CONTRIBUTION TO THE EUROPEAN COMMISSION'S PUBLIC CONSULTATION ON GENDER EQUALITY STRATEGY 2020-2024

The Center for Data Innovation is pleased to submit comments in response to the public consultation of the European Commission, which is gathering feedback to inform its gender equality strategy 2020-2024.[1] This initiative calls for a new policy framework to continue tackling gender inequality in the EU and beyond, and among other areas, it will focus on gender issues related to artificial intelligence (AI).

Our response aims to help EU policymakers better understand the implications of AI for gender equality, to inform them about the ways in which AI can be a powerful solution to address gender bias, and to suggest policies which could support the use of AI to this purpose.

The EU gender equality strategy is an opportunity for EU policymakers to recognize that AI can help tackle gender equality and use AI to correct for human bias; invest in research developing de-biasing methods; encourage best practices to diversify teams in organizations developing and deploying AI; and update regulations to ensure they enable collection and access to diverse high-quality datasets.

AI CAN HELP TACKLE GENDER EQUALITY

There are concerns that AI will perpetuate or amplify gender bias in society.[2] Some portray the technology as inherently discriminatory and believe algorithms reinforce discrimination by producing results that differ significantly in accuracy across different demographic groups. Since machine learning systems often train their models on data that reflects real-world, human cognitive bias, many worry that AI will perpetuate stereotypes.[3]

However, it is important to recognize that human decision-making is imperfect. Humans are influenced by the weather, their mood, their circadian rhythm, their culture, their geographical origin, and their educational and societal background. AI systems have the potential to be less biased because they are more consistent, and because it is possible for the designers of a system to consciously decide which information should and should not be used to make a decision.

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[1] "Gender Equality Strategy 2020-2024," European Commission, https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2020-267703.

[2] Celine Van den Rul and Stephan Luiten, "Executive Vice President Margrethe Vestager - A Europe Fit for the Digital Age," Daniel J. Edelman Holdings, Inc, October 9, 2019, https://www.edelman.be/insights/ep-hearing-vestager.

[3] Marcus Tomalin and Stefanie Ullmann, "AI could be a force for good - but we're currently heading for a darker future," The Conversation, October 14, 2019, https://theconversation.com/ai-could-be-a-force-for-good-but-were-currently-heading-for-a-darker-future-124941.

While bias is a valid concern, the right response for the EU should not be to postpone the development and use of AI until bias is eliminated from society, but rather the EU gender equality strategy should promote AI as a helpful tool for improving social fairness and gender equity in Europe.[4]

AI CAN CORRECT FOR HUMAN BIAS

First, the EU gender equality strategy should emphasize that AI can help identify and correct human bias in society. For example, Disney recently started using an algorithmic tool to analyze scripts and track gender bias.[5] Using a machine learning tool, the company can compare the number of male and female characters in scripts, as well as other indicators of diversity such as the number of speaking lines attributed to women, people of color, and people with disabilities.

Many companies are also using AI in employee recruitment not just to speed up processes by screening and filtering the most relevant applications, but also to ensure decisions are not driven by unconscious biases by the human recruiters involved.[6] In addition, there are opportunities to use AI for clearly beneficial ways to improve recruitment. For example, AI-powered applications and tools can automatically scan and flag job descriptions for biased language which might dissuade female applicants from applying.[7] Algorithmic bias is naturally undesirable if software incorrectly scores job applications from women as less competitive than those from men. However, it is important to recognize that the market has strong incentives to get this right, as improvements in accuracy help both recruiters and applicants.

[4] Pascal Hansens, "Juncker Commission: A Social 'Triple A'," Euranet Plus, March 13, 2019, https://euranetplus-inside.eu/juncker-commission-a-social-triple-a/. "Gender Equality Strategy," European Commission, https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/gender-equality-strategy_en.

[5] Andrew Pulver, "Geena Davis announces 'Spellcheck for Bias' tool to redress gender imbalance in movies," The Guardian, October 9, 2019, https://www.theguardian.com/film/2019/oct/09/geena-davis-institute-gender-media-disney-machine-learning-tool.

