of empowerment is still a dream. The need is to reach empowerment by a gender sensitization approach. We need to involve both men and women in the gender sensitization process so that men are mentally prepared for delicate roles, responsibilities, and power over their female counterparts. Lack of gender sensitization was the reason for not achieving much despite many efforts since independence. The need of the hour is to change insight into the whole society so that it recognizes women with a positive approach. Only when the men accommodate women by shading their ego, actions and efforts will be visible. Gender sensitization refers to the sensitization about gender equality concerns. It helps people in examining their attitudes and beliefs and questioning the realities of both sexes. Issues such as the problem of sexual harassment, sexual stereotyping, dearth of counselor sensitivity to complexities such as caste, minority experience or sexuality, and lack of special emotional and academic support both at the personal and institutional level for students from marginalized groups.

## 8.5 Machine Learning – A Type of Artificial Intelligence

Machine learning (ML) is a type of Artificial Intelligence that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning [algorithms](#) use historical data as input to predict new output values.

[Recommendation engines](#) are a common use case for machine learning. Other popular uses include fraud detection, spam filtering, malware threat detection, [business process automation](#) (BPA), and predictive maintenance. Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well as supports the development of new products. Many of today’s leading companies, such as Facebook, Google, and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.



### Process of Machine Learning/Artificial Intelligence

Classical machine learning is often categorized by how an algorithm learns to become more accurate in its predictions as shown in Fig. 8.3. There are four basic approaches: supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning. The type of algorithm data scientists choose to use depends on what type of data they want to predict.

## 8.6 Artificial Intelligence-Based Development Affected Gender Equality

There are several forms of Artificial Intelligence bias. One of the biases is cognitive biases which enter into models of machine learning and data set by human developers. From such entries, business gets into the algorithm. Another reason for biases is the incomplete data and this becomes significant if due to cognitive biases, this information is being omitted. By using technology, the goal of inculcating social

