Algorithmic Governance

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Algorithm, AI, and Governance: AI-enabled Algorithmic Government Service

Algorithm

In mathematics and computer science, an algorithm is a finite sequence of well-defined, computer-implementable instructions, typically to solve a class of problems or to perform a computation.

https://en.wikipedia.org/wiki/Algorithm

Defining Artificial Intelligence

- "Artificial intelligence is
  - science and set of computational technologies
  - inspired by the ways people use their nervous systems and bodies to
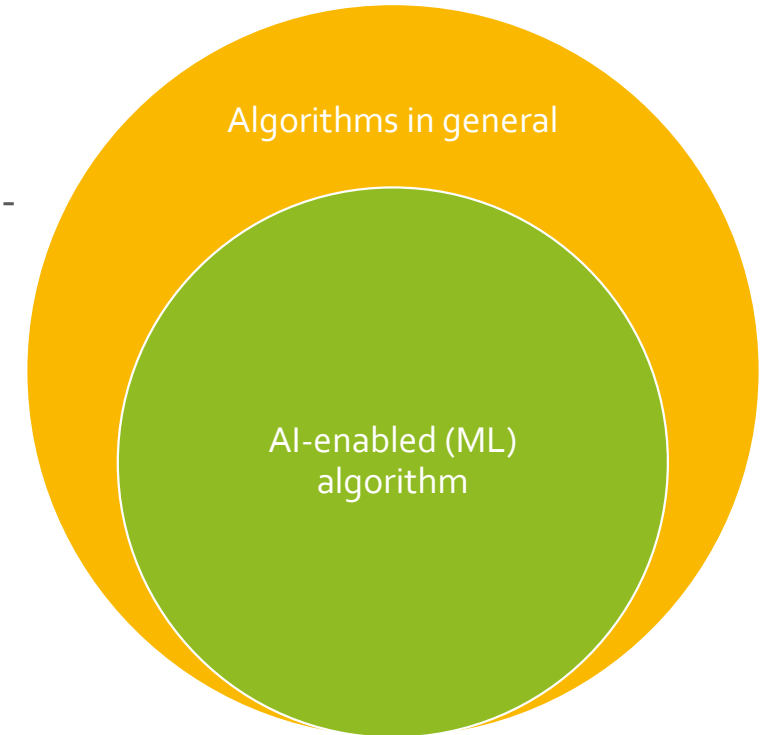 - sense, learn, reason, and take action." (Stone et al, 2016, p.4)
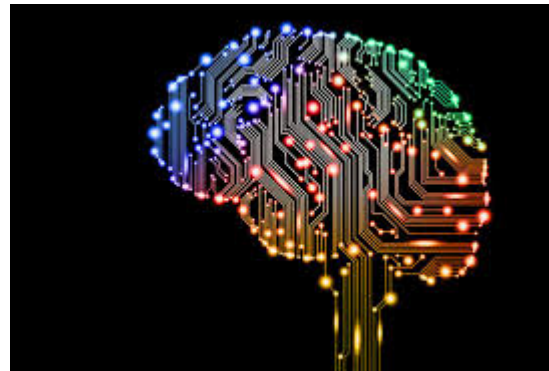
"Artificial intelligence is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment." Nils J. Nilsson (2009)

Public Governance

- An inclusive term that encompasses all the rules and actions related to public policy and services.
  - Fukuyama (2013), governance is defined as the activity to "make and enforce rules, and to deliver services (p.350)
  - Publicness is defined by the object of governance as "production and delivery of publicly supported goods and services" (Lynn, Heinrich, & Hill, 2000, p. 235).
  - Governance actors: individuals, citizens, organizations, and systems of organizations in public, private, and nonprofit sectors
  - Activity: engage in collective decision-making that is constrained, prescribed, and enabled by laws, rules, and practice to achieve the object of public governance.

