Automated Decision-Making Systems (ADS) Workgroup Meeting

July 29, 2021
Agenda for July 29, 2021 Meeting

Agenda

2:30 Welcome and administrative updates – Katy Ruckle
2:35 New member introductions
2:40 Artificial Intelligence (AI) Primer and Algorithmic Bias – Santosh Putchala, Kuma, LLC
3:30 System Ranking Results – Katy
3:35 Workgroup questions and discussion – All
3:50 Open Discussion
4:05 Adjourn
Welcome and Administrative Updates
New webpage for ADS Workgroup

OPDP Projects and Initiatives | Washington Technology Solutions

https://watech.wa.gov/privacy/projects-and-initiatives

ADS Charter

- ADS Workgroup Charter

ADS Meetings

- Thursday, July 29, 2021 (Agenda PDF)

Archived ADS Meetings

ADS Workgroup Kick-off Meeting (Thursday, July 15, 2021)

- Agenda
- Presentation slide deck
- Archived recording of meeting
- Meeting notes
New Workgroup Member Introductions
## ADS Workgroup Members

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<td>26 Puckett</td>
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Artificial Intelligence (AI) Primer and Algorithmic Bias – Santosh Putchala, Kuma, LLC
Featured Speaker Mr. Santosh Putchala

- Director of Privacy at Kuma, LLC
- Advises government, commercial and non-profit entities
- BA in engineering and law, and advanced degrees in cyber law, cyber security, and consumer privacy protection
- Privacy by Design and Privacy Engineering Expert
- Designated ‘Privacy by Design Ambassador’ by Information and Privacy Commissioner Dr. Ann Cavoukian.
- Currently serves on the IAPP Exam Development Board
Artificial Intelligence (AI) Primer and Algorithmic Bias

Automated Decision-making Systems (ADS) Workgroup Meeting
Thursday, July 29, 2021

Presented by:
Santosh Putchala
Director, Privacy – Kuma, LLC
A brief History of Artificial Intelligence (AI)
The Timeline of AI

- 1938-1946: Golden age of science fiction
- 1950: Can machines think? Turing test proposed by A. Turing
- 1955: Logic Theorists, the first AI programme, is invented
- 1956: Dartmouth summer conference on AI, "Artificial intelligence" is coined
- 1960: Manchester Mark 1, the first stored-programme computer, is invented
- 1961: First Industrial robot replaced humans at assembly line
- 1963: DARPA funds AI at MIT
- 1965: Moore’s Law is put forth
- 1966: Logic Theorists, the first AI programme, is invented
- 1968: “By the year 2001 we will have machines with intelligence that matched or exceeded human’s” (A. Clarke and S. Kubrick)
- 1969: E. Feigenbaum introduces expert systems
- 1970: “In 3-8 years we’ll have a machine with the general intelligence of a human being” (M. Minsky)
- 1971-1990
- 1970: Japan’s fifth generation computer project begins
- 1972: Deep Blue defeats Gary Kasparov in chess
- 1977: First publicly available speech recognition software, developed by Dragon Systems
- 1980: Installs the first autonomous car, is built by Carnegie Mellon
- 1984: First publicly available speech recognition software, developed by Dragon Systems
- 1986: Apple’s Siri and IBM’s Watson were developed
- 1988: EUGENE, a chatbot passed Turing test; Amazon launched Alexa, a voice enabled intelligent virtual assistant.
- 2001-2010
- 2002: iRobot launched autonomous vacuum cleaner robot in bulk.
- 2009: Google built first self driving car for urban conditions
- 1950-1960
- 1950: Turing Test by Alan Turing
- 1956: Term of AI was coined
- 2011-2020
- 2011: Apple’s Siri and IBM’s Watson were developed
- 2014: EUGENE, a chatbot passed Turing test; Amazon launched Alexa, a voice enabled intelligent virtual assistant.
- 2017: Google’s AlphaGo beat the world’s best Go player Ke Jie.
- 2020
- 2020: Moxel: A Social-Emotional Companion for kids is developed by Embodied.
- Earth’s first autonomous beehive is developed by beewise
- Triallotry is an AI enabled service to look for clinical trials.
- BrainBox AI is an AI system to predict a building’s thermal conditions.
Founding Fathers of Artificial Intelligence

