Bias in Computer Vision—It's Bigger than Facial Recognition!

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The Optimistic View

INTELLIGENT MACHINES

Will Smart Machines Be Less Biased Than Humans?

Robert D Atkinson Information Technology And Innovation Foundation

September 19, 2016

Bias in Computer Vision: Facial Recognition

Another Arrest, and Jail Time, Due to a Bad Facial Recognition Match

A New Jersey man was accused of shoplifting and trying to hit an officer with a car. He is the third known Black man to be wrongfully arrested based on face recognition.

By Kashmir Hill

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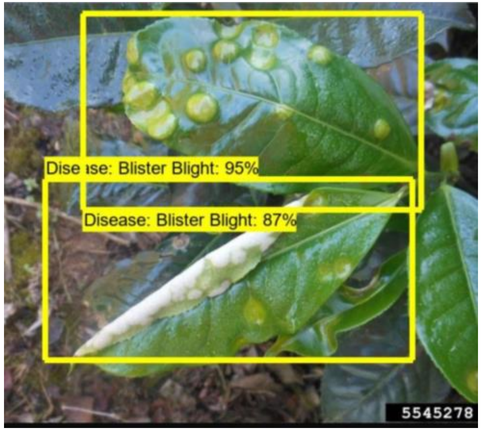
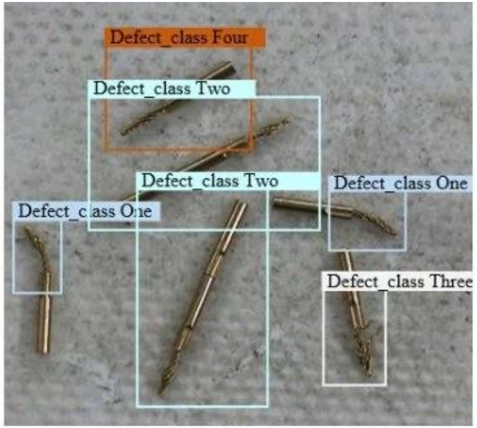
Bias in CV: Looking Beyond Facial Recognition

embedded VISION SUMMIT



Agriculture

Plant Disease Detection



Manufacturing

Quality Inspection

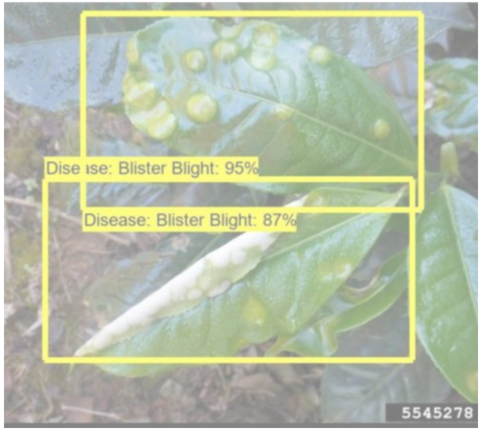
Transportation

Pothole Detection

Santa Clara University

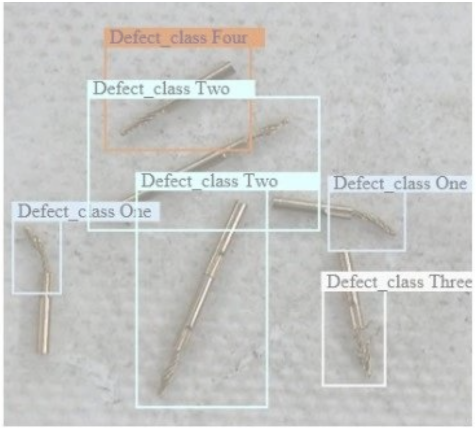
Bias in CV: Looking Beyond Facial Recognition

Bias can pose an ethical challenge, even without sensitive data!