[6] Christopher McFadden, "7 Amazing Ways Companies Use AI to Recruit Employees," Interesting Engineering, August 18, 2019, https://interestingengineering.com/7-amazing-ways-companies-use-ai-to-recruit-employees.
Olivia Folick, "How AI Can Stop Unconscious Bias In Recruiting," Ideal, April 2, 2019, https://ideal.com/unconscious-bias/.

[7] Carmen Nobel, "How To Take Gender Bias Out of Your Job Ads," Forbes, December 14, 2016, https://www.forbes.com/sites/hbsworkingknowledge/2016/12/14/how-to-take-gender-bias-out-of-your-job-ads/#556345251024.
Kat Matfield, "Gender Decoder for Job Ads," katmatfield.com, http://gender-decoder.katmatfield.com/.
Amber Laxton, "Critics of 'Sexist Algorithms' Mistake Symptoms for Illness," Center for Data Innovation, August 3, 2015, https://www.datainnovation.org/2015/08/critics-of-sexist-algorithms-mistake-symptoms-for-illness/.

It is important to note that there are contexts in which algorithmic bias can be acceptable, and even desirable, in the marketplace and in society. These include when algorithmic bias benefits consumers; corrects for societal bias; and is less than human bias.

Indeed, algorithms performing differently across different demographics are not always a problem, and can serve consumers better. For example, a women's shoe retailer may use an algorithm that favors showing online ads to women over men to reduce its advertising costs. A health agency running a campaign to raise awareness about HIV and encourage people to get tested would want to target ads to demographic groups with the highest likelihood of contracting the disease.

Furthermore, the bias of an algorithm can be less than that of a human, in which case it can be preferable to knowingly use a biased algorithm to perform a task than to rely on human decision-making. Consider, for example, facial recognition—the process of uniquely identifying a person's face.[8] There is a well-documented "cross-race effect" that shows people are generally better at recognizing faces from their own race.[9] In contrast, the most recent results from the U.S. National Institute of Standards and Technology's (NIST) Ongoing Facial Recognition Vendor Test (FRVT) showed that the most accurate algorithms it evaluated showed consistently high accuracy across all demographics.[10]These results demonstrate that even where facial recognition algorithms perform more accurately for certain demographics, they have the potential to dramatically improve on the status quo. While any bias is of course undesirable and should be improved upon, the use of the algorithms for facial recognition can still be desirable. Given the options of a significantly biased human decision-making and slightly biased algorithmic decision-making, a society that seeks to increase fairness would choose the latter every time.

THE EU SHOULD INVEST IN RESEARCH TO SUPPORT THE DEVELOPMENT OF DE-BIASING METHODS

Second, where algorithms generate biased results, EU policymakers should encourage the development of de-biasing tools that can make AI more impartial. For example, gender bias may appear in word embeddings—the association between two words, such as "woman" with "nurse"

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[8] Note: Some journalists conflate facial recognition with facial analysis, particularly by implying that facial recognition and facial analysis systems have comparable accuracy. This is not true, and the two technologies are distinct: facial recognition refers to uniquely identifying an individual's face, while facial analysis refers to determining the features of an individual's face, such as whether they have facial hair or wear glasses, their skin tone, or their gender.

[9] Hourihan, Kathleen, "Same Faces, Different Labels: Generating the Cross-Race Effect in Face Memory with Social Category Information," *Mem Cognit,* October 2013: 1021-1031, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3740049/.

[10] Patrick Grother, Mei Ngan and Kayee Hanaoka, "Face Recognition Vendor Test (FRVT), Part 3: Demographic Effects," National Institute of Standards and Technology (NIST), U.S. Department of Commerce, December 2019, https://nvlpubs.nist.gov/nistpubs/ir/2019/NIST.IR.8280.pdf.

and "man" with "doctor."[11] Researchers have been able to effectively reduce gender bias in AI systems using different techniques, such as by resampling data.[12] And many companies have developed open source tools to understand and reduce algorithmic bias, such as Microsoft Azure's Face API, Facebook's Fairness Flow, and Google's What-If.[13] Some of these techniques allow developers to generate visualizations exploring the impact of algorithmic adjustments, to manually edit examples from datasets, see the effects of changes in real time, detect previously ignored features of datasets, and identify the features that can lead to improvements.

