

AST 426 : Ethical and Social Considerations in Precision Agriculture

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Ethics in Precision Agriculture

What is Ethics?

- Ethics refers to the principles that govern behavior and decision-making.
- a set of moral principles or a theory or system of moral values (Merriam-Webster Dictionary)
- a branch of philosophy dealing with what is morally right or wrong

Why Ethics Matter in Precision Agriculture?

- Precision agriculture technologies impact farmers, labor, society, and the environment.

Privacy

Equity

Environmental sustainability

Labor and economic impacts



Data Privacy and Ownership

- Precision agriculture uses technological innovations such as sensors, drones, and data analysis tools to improve the productivity of resources and management decisions on the farm
- Since these technologies collect a large amount of data related to the farm, the farmers are concerned about the privacy of their data.
- The farmers are worried about unauthorized access, collection, and sharing of their data with third parties by the agricultural technology providers (ATPs)



Stakeholders of farm data



Kaur, J., Hazrati Fard, S. M., Amiri-Zarandi, M., & Dara, R. (2022). Protecting farmers' data privacy and confidentiality: Recommendations and considerations. *Frontiers in Sustainable Food Systems*, 6, 903230.

Questions that farmers can ask ATPs regarding their farm and personal data protection

S.no.	Questions
1	How can I access ATP's data license and terms of use agreements?
2	What personal data will be collected from my farm? Personal data such as email address, location information, farm owner's name, financial data, or any other sensitive information (other direct identifiers such as farm business registration number or Premises Identification number).
3	What farm-related data (e.g., crop data, livestock data, and machine data) will be collected from my farm?
4	What measures are considered by ATP to safeguard my farm and personal data (e.g., encryption)?
5	With whom (which organizations) my data will be shared and for what purpose?

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Questions that farmers can ask ATPs regarding their farm and personal data protection

- 6 For what purpose will my farm data and personal data be used?
- 7 Does the ATP agreement address farm data ownership?
- 8 Will I receive notifications about changes in the data agreements in advance?
- 9 How can I access and download my farm and personal data in a digital and well-structured format?
- 10 How long will my farm and personal data be retained?
- 11 Will the service provider obtain my consent before sharing my farm data with other organizations?
- 12 If my data is shared with third parties, are they obligated to comply with the ATP data agreement?
- 13 How does the ATP handle data breaches? How quickly will I be notified about the data breaches?
- 14 Can I request to delete my data and end the subscription to the service and how?
- 15 Who should I contact in the company if we have questions about farm and personal data privacy and confidentiality?

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Recommended data practices for ATPs

S.no.	Recommendations
1	ATP should provide farmers with a transparent, easy to read, and free of legal jargon data license agreement (Guntamukkala et al., 2015 ; Kaur et al., 2018 ; Office of the Privacy Commissioner of Canada., 2018, 2019).
2	ATPs should limit data collection to what is directly relevant and related to the purpose specified in the data contract (Hert et al., 2017).
3	Collected data from farms and farmers should be transferred and stored using safety protocols (Hazrati et al., 2022).
4	Farmers should be able to have full access to their farm data collected by ATPs.
5	ATPs should respect the right of farmers to data portability (Hert et al., 2017). This means that farmers should have the right to get access to their personal and farm data in a structured, commonly used, and machine-readable format.

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Recommended data practices for ATPs

- 6 ATPs should present a time plan for data retention. To this end, farmers' data must be deleted when the contract ends ([Guntamukkala et al., 2015](#); [Kaur et al., 2018](#); [Office of the Privacy Commissioner of Canada., 2018, 2019](#)).
- 7 Farmers should have the right to data erasure. This suggests that, upon farmers' request, their data must be completely deleted from the entire system, including back-up servers ([Guntamukkala et al., 2015](#); [Kaur et al., 2018](#); [Office of the Privacy Commissioner of Canada., 2018, 2019](#)).
- 8 Farmers' sensitive information, such as personal information, should be collected and stored in an anonymized and de-identified format as much as possible ([Amiri-Zarandi et al., 2022](#)).
- 9 ATPs should obtain farmers' consent before sharing their data with third parties ([Castelluccia et al., 2018](#)). ATPs should also require these organizations to adhere to the data agreements with farmers.
- 10 ATPs should present a failover and disaster-recovery plan. This recommendation requires that ATPs proactively address any probable issues such as system crashes or attacks to protect farm data ([Hazrati et al., 2022](#)). Also, the ATPs must notify farmers if a data breach takes place that causes disclosure of the data to an outside party ([Hazrati et al., 2022](#)).

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Discussion

Should farmers be compensated for their data?