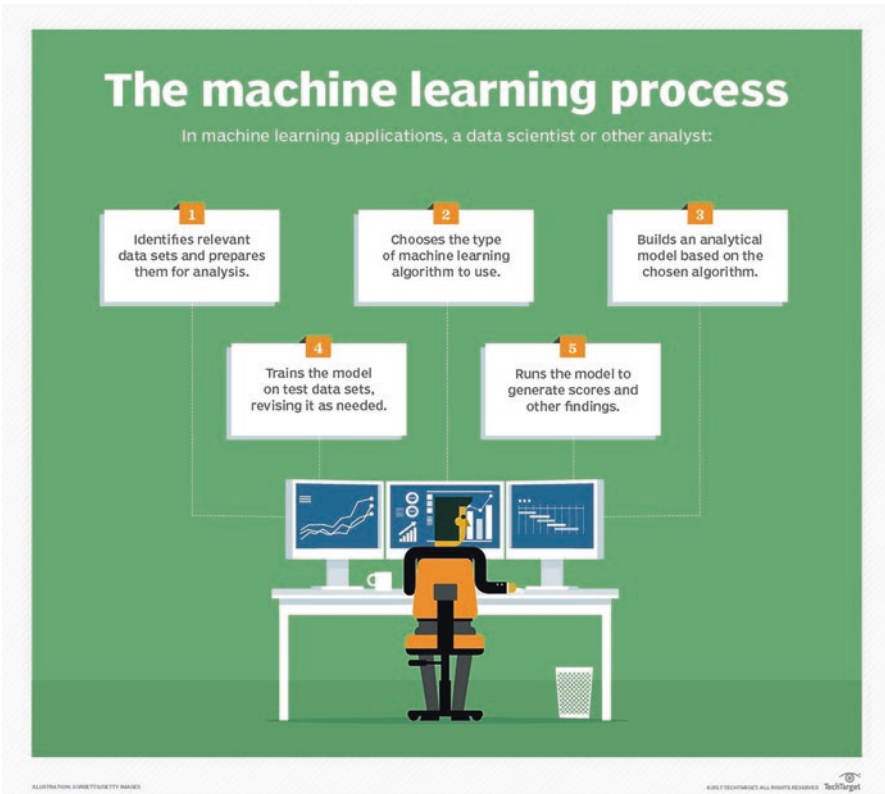


Fig. 8.3 The machine learning process



gender balance can be achieved with the amalgamation of gender balance in Artificial Intelligence applications. As now a day, Artificial Intelligence is becoming widespread, diversity in gender in data and governance of Artificial Intelligence should be utilized to promote gender inequalities and help communities that are struggling for controlling violence against gender and can inculcate a good work environment in the IT industry. These crucial issues need to be taken care of at the war front level now.

For pattern recognition, Artificial Intelligence increases applications of the algorithm, and the use of machine learning gets lots of funding and attention as well. To hold a high place as a global leader in Artificial Intelligence, the Government of Canada in 2017 announced \$ 125 million in developing Artificial Intelligence strategies for Pan Canadian in the 2018 budget. The government reaffirmed its commitment of government in investing more in Artificial Intelligence-based projects. The Canadian government has made explicit strategies for promoting women empowerment and gender equality a central theme and goal of its Pan-Canadian strategy. National Artificial Intelligence Research and Development Strategies plan mentions in its policy that racial, age, economic, and gender will be the main outline for consideration of the futuristic plan of growth in the IT sector. To promote gender equality and advance women empowerment issues related to gender need to be highlighted in all sectors and disciplines including Artificial Intelligence [10]. Though Artificial Intelligence has been considered a threat to gender inequality still society cannot ignore the potential of Artificial Intelligence in bringing positive changes regarding norms of gender balance.

For Instance-One Artificial Intelligence powered recruitment system has been found with gender discrimination but Artificial Intelligence-based decision models also help employers to write job postings in which more sensitive language regarding women can be used to promote gender diversity in the workforce. Therefore, Artificial Intelligence can become part of enhancing management practices in our society to support gender equality and can minimize gender discrimination [11].

## 8.7 Reinforcing Gender Biasness and Inequalities Through Artificial Intelligence

The robustness of Artificial Intelligence depends on the kind of input we give to it. An algorithm reads input data to recognize a data pattern. Development of data set in terms of relevant and irrelevant data is done by data researchers on the basis of their conscious and experience. Thus the output of Artificial Intelligence is completely dependent upon the quantity and quality of inputs which is dependent on human decisions and the kind of existing data in the real world as depicted in Fig. 8.4. Thus this relationship between input and output of the algorithm is completely justifiable. It's about giving a data pattern to the algorithm.

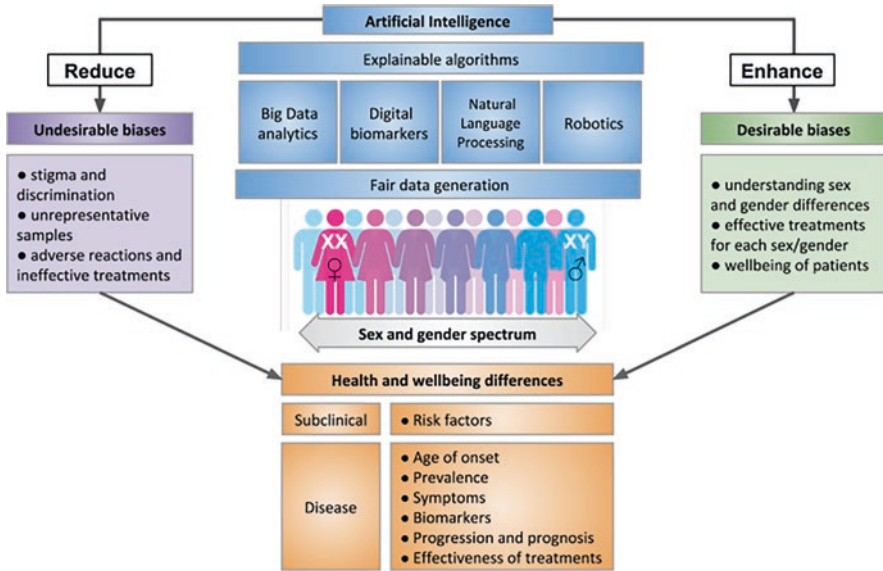


Fig. 8.4 Factors responsible to instigate gender biasness through artificial intelligence