Unfortunately, Europeans do not appear to be in the lead in developing more ethical AI systems. Indeed, the opposite appears to be true: EU researchers are lagging their U.S. counterparts in addressing ethical AI. Our analysis of all the research papers that were accepted at the 2018 FAT/ML (Fairness, Accuracy and Transparency in Machine Learning) conference—the premier research conference on the topic—found that only 5 percent of the authors were European, despite the fact that the conference was hosted in Stockholm. In contrast, 85 percent of the authors were American. If the EU is serious about addressing bias in AI systems then it needs to significantly increase its commitment to the field of AI broadly, and fairness, accuracy and transparency specifically.[14]

THE EU SHOULD ENCOURAGE BEST PRACTICES TO DIVERSIFY TECH TEAMS

Third, ensuring more women in the AI workforce would likely accelerate efforts to address gender bias. The EU gender equality strategy should therefore propose ways to invest in policies to

[11] Tommaso Buonocore, "Man is to Doctor as Woman is to Nurse: the Gender Bias of Word Embeddings," Towards Data Science, March 8, 2019, https://towardsdatascience.com/gender-bias-word-embeddings-76d9806a0e17.

[12] Tolga Bolukbasi, Kai-Wei Chang, James Zou, Venkatesh Saligrama, and Adam Kalai, "Man is to Computer Programmer as Woman is to Homaker? Debiasing Word Embeddings," Advances in Neural Information Processing Systems, 2016, https://papers.nips.cc/paper/6228-man-is-to-computer-programmer-as-woman-is-to-homemaker-debiasing-word-embeddings.pdf.
Kaiji Lu, Piotr Mardziel, Fangjing Wu, Preetam Amancharla, and Anupam Datta, "Gender Bias in Neural Natural Language Processing," arXiv at Cornell University, May 30, 2019, https://arxiv.org/pdf/1807.11714.pdf.
James Orme, "MIT researchers propose model for debiasing AI algorithms," Techerati, January 28, 2019, https://techerati.com/news-hub/mit-researchers-propose-model-for-debiasing-ai/.

[13] Eric Carter, "Microsoft Improves Face API to Reduce Racial and Gender Bias," Programmableweb, June 29, 2018, https://www.programmableweb.com/news/microsoft-improves-face-api-to-reduce-racial-and-gender-bias/brief/2018/06/29.
Dave Gershgorn, "Facebook says it has a tool to detect bias in its artificial intelligence," Quartz, May 3, 2018, https://qz.com/1268520/facebook-says-it-has-a-tool-to-detect-bias-in-its-artificial-intelligence/.
Kyle Wiggers, "Google's What-If Tool for TensorBoard helps users visualize AI bias," VentureBeat, September 11, 2018, https://venturebeat.com/2018/09/11/googles-what-if-tool-for-tensorboard-lets-users-visualize-ai-bias/.

[14] Daniel Castro, "Europe will be left behind if it focuses on ethics and not keeping pace in AI," EuroNews, July 8, 2019, https://www.euronews.com/2019/08/07/europe-will-be-left-behind-if-it-focuses-on-ethics-and-not-keeping-pace-in-ai-development.

attract, recruit, and retain more women in the computer science field, in order to diversify the teams ultimately developing AI systems.

While diverse development teams might not necessarily develop unbiased AI (just as less diverse teams might not develop biased AI), companies should still work to employ more diverse teams of developers and engineers to reduce the risk of bias from entering systems inadvertently, to ensure datasets do not include irrelevant or over- or under-represented metrics, and to ensure datasets are more representative of the general population. Many companies are already taking these steps, and EU universities should also train future developers about these issues to ensure they are widely understood.

EU GENDER DIVERSITY IN AI IN NUMBERS

- Women are underrepresented in STEM studies. Until the age of 15, girls excel over boys at STEM subjects, but then the situation drastically changes. Even though some women do graduate from STEM programs, many of them do not pursue a career in this field.