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The Digital Divide

- Access to precision agriculture tools can vary widely between large-scale and small-scale farmers.
- Disparities in internet access, especially in rural areas.

Impact

- Risk of widening the gap between large agribusinesses and smallholder farmers.

Solutions

- Government subsidies for small farmers.
- Open-access tools and platforms.

Labor Impacts

- Robotic harvesters are increasingly used to address labor shortages and enhance efficiency in harvesting crops like strawberries, lettuce, and citrus.
- Decline in the availability of farmworkers due to stricter immigration policies and aging workforce.
- Fear of unemployment for thousands of farmworkers who depend on seasonal agricultural jobs.
- Potential for reduced wages as demand for manual labor decreases.
- Risk of devaluing human contribution to agriculture.
- **Ethical responsibility to support displaced workers through training and alternative employment.**
- **Balancing technological efficiency with the livelihoods of farm laborers.**
- **Ensuring small-scale farms can afford such technologies without widening the gap between large agribusinesses and family farms.**
- **Invest in worker retraining programs.**



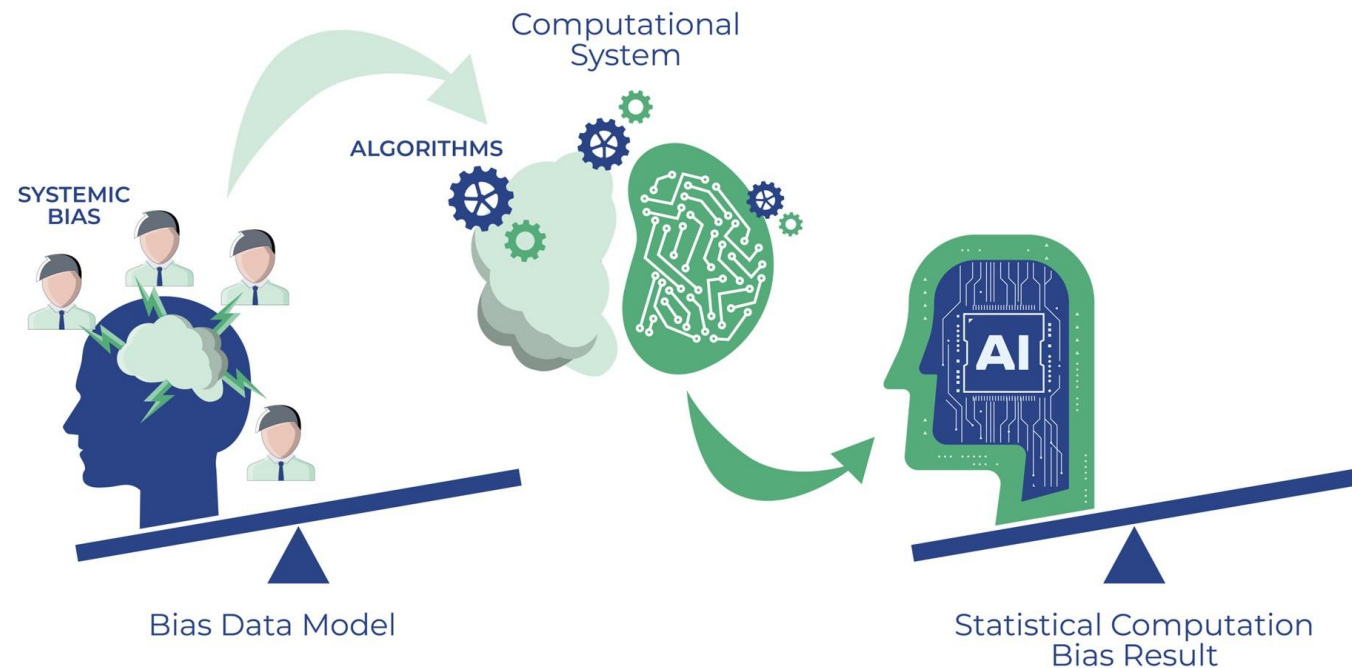
Algorithmic Fairness and Bias

Bias in AI Models

- Precision agriculture relies on AI; biased training data can lead to unfair outcomes.
- Example: Models that prioritize high-yield crops could overlook sustainable practices.

Ethical Issues

- Transparency in AI algorithms.
- Regular audits to ensure fairness.