Alan Turing, Allen Newell, Herbert A. Simon, John McCarthy, and Marvin Minsky
Takeaway from an Industry Perspective

The Future Of A.I.
Forecasted cumulative global artificial intelligence revenue 2016-2025, by use case (U.S. dollars)

- Static image recognition, classification, and tagging: $8,097.9m
- Algorithmic trading strategy performance improvement: $7,540.5m
- Efficient, scalable processing of patient data: $7,366.4m
- Predictive maintenance: $4,680.3m
- Object identification, detection, classification, tracking: $4,201.0m
- Text query of images: $3,714.1m
- Automated geophysical feature detection: $3,655.5m
- Content distribution on social media: $3,566.6m
- Object detection and classification - avoidance, navigation: $3,169.8m
- Prevention against cybersecurity threats: $2,472.6m

Challenges to AI Adoption
Source: Cognilytica © 2020

- Limited AI Skills or Talent
- Data Quantity or Quality Issues
- Insufficient ROI Justification
- Concerns over AI Ethics
- Confusing AI Vendor Ecosystem
- Non-AI Approaches are Sufficient
- Incomplete Understanding of AI

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How Companies Around the World Are Using Artificial Intelligence

IT activities are the most popular.

- Detecting and detering security intrusions: 44%
- Resolving users’ technology problems: 41%
- Reducing production management work by automating it: 34%
- Gauging internal compliance in using approved technology vendors: 34%
- Using runbook automation: 16%
- Anticipating future customer purchases and presenting offers accordingly: 19%
- Improving media buying: 16%
- Monitoring social media comments to determine overall brand affinity and issues: 16%
- Tailoring promotions (online or offline): 15%
- Financial trading (e.g., high-frequency trading enabled by AI): 17%
- Automating call distribution: 15%

Artificial Intelligence (AI) and Machine Learning (ML) Usage Among U.S. Small Businesses

- Currently using: 31%
- Planning to use in the next 1-2 years: 27%
- Evaluating: 25%
- No plans to evaluate: 16%

Source: Capterra Top Technology Trends Survey 2019
Chart only shows data for artificial intelligence and machine learning responses.
N=320
Note: Percentages may not add up to 100% due to rounding.
Global AI Strategy Landscape

50 National Artificial Intelligence Policies as at February 2020.

Argentina
- During 2019, Argentina launched its first national AI strategy: "AI in Action: towards a national AI strategy." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

Australia
- In 2018, Australia released its first national AI strategy: "AI in Australia: a national approach to artificial intelligence." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

Austria
- In 2019, Austria launched its national AI strategy: "Artificial Intelligence Austria 2030." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

Belgium
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Colombia
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Czech Republic
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Germany
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Ireland
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Italy
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Japan
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Kenya
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Lithuania
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Luxembourg
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New Zealand
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Netherlands
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Norway
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Portugal
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South Africa
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Spain
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Switzerland
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Thailand
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Turkey
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United Arab Emirates
- In 2019, the United Arab Emirates launched its national AI strategy: "Artificial Intelligence United Arab Emirates." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

United Kingdom
- In 2019, the United Kingdom launched its national AI strategy: "Artificial Intelligence United Kingdom." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

United States of America
- In 2019, the United States launched its national AI strategy: "Artificial Intelligence United States." The strategy includes a roadmap for AI development and aims to create a vibrant AI ecosystem.

Source: HoloniQ, LLC – Unrestricted Distribution – Public

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Takeaway from a Global Perspective
Artificial Intelligence (AI) 101
What is Artificial Intelligence (AI)?

**Definition 2**
Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are **programmed to think like humans and mimic their actions**.

The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.

**Definition 3**
Artificial intelligence (AI) is about creating algorithms to classify, analyze, and **draw predictions from data**.

AI involves learning from new data and improving over time.

**Commercial Examples Of AI-based Systems**
Voice-based Virtual Assistants, Automated home vacuum cleaners, Driver-less cars, Autonomous fleets, Smart maps for navigation, AI-predicted travel booking, password-less secured cellphone login, bad-actor bans on social media platforms, conversational marketing etc.,
Automated Decision-making Systems (ADS)
**What is an ADS?**

**Automated Decision-making System (ADS)**

An Automated Decision-making System is a technical system that aims to aid and complement human decision making.

