

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 ?)
- Trustability and Responsibility on crop and food security: the system's decision has serious consequences (crop yield, subsistence, quality of wine)
- Sustainability and fair access to water: How would we input such data in regular AI ? Federated source with logical constraints and NLP
- Automation: reduction of workload, is the system better than the farmer at predicting ?



Our technical solution

- Data: 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
- LLM 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

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_SMART_IRRIGATION_MECHANISM_FOR_SOIL_MANAGEMENT_USING_BBC_MICRO_BIT_IN_INTERNET_OF_THINGS