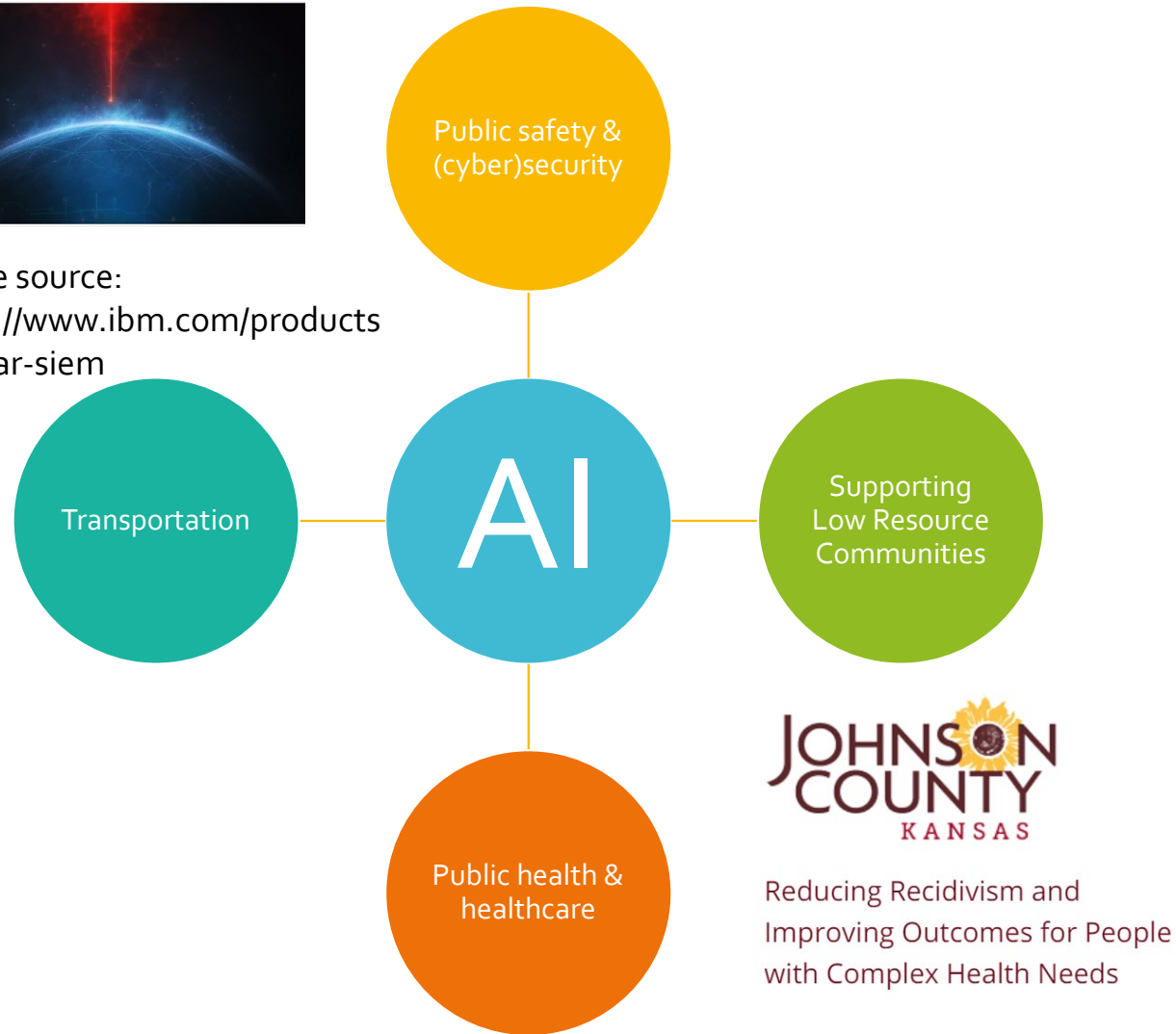# Algorithm-based decision-making in the public sector

- Predictive capabilities
  - Without machine learning
  - With machine learning (AI-enabled)

Algorithms in general

AI-enabled (ML) algorithm

Public service areas of AI applications

Image source: https://www.ibm.com/products/qradar-siem

Public safety & (cyber)security

Transportation

AI

Supporting Low Resource Communities

Public health & healthcare

JOHNSON COUNTY KANSAS

Reducing Recidivism and Improving Outcomes for People with Complex Health Needs

Adapted from GAO (2018) and Stone et al. (2016)

Use AI to combat Covid-19 by OECD

Figure 1. **Examples of AI applications at different stages of the COVID-19 crisis**