The entity codifies a set of rules that create a connection between the data and how the decision-making gets done. This system can also be set up to replace the human decision-making process to a degree.

**Decision Support System (DSS)**

A decision support system (DSS) is a technical system (or a computerized program) used to support determinations, judgments, and courses of action in an organization or a business.

A DSS sifts through and analyzes massive amounts of data, compiling comprehensive information that can be used in decision-making.
Takeaways: DSS vs ADS

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<td>• Decision support tools required too much time and expertise.</td>
<td>• ADS are readily maintained and updated. These operate throughout the enterprise as well.</td>
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<td>• Technology was available for 'limited-scope' prototypes.</td>
<td>• Technology exists in the form of large-scale systems with ability to handle large volumes of data.</td>
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<td>• A single technology focus for structured, semi-structures and un-structured data-based decisions.</td>
<td>• Integrated tools or suites exist.</td>
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<td>• Customized tools were difficult to use.</td>
<td>• Off the shelf applications are simple to install and use.</td>
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<td>• Tools were standalone black boxes.</td>
<td>• Tools are integrated with automated information sources and workflows.</td>
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<td>• Data were not widely available in electronic form.</td>
<td>• Online data are widely available as inputs to ADS.</td>
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Vs
Applications of ADS

**Building Inspection Predictive Analytics**

Uses public data to identify buildings at the greatest risk for physically deteriorating conditions that endanger the health and safety of residents. Buildings identified are prioritized for inspections.

**Public Benefits Fraud Detection System**

Pattern recognition systems used to detect fraud or abuse of public benefits.

**School Bus Times Algorithms System**

School bus time algorithms are used to help determine the most efficient school bus routes based on a school district’s objectives.

**Tenant Harassment Predictive Analytics System**

Analyzes public data to identify landlords with a high likelihood to harass tenants to help prioritize inspections for tenant harassment.

**Prescription Drug Monitoring Programs System**

These systems mine state prescription drug databases for irregularities that indicate doctor shopping, doctors overprescribing, and other practices that lead to abuse and overdoses. There have also been incidents of health departments alerting law enforcement to possible unscrupulous doctors for investigation.

**Homelessness Prioritization Algorithms System**

Uses information from different government agencies and sometimes third-parties to assess prioritized allocation of existing housing based on need. Works in conjunction with systems that identify which individuals use the greatest number of public services by analyzing data from public agencies to recommend which homeless individuals should be given housing in order to save public expenditures on homelessness.
Potential Risks from ADS

**Economic Risks**
- Availability of limited choices
- Reduced availability of credit
- Differential pricing

**Social Risks**
- Impacts on dignity
- Bias in presented information
- Filter bubble

**Risks Related to Loss of Liberty**
- Heightened suspicion
- Higher susceptibility to surveillance
- Varied amount of incarceration

**Risks of Opportunity Losses**
- Discrimination related to employment opportunities
- Hiring biases
- Limitation or denial of education opportunities
Mitigation of Potential Risks from ADS

Sample Mitigation Method per Component:

- **Technology Component**: Algorithmic design review and due-diligence
- **DSS Component**: Incorporation of check-points to ensure trigger of manual reviews
- **AI Component**: Review for Data Related Risks, AI/ML Attacks, Testing and Trust, and Compliance
- **Business Process Component**: Ethics framework, best practices to monitor & evaluate outcomes, all supported by a governance framework
- **Business Decision Rules**: Updates based on key changes to the business landscape of the entity. Periodic internal and third-party reviews.
- **Automated Decisions**: Review of the outputs of ADS at a minimum on a statistically sound sample basis.

Others:

- **Policy Component**: Requirement to conduct DPIA (Data Protection Impact Assessment) for high-risk decisions
- **Historical facts Component**: Measures to ensure that data processed by the ADS does not magnify historical bias
Algorithmic Bias 101
What is Algorithmic Bias?