Therefore, input data for Artificial Intelligence technologies should be simplistic and analyzed in sense of balance between each gender in all aspects. To overcome the biases, the women percentage must be increased in Technology, Science, Maths, and Engineering. Such fields are generally solely led by men. In such a scenario, input data ignores the diversity which can be there in the perception of different genders, and their considerations for some issues. As a result, gender inequality and biases get to enter into a pattern of data [12].

A big change in the culture is required to implement systematic reforms. It is unclear how Artificial Intelligence will fix this inequality of gender itself. An algorithm is only replicating its data patterns. If a company wants to figure out their customers who are premium based on their purchase and the company wants to provide some extra benefits to these customers. An Artificial Intelligence model can be utilized to figure out such customers by using details of customers as input data sets. But the quality of this input data should be ensured by removing blind spots and biases in it.

There is an important example of racial biases by the Artificial Intelligence model of GOOGLE in 2015, their photo-categorization software started creating decisions by recognizing people based on their dark/black color as “Gorilla”. Later Google corrected this by using the Band-Artificial Intelligence solution by which the word “Gorilla” was removed [13].

UNESCO Report (2019) [1] reveals that gender biases exist in datasets of Artificial Intelligence and particular biases exist in training data sets. Removal of these built-in biases is essential and representation of the complete population in input data is mandatory. In particular, collection, labeling, and thus generation of

data is done by humans only that goes into the Artificial Intelligence system model and sets the pattern and rules for an algorithm to make concrete predictions. Any Artificial Intelligence system gets embedded by biases at these two stages only.

### Inequality in Practice

Gender disparity issues are more prominent in the fields where gender inequality is predominant such as – Military and Security. In the security field, work on Artificial Intelligence and research has more focused on applications of the military in comparison to peacebuilding.

Generally, Artificial Intelligence has two types of bias, as depicted in Fig. 8.5. One is “Data Bias” or “Algorithmic Artificial Intelligence Bias” – which is the result of the training of an algorithm by using biased data.

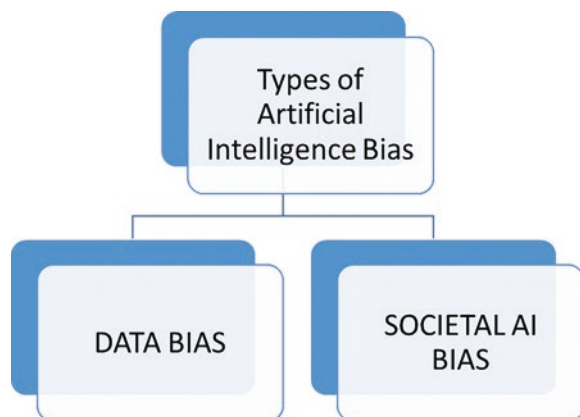
The next type of bias in Artificial Intelligence is the societal Artificial Intelligence bias. This bias occurs due to societal norms and assumptions which force us to create blind spots about certain expectations in our cognitive decisions.

Artificial Intelligence systems contain biases due to two reasons:

1. Cognitive biases: These are unconscious errors in thinking that affect individuals’ judgments and decisions.
2. Lack of complete data: If data is not complete, it may not be representative and therefore it may include bias.
  - Confirmation bias. This occurs when the person performing the data analysis wants to prove a predetermined assumption. ...
  - Selection bias. This occurs when data is selected subjectively. ...
  - Outliers. An outlier is an extreme data value. ...
  - Overfitting and underfitting. ...
  - Confounding variables.