Accelerating research: Open data projects and distributed computing to find AI-driven solutions to the pandemic, e.g. *drug and vaccine development*			
Detection	**Early warning** Detecting anomalies and digital "smoke signals", e.g. *BlueDot*	**Diagnosis** Pattern recognition using medical imagery and symptom data, e.g. *CT scans*	
Prevention	**Prediction** Calculating a person's probability of infection, e.g. *EpiRisk*	**Surveillance** To monitor and track contagion in real time, e.g. *contact tracing*	**Information** Personalised news and content moderation to fight misinformation, e.g. *via social networks*
Response	**Delivery** Drones for materials' transport; robots for high-exposure tasks at hospitals, e.g. *CRUZR robot*	**Service automation** Deploying triaging virtual assistants and chatbots, e.g. *Canada's COVID-19 chatbot*	
Recovery	**Monitor** Track economic recovery through satellite, GPS and social media data, e.g. *WeBank*		

Source: https://www.oecd.org/coronavirus/policy-responses/using-artificial-intelligence-to-help-combat-covid-19-ae4c5c21/
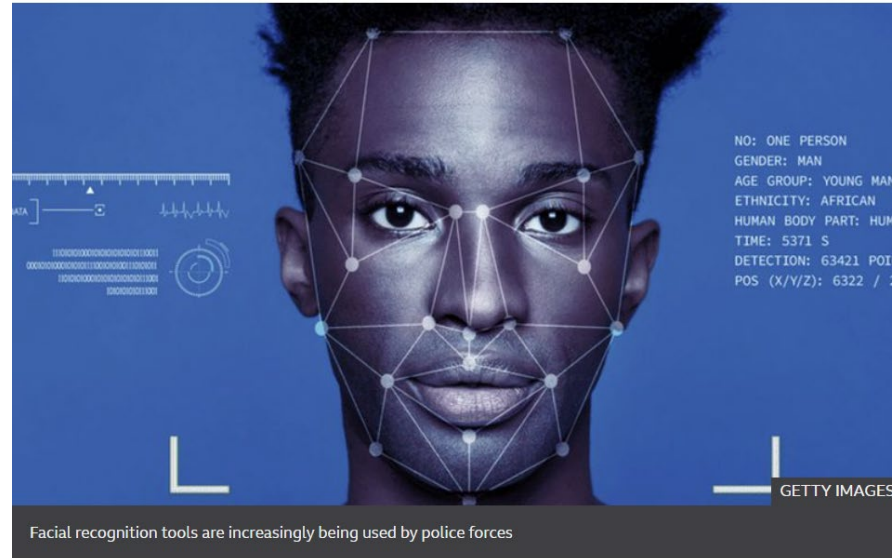
Benefits of AI/ML for Government Service

- Information processing (comprehensive)

- Adherence to the rules

- Consistency (not rely on heuristics/impression/stereotyping)