**Algorithm**
- A series of steps that we follow to accomplish a task.
- Artificial Intelligence (AI) is a special type of algorithm because they are inherently required to find patterns and methods that can be used to make decisions on behalf of humans using a programmed protocol.

**Bias**
- Whatever causes an unfair action or inaction.
- Can sometimes lead to harm. Prejudice, hate and ignorance can be some of the contributing factors.

**Algorithmic Bias**
- Whatever causes the algorithm to produce unfair actions or representations.
- Algorithms are based on mathematics but being mathematical does not necessarily mean ‘objective’.
- Biases that exist in workplace, culture or community enter into the process and ultimately find a place within the model or code.
Types of Algorithmic Bias

**Algorithmic Prejudice**

- Occurs when there is a statistical dependence [correlation] between protected features and other information used to make a decision.
- **Example:** Early predictive policing algorithms did not have access to racial data when making predictions, but the models relied heavily on geographic data (e.g., zip code), which is correlated with race. In this way, models that are “blind” to demographic data like gender and race can still encode this information through other features that are statistically correlated with protected attributes.

**Algorithmic Negative Legacy**

- Refers to bias already present in the data used to train the AI model.
- **Example:** AI/ML models trained to perform language translation tasks tended to associate female names with attributes like “parents” and “weddings,” while male names had stronger association with words like “professional” and “salary.” It is unlikely that the model is picking this association up on its own; rather, it is trained on a corpus of text that reflects these gender tropes.

**Algorithmic Underestimation**

- Occurs when there is not enough data for the model to make confident conclusions for some segments of the population.
- **Example:** A global e-commerce company recently trained a machine learning model to screen applicants in its hiring process, but like many other tech companies, global e-commerce company has a disproportionately high male workforce. This data imbalance made its AI model provide stronger recommendations for male applicants. Recognizing the bias in recommendations made by the model, the company scrapped this model from their recruiting pipeline.
What Causes Algorithmic Bias?

**Historical human, cultural or institutional biases**
- Historical human biases are shaped by pervasive and often deeply embedded prejudices against certain groups, which can lead to their reproduction and amplification in computer models.

**Incomplete or unrepresentative training data**
- Insufficient training data is another cause of algorithmic bias. If the data used to train the algorithm are more representative of some groups of people than others, the predictions from the model may also be systematically worse for unrepresented or under-representative groups.

**Algorithms with too much data**
- Researchers at Georgetown Law School found that an estimated 117 million American adults are in facial recognition networks used by law enforcement, and that African-Americans were more likely to be singled out primarily because of their over representation in mug shot databases.

**Negative feedback loop-based suggestions**
- Potential negative feedback loops occur due to unavailability of other valid facts that cause an algorithm to become increasingly biased over time.

**Reinforcement with human intervention**
- Involvement of untrained, semi-trained or fatigued personnel in the ADS process for activities such as intake, outside system processing, ad-hoc processing, override processing etc.,

**Use of an ‘out of context’ algorithm**
- Data processing activities are context based. When an out of context algorithm is applied on data, results may not only be erroneous [sometimes undetectable], but also biased.
# Detection & Mitigation of Algorithmic Bias

## Have an audit framework in place
- Explore this method to audit algorithm’s code and the data from its results.
- Supplement this with viewing an algorithm’s potential effects through interviews and workshops with employees.

## Ensure interpretability
- Some types of ADS systems, for example those using deep learning, may be difficult for a human reviewer to interpret.
- If the inputs and outputs of ADS systems are not easily interpretable, and other explanation tools are not available or reliable, there is a risk a human will not be able to meaningfully review the output of an ADS system.

## Distinguish ‘solely automated’ from ‘non-solely automated’ ADS systems
- Organizations should take a clear view on the intended use of any ADS system from the beginning.
- They should specify and document clearly whether AI will be used to enhance human decision-making or to make solely automated decisions.

