

From Farm to Table

Towards Knowledge-Centric

Agricultural Digital Twins

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Context: The Data Chefs and Partners

- TDC is a boutique consultancy based in New York City. Established in 2017.
- Specialized in enterprise data management
- Clients in Finance, Legal, and Technology domains
- A Network of Data Chefs, Expert in Semantic Technologies:
 - Knowledge Graphs, Ontology and Taxonomy.
- Provide a range of Consulting Services
 - AI solutions involving LLMs and KGs
 - Hands-on Modeling, Development, Technical Mentorship

- This project is a collaboration between RBC, Ontotext, Elzeard and The Data Chefs
- Also based on foundational work at the University of Montpellier, France

Outline

Towards the industrialization of Flamel

- Context: Farms in a Rapidly Evolving Global Landscape
- Problems: 1) Various heterogeneous data sources, 2) Getting data from farms.
- Solution: A knowledge graph and an application in the hands of farmers
- Demo: the frontend, the backend
- Conclusion and questions

Context: Farms in a Rapidly Evolving Global Landscape

- Over 2M farms in the US. 33,400 in New York State (2022 Census)
- Economy: crops valuations fluctuate
- Climate change: crops need to be adapted



Generated with Google Bard

Context: Farms in a Quickly Evolving Global Landscape

- Farmers are busy running their farms
 - Data is hard ... and expensive
 - Data integration at scale is hard
 - Farmers are too busy to collect and report data
- Agricultural Twins solutions are often too complex to deploy at individual farms
- Wisdom comes from knowledge accumulated and distilled over time... but times have changed...



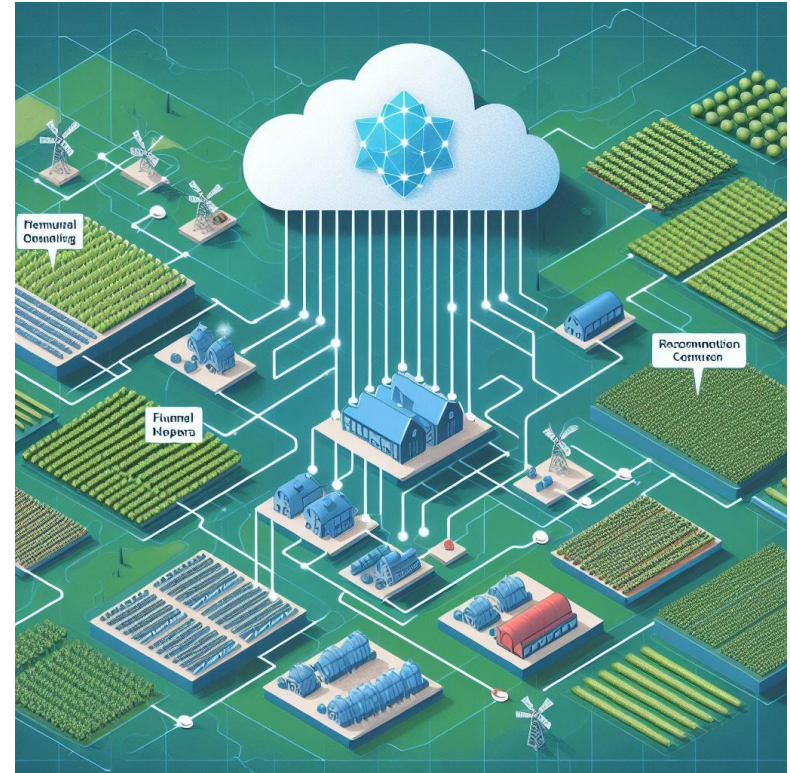
Context: Farms in a Quickly Evolving Global Landscape

- Stakeholders need a high level view in order to make decisions and provide recommendations
 - Governments agencies need precise data in order to provide helpful public policies
 - Investors need decision making support for where to invest or how to support their investments



Solution: An Agricultural Digital Twin

- A **knowledge graph** based on a rich set of ontologies and data sources
- A farm management tool plugged to the knowledge graph