- Processing institutional and policy complexity

Biases in AI-enabled Algorithmic Government Service

Examples of Biases

- Facial recognition in policing

Facial recognition tools are increasingly being used by police forces

NO: ONE PERSON
GENDER: MAN
AGE GROUP: YOUNG MAN
ETHNICITY: AFRICAN
HUMAN BODY PART: HUMA
TIME: 5371 S
DETECTION: 63421 POINT
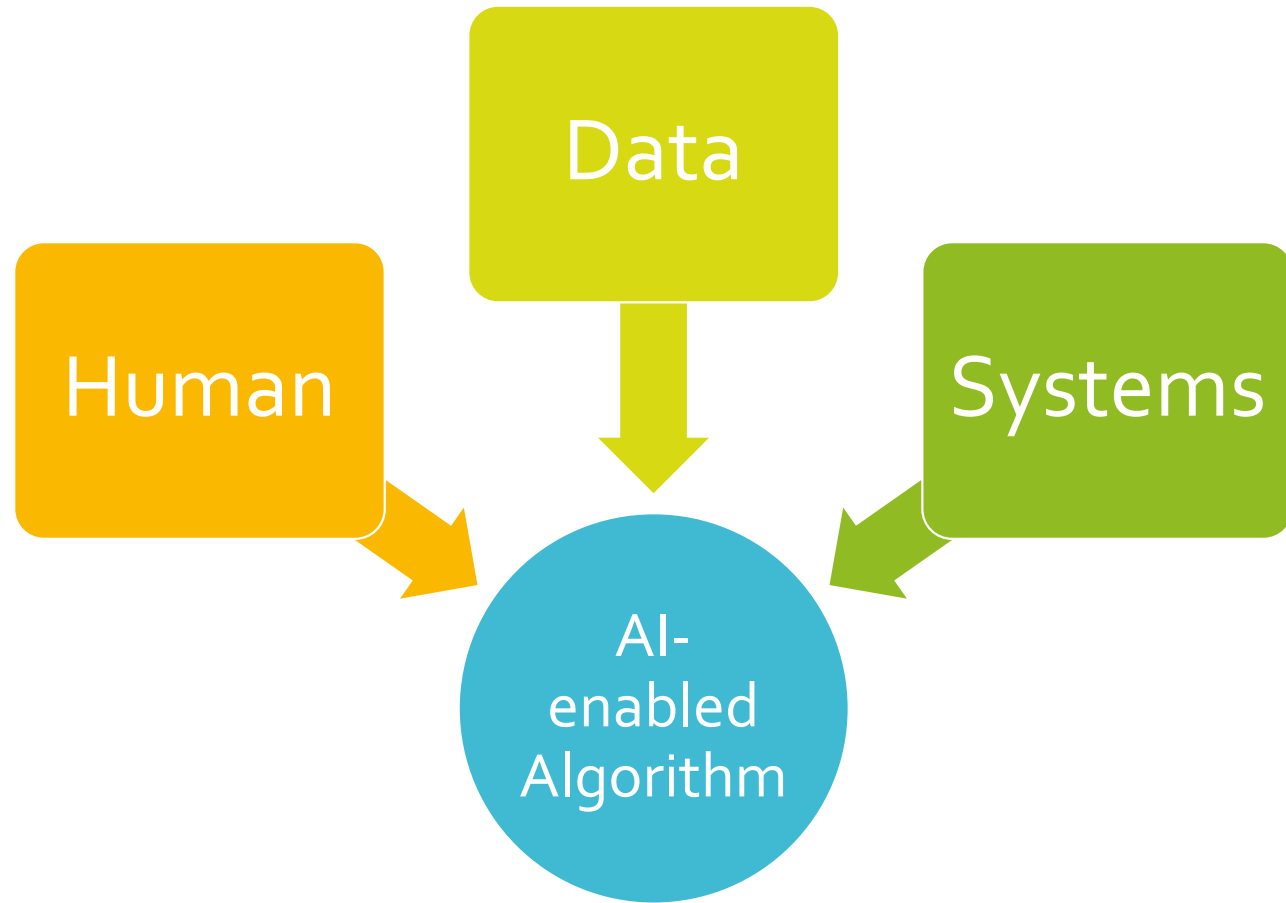POS (X/Y/Z): 6322 / 25

GETTY IMAGES

- "A 2019 study revealed that a healthcare ML algorithm reduced the number of black patients identified for extra care by half." Due to the use of healthcare cost as a proxy for risks to justify extra care.

https://www.bbc.com/news/technology-50865437

Source: https://www.educative.io/blog/racial-bias-machine-learning-algorithms

Sources of Biases

Human

Data

Systems

AI-enabled Algorithm

- **Bias is a human problem that is bound to happen. "Algorithms are our opinions written in code"**