One example of gender discriminatory outcomes biases in 2014 was when the Artificial Intelligence model was selecting applicants as the top five applicants from 100 applicants. Due to an error in trained data, it was selecting only male candidates

**Fig. 8.5** Types of artificial intelligence biasness



selected and rejected the word “women” in the CVs. This algorithm selected mostly male applicants over a 10 10-year period. Women applicants were penalized by this biased algorithm because of the “women” word in their resumes. As soon as the bias was detected, it was removed and the company declared that they were not using this algorithm in their selection procedure.

This was a critical finding because Amazon has been using algorithmic decision-making for their recommender system to recommend customers about their purchases and products [14]. Amazon is the forefront user of such technologies as Artificial Intelligence has been a significant part of their business. To save energy and time, IT companies use these selection decision algorithms to make the process automation. Such algorithms replicated the pattern which they receive by selecting individuals. In fact, among all industries, tech companies face the highest gender disparities. 19.8% of the total workforce of IT are women programmers. Amazon learns to reinforce those normalized discriminatory outcomes. Amazon’s system learns about these outcomes of normalized gender discrimination. This strategy penalized the word “women”. This algorithm even downgraded the score of that candidate who has even used the word women’s college in their resume [7].

The issue of gender discrimination was so deep-rooted that it could not be removed even after a few attempts to resolve it. There is no guarantee of not much happening shortly because if the system is based on a biased database, it cannot be rectified. Though it was not accepted by Amazon that it has used recommendations given by machine learning intentionally or unintentionally, it has affected the selection process.

Artificial Intelligence may affect the process of women’s decision-making, therefore propositional knowledge of Artificial Intelligence must be spread. As Artificial Intelligence is increasingly used in everyday commercial applications, users may become accustomed to algorithms making decisions for them, whether they are aware that these decisions are being made or not. We may be limiting our decision-making capacities and skills when the responsibility to make decisions is relegated to Artificial Intelligence. And if Artificial Intelligence is unable to capture embodied knowledge, there are sure to be gender implications that developers and regulators alike have not yet accounted for.

## **8.8 Preventive Measures to Eliminate/Minimize Biasness in Artificial Intelligence**

Artificial Intelligence cannot be blamed for existing gender inequalities and be responsible to fix the existing challenges especially when input data for Artificial Intelligence have been taken from the real world where such inequalities exist. To better understand these real-world gender inequalities, social innovation, and more

improvised research programs should be accompanied by increased investment in Artificial Intelligence. A comprehensive analysis of the relationship between gender equality and the complexities of the Artificial Intelligence ecosystem should be practiced continuously.

There is a strong need to understand and implement the following aspects in the private and government sectors:

1. View society in a holistic view and consider the broader goals to achieve.
2. Position gender equality in Artificial Intelligence ethics and principles.
3. Design new approaches to implement principles of Artificial Intelligence and Gender Equality.
4. Identify and develop an action plan which should be beneficial for multi-stakeholders.

Women must be empowered to influence and reshape a system where Artificial Intelligence operates. Societal implications of Artificial Intelligence must be recognized not only in the technology field, but also in economics, law, security, politics, and cross-disciplinary research/education. Artificial Intelligence can reproduce and increase injustice, tribalism, and societal inequalities. Categories of men and women can be counted at the very starting point of data entry. If the difference is large, remedial measures can be taken to widen the net of more women. A gender-equitable screening process can be built by tracking this data over time.