Agriculture

Plant Disease Detection



Manufacturing

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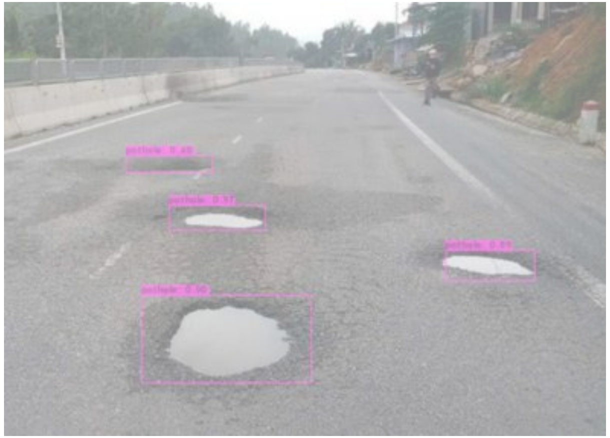
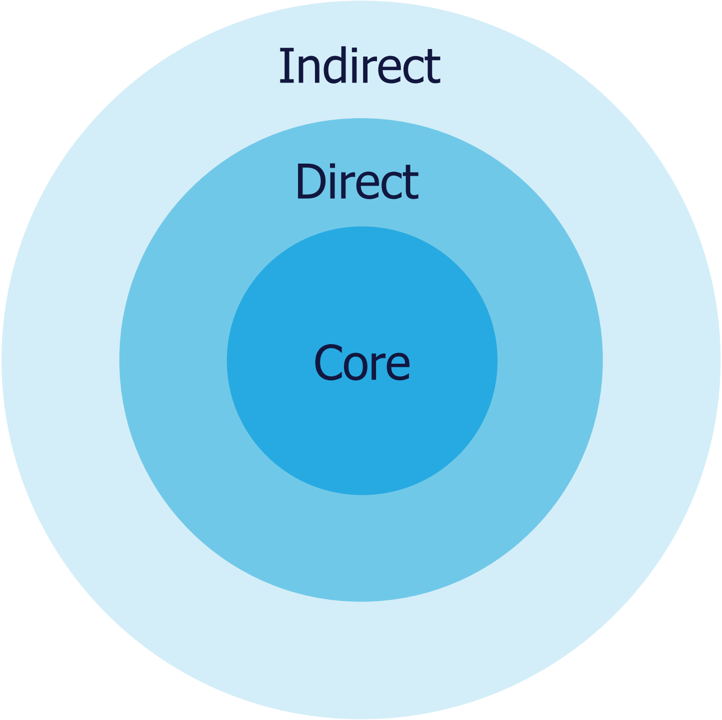


Transportation

Pothole Detection

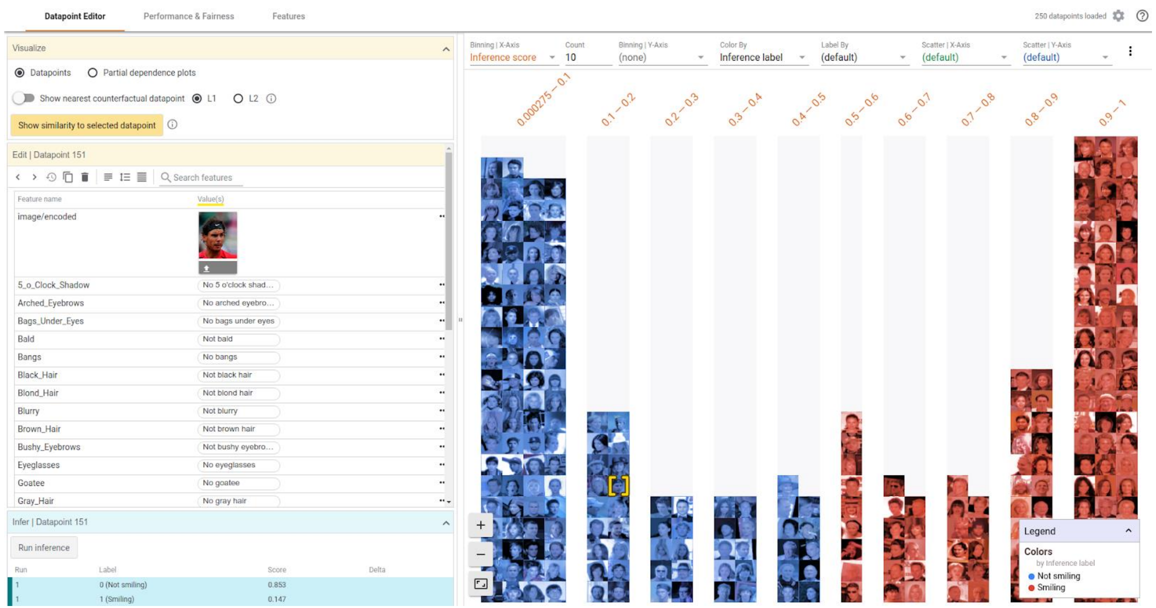
Human *Subjects* ≠ Human *Impacts*

- Expand the ethical circle to take into account the full range of stakeholders
  - *Who* does it not work for?
  - *What* does it not work for?
  - *When* does it not work?