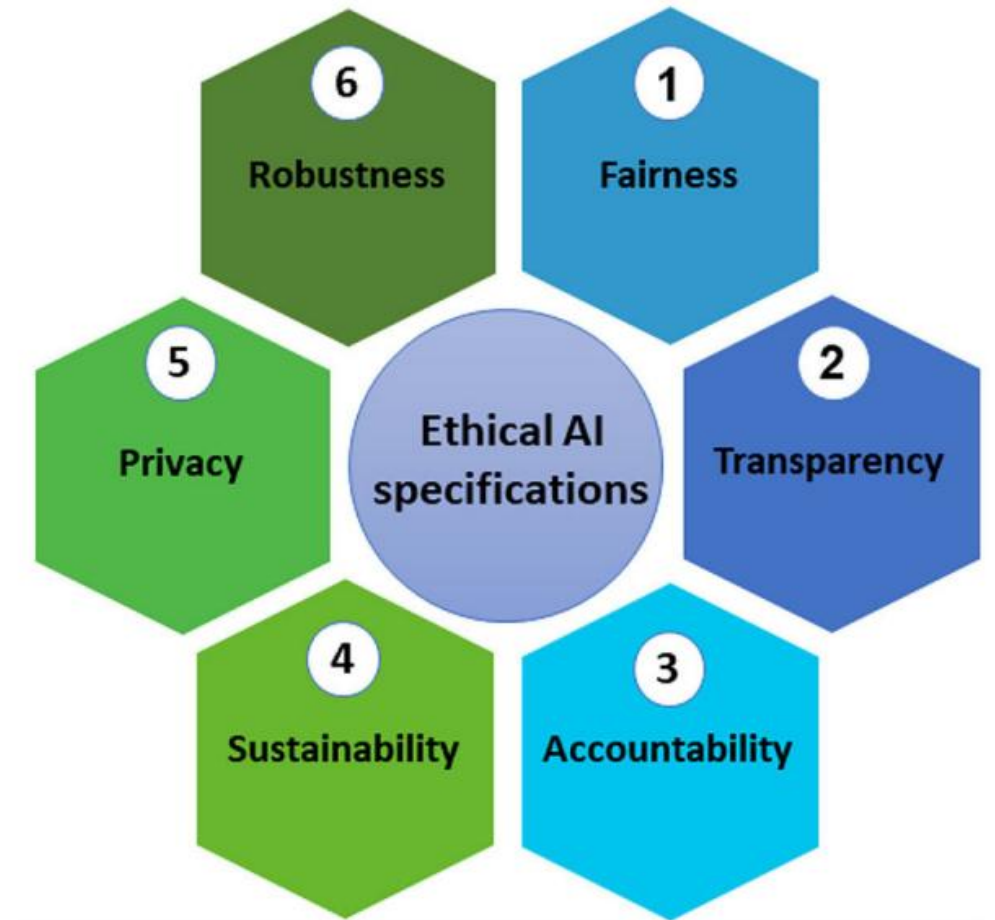


Algorithmic Fairness and Bias

Bias in AI Models

Crop-Specific Training Bias

- An AI model trained primarily on data from high-yield crops like corn or wheat may not perform well on less common crops, such as quinoa or millet, which are important in specific regions.
- This can lead to unequal benefits of AI technologies, favoring farmers who grow common crops while neglecting the needs of smallholder farmers in diverse cropping systems.



Algorithmic Fairness and Bias

Bias in AI Models

Biased Fertilizer Recommendations

- AI models might recommend fertilizer amounts based on datasets optimized for conventional farming systems, ignoring organic or sustainable farming practices.
- Organic farmers may receive inaccurate advice, undermining their yields and ecological practices.



Regulations and Governance

- Lack of standardized regulations for data, technology, and environmental impacts.
- Transparent guidelines for data use.
- Policies to ensure equitable access and sustainability.
- **General Data Protection Regulation (GDPR):** While GDPR in the European Union provides robust data protection for personal information, its applicability to non-personal farm data remains ambiguous
- In the United States, data privacy laws primarily focus on personal data, leaving farm data without comprehensive legal safeguards.
- **Establishing specific regulations that address data ownership, privacy, and sharing in agriculture is essential to protect farmers' interests**



What does the "digital divide" in precision agriculture refer to?

- A) The gap between traditional and modern farming techniques
- B) The disparity in access to advanced technologies between regions or farmers
- C) The split between government and private ownership of data
- D) The difference in crop yields between rural and urban areas

What steps can be taken to ensure that smallholder farmers benefit from precision agriculture technologies?

- Subsidies or financial assistance programs for technology adoption.
- Development of low-cost tools and open-access platforms.
- Training and capacity-building programs tailored to smallholder needs.

- Final Exam will be on **Dec 18, 2024, from 1:45 PM to 3:45 PM.**
- Open Book
- Calculators allowed

Thank you all and best wishes for the final!