- In 2018, out of 8.9 million people employed in the EU as ICT specialists, only 17 percent (1.5 million) were women.[15]

- There are significant differences between EU countries in terms of computational thinking among middle school students, females score better than males in Finland and the same in Denmark, but lower than males in France, Germany, Luxemburg, and Portugal.[16]

- Only about 16 percent of all AI workers in the EU on LinkedIn are women, and only 22 percent of the users on LinkedIn with AI skills are women.[17]

- Women represent 27 percent of Microsoft's employees, 32 percent at Apple, 36 percent at Facebook, and 47 percent at Netflix, but these numbers do not mean that women occupy "tech jobs"—only 30 percent of them do.[18]

- Women represent less than 30 percent of the world's AI researchers.

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[15] "ICT specialists are predominantly male," European Commission, May 13, 2019, https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190513-1.

[16] Julian Fraillon, John Ainley, Wolfram Schulz, Tim Friedman and Daniel Duckworth, "Preparing for Life in a Digital World," IEA International Computer and Information Literacy Study 2018, International Report, International Association for the Evaluation of Educational Achievement (IEA), see table 4.2. https://www.iea.nl/sites/default/files/2019-11/ICILS%202019%20Digital%20final%2004112019.pdf.

[17] Thomas Roca, Claire Dhéret, Liz Wilke, and Sein O'Muineachain "AI Talent in the European Labour Market" LinkedIn Economic Graph, November 2019, https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/reference-cards/research/2019/AI-Talent-in-the-European-Labour-Market.pdf. Joe Miller, "The battle against AI bias," BBC News, January 27, 2019, https://www.bbc.com/news/business-46999443.

[18] Felix Richter, "The Tech World is Still a Man's World," Statista, March 8, 2019, https://www.statista.com/chart/4467/female-employees-at-tech-companies/.

- Only 18 percent of paper authors at 21 leading AI conferences were women.[19]

- In the UK, the amount of research published by female AI professionals has dropped over the last decade, and gender diversity in AI is little better than in the 1990s.[20]

The lack of women in IT, computer science, and in AI R&D is a critical issue. Companies adopting AI acknowledge that sourcing and retaining AI talent is a top challenge because so few women are in the pipeline.[21]

One potential underlying cause is that women are not sold on AI. A study by the Center for Data Innovation showed that 41 percent of men, compared to only 31 percent of women, agreed with the statement, "Technological innovations, like artificial intelligence and robotics, will make the world a better place."[22] A 2019 global survey of consumers by Ford Motor Company found that 44 percent of women agreed with the statement, "I am afraid of AI," compared to 37 percent of men.[23] And a few years ago, an Edelman study suggested that women are "substantially" more skeptical than men when it comes to innovation.[24]

The EU gender equality strategy should prioritize advancing computer science skills among female students by integrating data science and computer science courses into school curriculums, particularly at the secondary school level, to inspire more women to gain interest in these fields. EU policies and those of member states should support the development of specialty math and science in high schools, which at least in the United States has appeared to have led to better gender balance in the sciences fields.[25] Policies should also encourage

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[19] Jean-François Gagné, Grace Kiser, and Yoan Mantha, "Global AI Talent Report 2019," jfgagne.ai, 2019, https://jfgagne.ai/talent-2019/.

[20] Kostas Stathoulopoulos and Juan Mateos-Garcia, "Gender Diversity in AI Research," Nesta, July 2019, https://media.nesta.org.uk/documents/Gender_Diversity_in_AI_Research.pdf.

[21] Preston Gralla, "AI by the numbers," Hewlett Packard Enterprise, August 20, 2019, https://www.hpe.com/us/en/insights/articles/ai-by-the-numbers-1908.html?chatsrc=em-en&jumpid=ba_fp2k16j8v3_aid-520000028.

[22] Daniel Castro, "Many Women Aren't Sold On AI. That's a Problem.," Center for Data Innovation, March 12, 2019, https://www.datainnovation.org/2019/03/many-women-arent-sold-on-ai-thats-a-problem/..