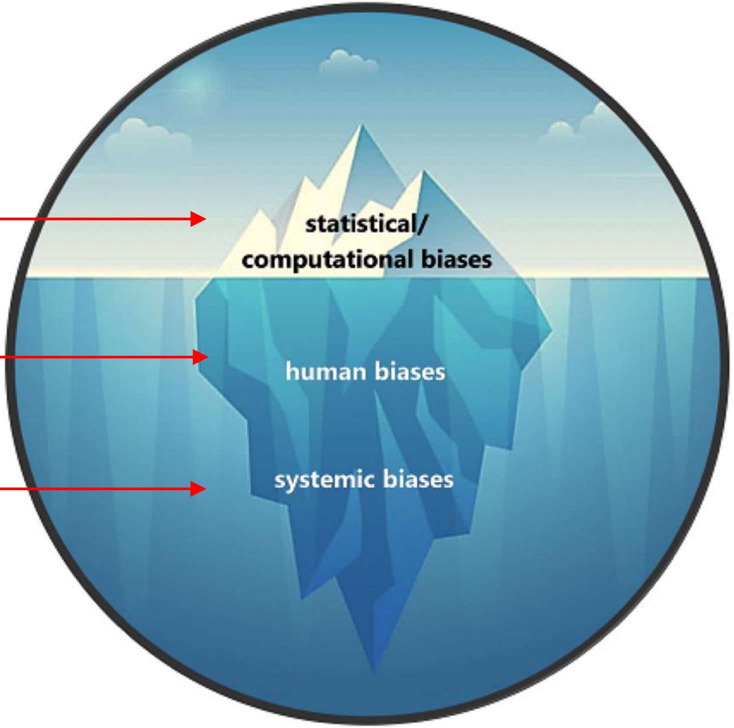
Mitigating Bias – Technical Solutions

- Toolkits
  - Google What-If
  - IBM Fairness 360
  - Microsoft FairLearn



The Tip of the Iceberg

- Systematic errors stemming from bias in the datasets and algorithmic processes used
- Human bias present across the AI lifecycle and in the use of AI once deployed
- Present in the datasets used in AI, and the institutional norms and practices across the AI lifecycle and in broader society



Bias-Aware not Bias-Free!

- Bias-free AI is an unachievable goal

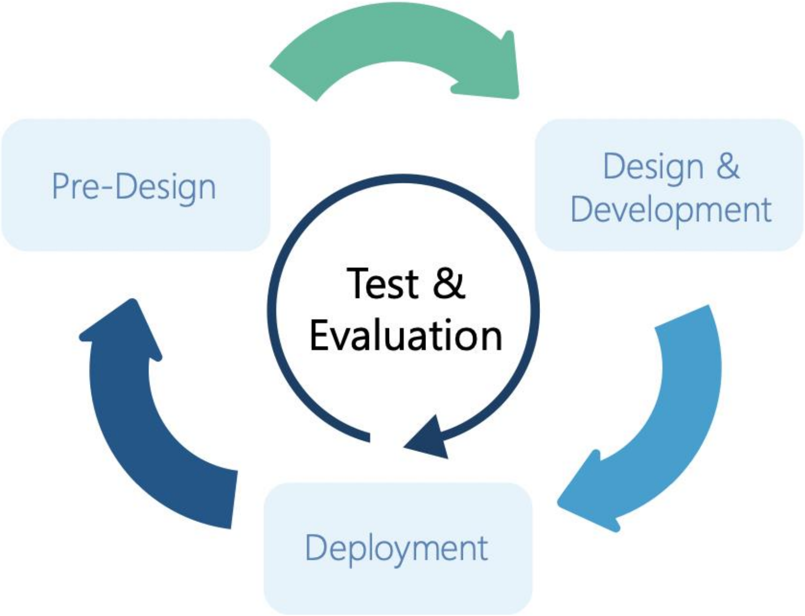
  → Mitigating bias requires a **bias-aware** approach

- AI exists within a larger social system

  → Mitigating bias requires a **sociotechnical** approach

Responsible AI – Ethical Pre-Mortems

- Instead of waiting for bias to strike, build a habit of anticipating preventable causes so they can be mitigated
- Across the entire AI lifecycle – From pre-design to deployment
- 3 key problem areas:
  - Datasets
  - Testing and evaluation
  - Human factors



Strategies to Employ

Dataset	• Interrogating decisions about who/what gets counted and how • Statistical methods to mitigate representation issues • Culture, context, & stakeholders in terms of dataset suitability
Testing and Evaluation	• Fairness metrics (context specific!) • Monitoring performance after deployment • Periodic model updates, test and recalibrate model parameters
Human Factors	• Multistakeholder engagement and diverse perspectives • Model and procedural transparency • Algorithmic impact assessments, iterative process

Thermal Imaging for Human-Wildlife Conflict - Arribada Initiative

Dataset

- Hardware testing – optimizing data collection methods across species
- Suitability – adjusting for variations in the environment (dirt, grass, snow)

Human Factors

- Stakeholder engagement – WWF team in Tezpur advised on locations for field testing
- Commitment to model transparency

Key Takeaways

1. Bias poses an ethical challenge, regardless of the stakes involved
2. Reframing the goal - bias-aware not bias-free
3. An effective mitigation strategy requires a combination of technical and social considerations

Resources

1. NIST Special Publication 1270 – Towards a Standard for Identifying and Managing Bias in Artificial Intelligence
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1270.pdf

2. (In Progress) NIST Mitigation of AI/ML Bias in Context
https://www.nccoe.nist.gov/projects/mitigating-aiml-bias-context

3. An Ethical Toolkit for Engineering Design Practice – Markkula Center for Applied Ethics
https://www.scu.edu/ethics-in-technology-practice/ethical-toolkit/