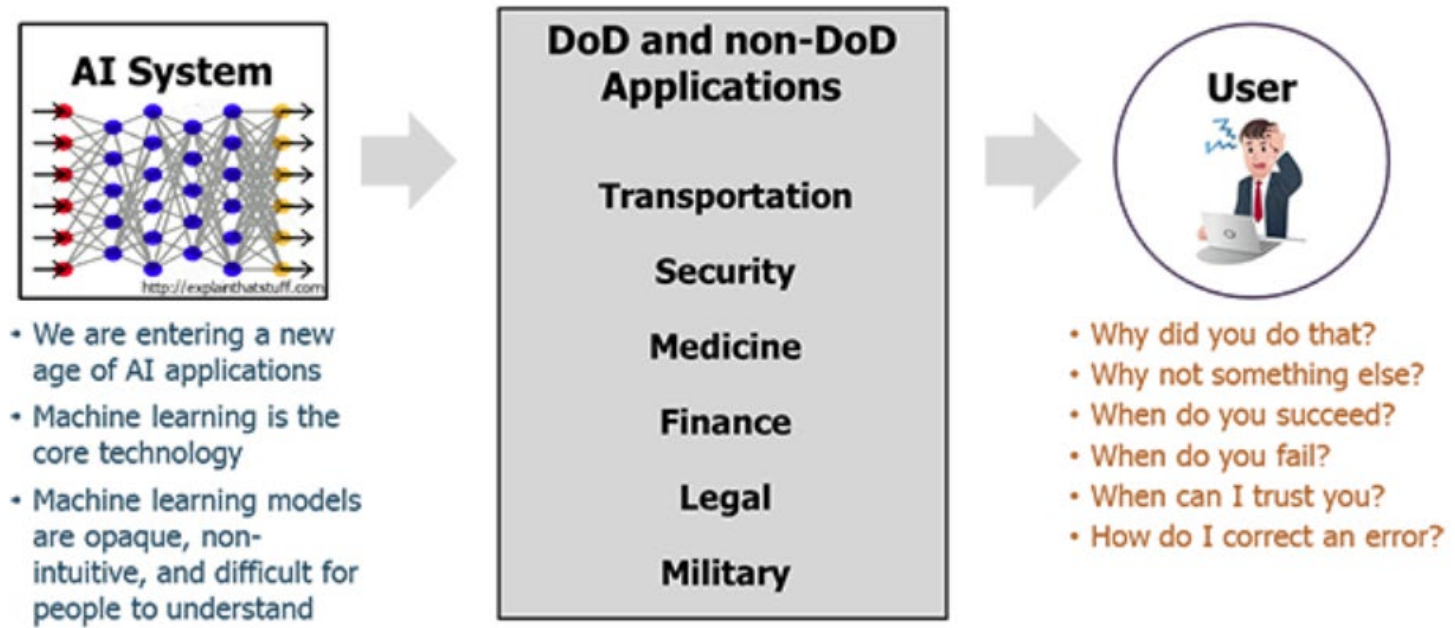# Explainable AI (XAI) for Transparency and Trust

Explainability

AI System
http://explainthatstuff.com

- We are entering a new age of AI applications
- Machine learning is the core technology
- Machine learning models are opaque, non-intuitive, and difficult for people to understand

DoD and non-DoD Applications

Transportation

Security

Medicine

Finance

Legal

Military

User

- Why did you do that?
- Why not something else?
- When do you succeed?
- When do you fail?
- When can I trust you?
- How do I correct an error?

Figure 1. The Need for Explainable AI

https://www.darpa.mil/program/explainable-artificial-intelligence

What to explain and How

- What
  - Explain the reasons (why)
  - Explain success/failure (error)
  - Explain the data and model
- How
  - Explain in a way that users can understand
  - User friendly interface

https://www.darpa.mil/program/explainable-artificial-intelligence
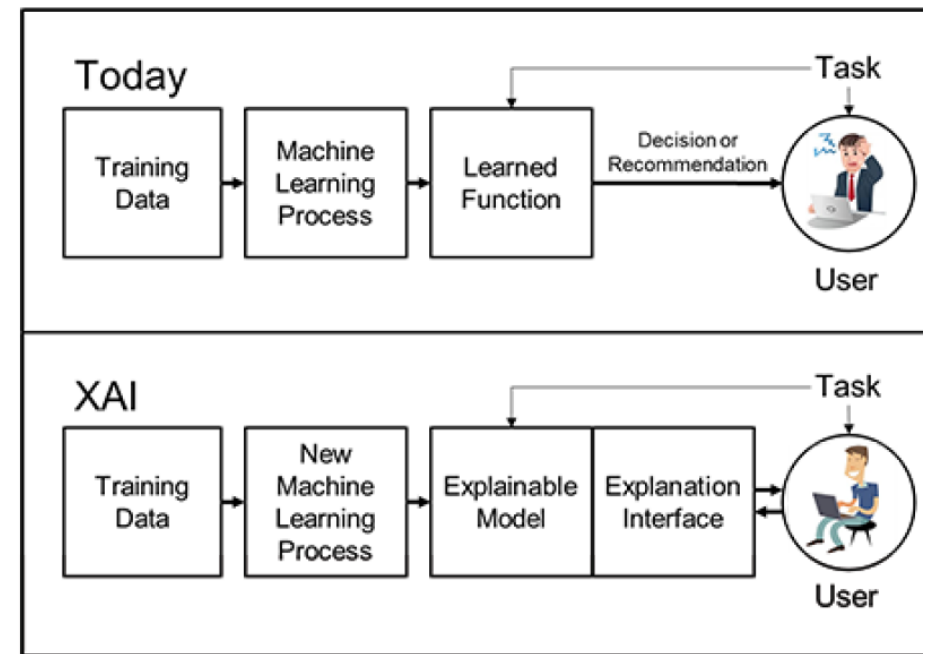
Target audiences