### ***8.8.1 Reinforcement Learning***

Reinforcement learning means the training of an algorithm with a distinct goal and rules to be set to achieve that goal through that algorithm. Positive rewards can also be sought by programming the algorithm by data scientists. The ultimate goal can be achieved when it acts in the same direction. Robots are one example of reinforcement learning which perform a task based on the remaining instructions. Bots have been trained by using reinforcement learning only to respond and communicate to humans because its goal has been predefined CRM (Customer Relationship Management) software uses models based on machine learning to analyze messages in emails and respond to prompt sales. Thus we can see that a machine that is based on Artificial Intelligence and has been trained on input data can be channelized easily by using reinforcement learning. Therefore, this reinforcement learning can also train the data to balance gender equality, and the output of algorithms can be rechecked before relying on its decision model. These practices will help minimize gender biases. For example, in the HRIS system, a trained machine learning model (along with human intervention) can be used to filter applications and justify the selection of the best candidate for the job role.

### ***8.8.2 Selection of Right Machine Learning Model***

To solve a problem, the selection of the correct machine learning model is most significant to avoid Biased outputs. The following steps are suggested to minimize this hassle:

**Step 1:** With the help of experts and data scientists, alignment of potential data inputs and problems can be done to receive the required solution.

**Step 2:** In this step, data should be collected, and reformatting of data and labeling of data should be done. Execution of this step will be done by data wranglers along with data scientists.

**Step 3:** Select the appropriate algorithm(s) to be used and analyze its performance as well. Data scientists usually carry this step.

**Step 4:** Level of accuracy must be ensured by fine-tuning outputs continuously. A data scientist should perform this based on feedback from data experts in the field of Artificial intelligence and technology.

### ***8.8.3 Usage of Human Interpretable Machine Learning***

Explaining how a specific Machine Learning model works can be challenging when the model is complex. There are some vertical industries where data scientists have to use simple machine learning models because it's important for the business to explain how every decision was made. This is especially true in industries such as banking and insurance. Complex models can produce accurate predictions, but explaining to a layperson how the output was determined can be difficult. Major IT players are using the application of Artificial Intelligence in their spectrum of Machine Learning activities. Big vendors such as – Microsoft, IBM, Amazon, Google, and other IT leads are in the race to sign up customers for their services which are Artificial Intelligence-based platforms. These leads are using Artificial Intelligence for collection of data, processing of data, classification of data and building models, training, and deployment but human intervention should not be ignored at any stage of data processing. This will help in reducing error due to training of data set and will not produce unnecessary biases in the results.

### ***8.8.4 The Right to Internet***

As per the UNESCO report [1], In the Digital Economy, women share a very less share in advanced technology jobs where non-task-routine is in demand. A major problem in India is the result of a lack of access to technology. This report reveals that 56% of Indian men own a mobile phone in comparison to 46% of Indian women aged between 15 years and 65 years. For Indian Law, to enhance the rights of women

in India, there should be the principle of the right to the internet for Indian Women. In 2020, mobile phones and internet access by everyone have been recognized as an everyday necessity by Kerala High Court. This should be considered a significant part of freedom of expression and speech. The United Nations Human Rights Council and the General Assembly have adopted a resolution that depicts that to enhance the quality of education and information, the right to the internet should be considered an essential aspect. Article 21 of the constitution has given two rights – Rights to Personal Liberty and the Right to Life. The government looked at the view that the right to be able to access the internet can be part of this article.

### **8.8.5 Role of Labor**

The Institute for Women’s Policy Research found that due to job automation, women are at a high risk of displacement in comparison to men. A category of jobs which is called midlevel jobs such as routine jobs and cognitive jobs are dominated by women which are a major threat to be displaced due to automation. As per the report of the world economic forum [57] 57% of such jobs are at risk of being displaced by 2026. For example, in a survey on gender balance workforce, reports say that in the gaming industry of the UK, 33% of women faced harassment due to their gender and 45% of women admit that their gender was a factor that has limited their progression in this career. This brings an insight that there is an urgent need to have improvised practices during the hiring process to increase the number of female programmers in the IT field.

As a first step toward this objective, California passed the California Senate Bill No. 826, which mandates that a minimum number of women be included on corporate boards. Today in the United States, women make up almost half (47%) of the workforce, but they hold less than one-third (28%) of the leadership positions in tech companies.