## Utilize open-source tools to detect Bias
- Pymetrics: Audit AI [https://github.com/pymetrics/audit-ai]
- Skater [https://github.com/oracle/Skater]
- What-If Tool [https://pair-code.github.io/what-if-tool/]
- AI Fairness 360 [https://github.com/Trusted-AI/AIF360]

## Minimize other risk-factors such as ‘Automation Bias’
- Business and system owners must think about what features they would expect the ADS system to consider and which additional factors the human reviewers should look at. Meaningful human review shall be an integral part of ADS.
Examples of Automated Decision-making Systems (ADS)
**Examples of ADS**

<table>
<thead>
<tr>
<th>DNA Analysis System</th>
<th>Risk Assessment Tools in Criminal Justice</th>
<th>School Assignment Algorithm</th>
<th>Automated License Plate Reader System</th>
<th>Fire Risk Assessments Tool</th>
<th>Healthcare Delivery and Workflow Decision Systems</th>
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<tr>
<td>These systems interpret forensic DNA samples by performing statistical analysis on a mixture of DNA from different people to determine the probability that a sample is from a potential suspect. This process is also known as probabilistic genotyping.</td>
<td>Uses existing criminal justice data to produce a “risk score” to inform decisions made pre-trial, during incarceration, sentencing, and parole/probation</td>
<td>Used to assign students to schools for k-12. Used to match eighth-graders to high schools based on preference, test scores, portfolios, and other requirements.</td>
<td>Automated License Plate Readers are high speed, computer-controlled camera systems that automatically capture all license plate numbers that come into view, along with the location, date, and time, and sometimes photographs of the vehicle and its drivers and passengers.</td>
<td>Fire Risk Assessments use data mining to predict which areas of the forest or buildings are at highest risk of catching fire.</td>
<td>These are software and IT infrastructure intended to provide predictive analytics for care providers and hospital systems to ascertain how best to distribute healthcare resources.</td>
</tr>
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</table>
Points to Note: AI, ADS & AB

- Bias is neither new nor unique to AI.
- The end goal of mitigation is not to achieve zero risk.
- Identifying, understanding, measuring, managing and reducing bias are the intended outcomes of the risk mitigation process.
- Standards and guides are needed for terminology, measurement, and evaluation of bias.
Thank You !
Further Reading: 1 of 2

- Algorithmic Bias in Health Care: https://www.hsph.harvard.edu/ecpe/how-to-prevent-algorithmic-bias-in-health-care/
- Artificial intelligence and algorithmic bias: implications for health systems: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6875681/
- Algorithmic Bias and Governance: https://ischool.uw.edu/events/2021/05/ischool-spring-lecture-algorithmic-bias-and-governance
- Bias in Library Search Systems: https://libguides.rowan.edu/c.php?g=1033634&p=7494656
- Algorithmic Bias in Marketing: https://store.hbr.org/product/algorithmic-bias-in-marketing/521020
- Algorithmic Bias in AI-Assisted Conversations: https://cssh.northeastern.edu/nulab/algorithmic-bias-in-ai-assisted-conversations/
- Combatting Algorithmic Bias in Recruiting: https://digitalstrategies.tuck.dartmouth.edu/publication/combatting-algorithmic-bias-in-recruiting/
Further Reading: 2 of 2

- Dissecting racial bias in an algorithm used to manage the health of populations: https://science.sciencemag.org/content/366/6464/447
- Artificial Intelligence (AI), Definition: https://csrc.nist.gov/glossary/term/artificial_intelligence
- NIST Workshop on Bias in AI: https://www.nist.gov/system/files/documents/2020/08/14/Pre-Workshop%20Brief%20Final_0.pdf
- Understanding AI Technology: https://www.ai.mil/docs/Understanding%20AI%20Technology.pdf
System Selection and Rankings
Need more votes!

- Only twelve workgroup members voted
- Would like to have a quorum at least to base decision on system selection
- Will resend out the link to workgroup members who did not vote
- If you need a refresher on the systems we reviewed – presentation recording and slide decks are on the ADS website
- To understand ranking – weighted 1\textsuperscript{st}, 2\textsuperscript{nd}, 3\textsuperscript{rd}, 4\textsuperscript{th} choices
  - 1\textsuperscript{st} = 4 pts
  - 2\textsuperscript{nd} = 3 pts
  - 3\textsuperscript{rd} = 2 pts
  - 4\textsuperscript{th} – 1 pt
Workgroup Member Questions and Discussion
Open Discussion
Thank you!