[23] "Looking Further with Ford" Ford Motor Company, 2019, December 11, 2018, http://www.campaign.ford.com/campaignlibs/content/fordmedia/fna/us/en/asset.download.document.pdf.html/content/dam/fordmedia/North%20America/US/2018/12/11/FordTrends2019.pdf.

[24] John Cook, "Study: Women are way more skeptical of tech advances than men," GeekWire, March 12, 2015, https://www.geekwire.com/2015/study-women-are-way-more-skeptical-of-tech-advances-than-men/.

[25] Robert D. Atkinson, "Addressing the STEM Challenge by Expanding Specialty Math and Science High Schools," ITIF, March 20, 2007, https://itif.org/publications/2007/03/20/addressing-stem-challenge-expanding-specialty-math-and-science-high-schools.

colleges and universities to do a better job at recruiting and retaining female professors in computer science.[26]

Making AI more attractive to women can expand the EU talent base and accelerate growth of the industry.[27] Policymakers should foster an AI-friendly culture by initiating awareness-raising campaigns that articulate more clearly the value that AI and related digital technologies offer. The gender equality strategy should also encourage educational institutions to organize more interaction between technology businesses and students. Schools can initiate interventions from professionals or role models that work in the field of technology, by inviting them to discuss with students, and explain the promises this industry holds in terms of career prospects. Schools and companies alike can inspire women to take up courses that can lead them to gain interest for this field, as well as making it more welcoming to women. For example, the EU gender equality strategy can propose incentives for companies to help women pursue their careers by providing childcare, supporting visibility of their female experts at corporate events, and encouraging women entrepreneurship.

AI is fueling sectors such as education and healthcare, where many women work, which reflects the many opportunities for positive change: This could be where targeted AI training would be most efficient in teaching women digital skills. In addition, there is increasing awareness of the importance of gender and diversity to progress in AI. For instance, the participation of women to organizations such as Women in Machine Learning is growing and many similar platforms have mushroomed across member states and globally—such as Women in Tech, and Women in AI.[28] The EU gender equality strategy can tap into these networks as an opportunity to consolidate awareness raising efforts, for instance by proposing to federate these initiatives under an EU-wide platform, open to all, using the example of the European AI Alliance. This will create a sense of urgency, raise the stakes constructively among decision-makers, help in growing interactions between various types of leaders, and generate more support for those initiatives.

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[26] Robert D. Atkinson and Merrilea Mayo, "Refueling the U.S. Innovation Economy: Fresh Approaches to Education," ITIF, December 7, 2010, https://itif.org/publications/2010/12/07/refueling-us-innovation-economy-fresh-approaches-stem-education.

[27] Daniel Castro, "Many Women Aren't Sold On AI. That's a Problem.," Center for Data Innovation, March 12, 2019, https://www.datainnovation.org/2019/03/many-women-arent-sold-on-ai-thats-a-problem/.

[28] Raymond Perrault, Yoav Shoman, Erik Brynjolfsson, Jack Clark, John Etchemendy, Barbara Grosz, Terah Lyons, James Manyika, Saurabh Mishra, and Juan Carlos Niebles, "The AI Index 2019 Annual Report," Human-Centered AI Institute at Stanford University, December 2019, https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai_index_2019_report.pdf.

"Women in AI: Bringing All Minds Together," womeninai, 2020, https://www.womeninai.co/.

THE EU SHOULD ENCOURAGE AND ENABLE ACCESS TO DIVERSE, HIGH-QUALITY DATASETS

Fourth, the gender equality strategy should update regulations that make it difficult for companies to gather diverse, high-quality data to improve their AI systems and address biases.[29] There are many examples of datasets that under represent women, and incomplete datasets can distort an AI system's reasoning.[30] For example, clinical trial datasets often under-represent women, and medical researchers should be encouraged to collect datasets that more accurately represent the real-world population.[31] Collecting useful data without fear of breaching rules will be critical to ensure algorithmic decision-making fosters social fairness. Policies should encourage, but not mandate companies deploying AI to establish or further enforce responsible processes mitigating bias. For example, organizations already are actively using technical tools and operational practices such as third party audits or internal "red teams," or are developing features in algorithms to reduce gender bias, such as by providing both feminine and masculine translations for gender-neutral words.[32] As shown in Figure 1, Google is taking this step.