There is a need to involve gender experts and more participation of women at the foundation level to formulate the principles. Emphasis should be given to an increased number of women in board rooms and representation of women in technical roles in Tech companies at the Indian and Global Levels. A robust gender-inclusive Artificial Intelligence-based guidelines, principles, and codes of ethics must be incorporated to enable gender equality. Every company makes some policy related to fairness, transparency, and work ethics practices but none has framed any policy related to algorithm fairness and till now there is no clear definition that has explained “Fairness of Algorithm”. More feminist principles like- languages, access to the internet, privacy, and information to make informed decisions should be common now in tech companies.



### **8.8.6 Data Sets – The Starting Point**

Even if it is “Apparently” women-centric data, many data sets which are Artificial Intelligence based may lead to a biased result. A computer that retrieves information from a data set treats collected data as a single unit. This means that separate pieces of data are used to train an algorithm to predict a pattern inside the whole data set.

To create an Artificial Intelligence model, data sets are the very first step and therefore it is difficult to ensure that model is without bias. As we know that women are a heterogeneous group that faces varied realities. This includes indigenous women, women from remote and rural areas, women from a religious minority, women living with disabilities, etc. Thus they may not be always part of our initial data set. For example, the word “chamar” is not to be used on Twitter and it is punishable under the scheduled castes and tribes Act, 1989. Thus any specific word cannot be eliminated from the training of the data set but a systematic input with human intervention can resolve this problem. To avoid biases and exclusions into data sets, the relationship or intersectionality between gender and discrimination must be considered a significant aspect. Any information which is Artificial Intelligence generated always depends on predictions, patterns, and recommendations which are various parameters of accuracy, reliability, and universality of the used data. This information also gets affected by the biases of developers of algorithms and inherent assumptions of the data. If these coders or developers and designers are biased toward gender notions, then neutral results by machines cannot be expected and hidden discrimination will come into the system. The study reveals that in the field of Data Science and Artificial Intelligence, only 22% of professionals are women. Gender bias does creep into systems that are Artificial Intelligence based as women hold middle-level jobs only with less status.

### **8.8.7 Watch Carefully Where Can Gender Bias Creep in**

IT professionals need to watch carefully at which step of Artificial Intelligence developed models, gender biases can creep into the system. For example, in NLP (Natural Language Processing) “HERS” is not read as a pronoun by widely used technologies. Once an incident happens with the Apple application in 2019 when it was found from a decision model that it was offering smaller lines to women with the same credit scores in comparison to men. The company then stated that the algorithm which was giving results was gender-blind but explained like that algorithm was intended to set the limit and inherently and unintentionally biased against women. A much better corporate governance in software applications is required for the prevention of such gender biases. This also includes the incorporation of gender equality practices and principles in the recruitment process and diversity in work culture and retention practices.

## 8.9 Conclusion

A computer's retrieved information is only good as the human mind behind it. This is the fundamental characteristic for unbiased results or gender equality, which should be kept in mind before implementing Artificial Intelligence solutions and training datasets. India failed in addressing the women's issues related to digital services and access to the internet needs women during the pandemic. India should look for such digital services, where women can depict more fulfilling roles. At present, we hardly find women's roles in the IT sectors such as – digital deliverable services and cloud computing. For a better digital future for all, societies should be more open to the requirement of gender minorities and co-ownership should be enabled so that undercooked communities should take a front seat at the table and can boost gender equality. In a society of free citizens, the core principle of developing any model must be based on data ethics. Different people have a different understanding of the meaning of fairness and biasness. Though some basic values or principles lack uniformity in recourse sharing and distribution to each gender equality means that everybody has given equal attention, and level of recourses to receive the same outcome. An organization never distributes the different amount of equity on the individual or group's need-based to achieve the goal. Equality and equity to minimize bias can lead to confusing results. The unfairness of one group should not be transferred to another group. For instance, a long-awaited list of cancer patients in a hospital should not be sorted based on an Artificial Intelligence model. Artificial Intelligence technologies have evolved with new opportunities and challenges. This is the time of action, though algorithms of machine learning have been there for past decades now it has reached new popularity as Artificial Intelligence has fully-fledged grown in prominence, which has brought gender biases as a dependent decision-making tool. Business decision makers should not ignore the significance of human intervention in any decision-making process and data analytics and data scientists should take precautionary measures while training data which can become the reason for biased decisions at a later stage.

