Three cases

Indian small farmers

Financial constraints, small patches, potential droughts (leasing?)

US extensive agri

Huge patches of land

French Vineyard

Seasonal irrigation, grape quality



Problem Statement in Smart irrigation systems

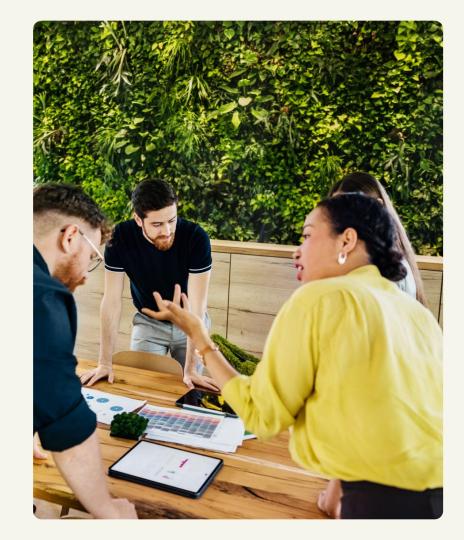
- Explainability of AI: the farmers want to know how the irrigation decision was made (why did we irrigate less last week ?)
- <u>Trustability and Responsibility</u> on crop and food security: the system's decision has serious consequences (crop yield, subsistence, quality of wine)
- <u>Sustainability and fair access to water</u>: How would we input such data in regular AI ? Federated source with logical constraints and NI P
- <u>Automation</u>: reduction of workload, is the system better than the farmer at predicting?





Our technical solution

- <u>Data</u>: Sensors, Static conditions, Satellite soil data, Crop type, Evapotranspiration
- RL for irrigation systems
- Messaging system with Kafka for valve controller and sensors (1 every Ha)
- GAN for drought or climatic events forecasts
- <u>LLM</u> that the farmer can communicate with. Prompt with:
 - + RL
 - + RAG (experts, scientific papers farmer's knowledge integration)
 - + GAN predictions
 - + Websearch for policy changes
 - + Autonomous agents for irrigation and alerting decisions
 - + Alerting/communication SMS solution



Focusing on explainability and accountability

- Regulatory frameworks and accountability
- Evaluation criteria for LLM and agent
- Historical data and farmer's knowledge
- Trust of the farmers who can verify explanation of Agent's decision



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Potential applications

Existing companies working on the issue:

- Instadeep
- Lacroix
- Koan Irrigation

Extension of the tool:

Food security policy and accountability for policy makers would be a possible adaptation

Articles:

https://arxiv.org/abs/2502.18298?utm_source=chatgpt. com

https://www.researchgate.net/publication/332513655_S MART_IRRIGATION_MECHANISM_FOR_SOIL_MANAGE MENT_USING_BBC_MICRO_BIT_IN_INTERNET_OF_THIN GS