- Domain experts/users of the model
- Users affected by model decisions
- Regulatory entities/agencies
- Data scientists, developers, product owners etc.
- Managers and executive board members

Source: Arrieta et al. 2020, p. 84

Explainability approaches of ML/AI

- Visualization
- Local explanation
- Model simplification
- Feature relevance
- Text explanations
- Explanations by exam

Source: Arrieta et al. 2020, p. 89
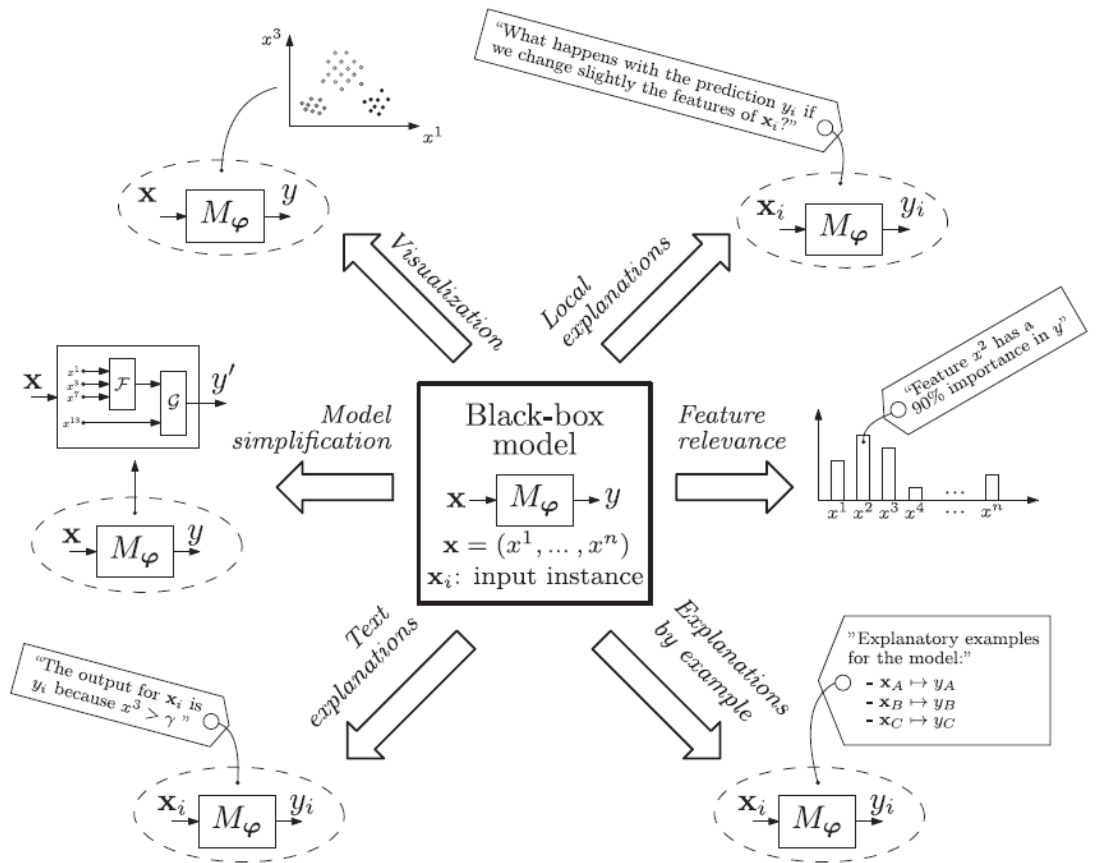
Summary

- AI-enabled algorithmic government services are on the rise and yield benefits

- Biases are a critical source of challenges

- Transparency through explainability is a robust solution

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