## References

1. UNESCO Report. (2019). Data retrieved from: <https://en.unesco.org/ARTIFICIAL-INTELLIGENCE-and-GE-2020>
2. Fajimi, F. O., & Omonona, B. T. (2011). Women participation in agro-allied small and medium scale enterprise and its impact on poverty alleviation in Oyo State Nigeria. *International Journal of Agricultural Environment*, 1, 27–37.
3. Perinelli, B., & Beken, V. A. (2011). *The gender gap: A comparative analysis of wages in times of recession*. Wage Indicator Foundation. Retrieved from <https://wageindicator.org/Wageindicatorfoundation>
4. Swift, S. (2015). Gender disparities in the tech industry: The effects of gender and stereotypic ability on perceived environmental fit. In *2015 NCUR*.
5. Machin, S., & Puhani, P. (2003). *Economics Letters*, 79(3), 393–400.

6. Shidhaye, R., & Patel, V. (2010). Association of socio-economic, gender and health factors with common mental disorders in women: A population-based study of 5703 married rural women in India. *International Journal of Epidemiology*, 39(6), 1510–1521.
7. Linden, G., Smith, B., & York, J. (2003). Amazon.com recommendations: Item-to-item collaborative filtering. *IEEE Internet Computing*, 7(1), 76–80.
8. Dastin, J. (2018). Amazon scraps secret ARTIFICIAL INTELLIGENCE recruiting tool that showed bias artificial Intelligence women. Reuters. <https://www.reuters.com/article/usamazon-com-jobs-automation-insight/amazon-scraps-secret-Artificial-Intelligence-recruiting-tool-that-showed-bias-artificial-Intelligence-st-women-idUSKCN1MK08G> (2018). Accessed 24 Apr 2021.
9. Vincent, J. (2018). Amazon reportedly scraps internal ARTIFICIAL INTELLIGENCE recruiting tool that was biased artificial Intelligence women. *The Verge*. <https://www.theverge.com/2018/10/10/17958784/Artificial-Intelligence-recruiting-tool-bias-amazon-report> (2018). Accessed 28 Mar 2021.
10. Ministry of Panchayati Raj. (2012). *Annual Report-27*. Ministry of Panchayati Raj, Government of India.
11. Font, J. E., & Costa-Jussa, M. R. (2019). Equalizing gender biases in neural machine translation with word embedding techniques. Xiv preprint arXiv:1901.03116.
12. Munjal, R., & Kaur, J. (2019). Gender sensitization for women empowerment: A review. *Indian Journal of Economics and Development*, 15(1), 132. <https://doi.org/10.5958/2322-0430.2019.00015.5>
13. Leavy, S. (2018). Gender bias in artificial intelligence: The need for diversity and gender theory in machine learning. *2018 IEEE/ACM 1st international workshop on gender equality in software engineering (GE)*, 14–16.
14. Shields, M. (2015). *Women's participation in Seattle's high-tech economy*. [https://smartech.gatech.edu/bitstream/handle/1853/53790/madelyn\\_shields\\_women's\\_participation\\_in\\_seattles\\_high\\_tech\\_economy.pdf](https://smartech.gatech.edu/bitstream/handle/1853/53790/madelyn_shields_women's_participation_in_seattles_high_tech_economy.pdf). Accessed 15 Aug 2021.