Figure 1: Change in output to reduce gender bias in Google Translate:

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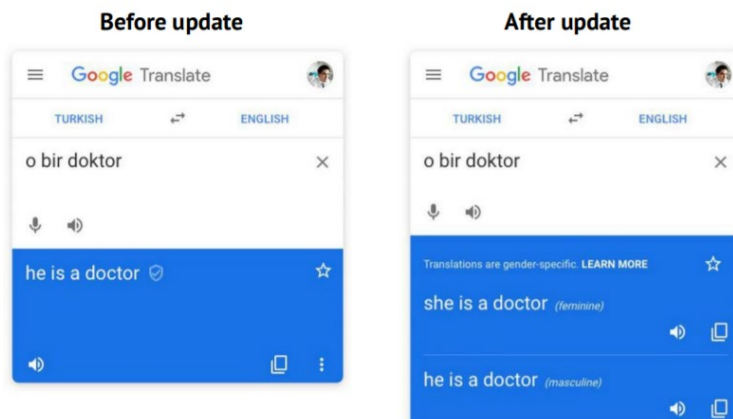
[29] Charles Towers-Clark, "How To Train Your AI Dragon (Safely, Legally and Without Bias)," Forbes, October 12, 2019, https://www.forbes.com/sites/charlestowersclark/2019/10/12/how-to-train-your-ai-dragon-safely-legally-and-without-bias/#2bbd890c7e5c.

[30] Caroline Criado Perez, "Invisible Women: Data Bias in a World Designed for Men," (Harry Abrams, 2019).

[31] Katherine Ellen Foley, "25 years of women being underrepresented in medical research, in charts," Quartz, July 3, 2019, https://qz.com/1657408/why-are-women-still-underrepresented-in-clinical-research/.

[32] James Kuczmarski, "Reducing gender bias in Google Translate," Google, December 6, 2018, https://www.blog.google/products/translate/reducing-gender-bias-google-translate/.

In addition, the EU gender equality strategy should emphasize that opening up the public sector's data and expanding authorizations to use them can ensure companies have broader and safer access to higher-quality datasets. As one promising technique to tackle bias is the use of synthetic data to train algorithms on more diverse and reflective datasets, the gender equality strategy should encourage member states' statistical agencies to release more of such data while protecting data privacy.[33] They should also encourage the public and private sectors to collaborate on developing more inclusive data sets.[34]

GENDER EQUALITY AND AI ARE CONNECTED

No technology is perfect, especially in its early stages of development. Restricting the use of technology until it becomes perfect is the path to technological stagnation. Given the potential of AI and other emerging technologies both for societal and economic prosperity, EU policymakers should work to reduce harms while also enacting policies to improve their benefits and promote their long-term acceptance.

It may be impossible to correct human bias, but it is possible to correct bias in AI. Building a fairer EU and gender equality not only includes but depends on AI. This means working towards expanding diversity into teams creating algorithms, facilitating business access to more and richer data, adapting regulations to accelerate the adoption of AI, and, by increasing investment in AI, encouraging companies to develop methods that improve bias detection. Supporting efforts to reduce bias is how the EU will achieve greater social fairness and gender equality.

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[33] Yehudah Sunshine, "Solving Bias AI through Synthetic Data Facial Generation," medium.com, December 10, 2018, https://medium.com/solving-ai-bias-through-synthetic-data-facial/solving-bias-ai-through-synthetic-data-facial-generation-3911d5dd3986.
Jörg Drechsler and Jerome P. Reiter, "An empirical evaluation of easily implemented, non-parametric methods for generating synthetic datasets," European Commission, June 3, 2011, https://ec.europa.eu/eurostat/cros/system/files/S5P1_0.pdf_en.
[34] Daniel Castro, "The Rise of Data Poverty in America," Center for Data Innovation, September 10, 2014, https://www.datainnovation.org/2014/09/the-rise-of-data-poverty-in-america/.