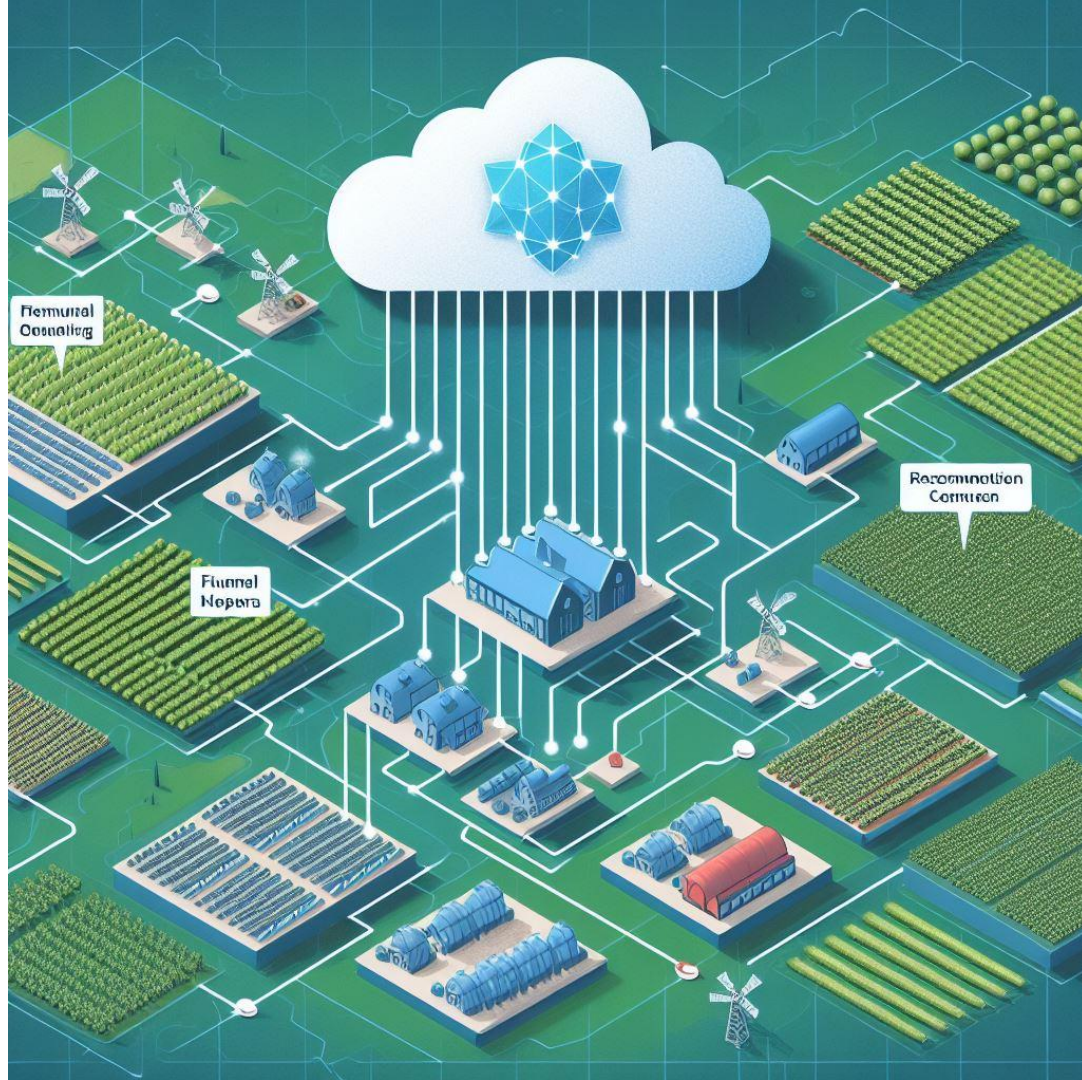
Ontologies

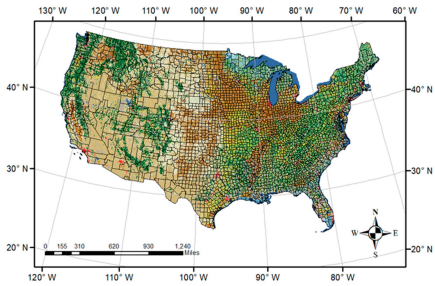
- Flamel - An agricultural digital twin ontologies (see previous presentation from Dr. Gruninger)
- C3PO - A crop planning and production process ontology
- Soil Properties - Physical properties of the soil
- GeoSparql, Time - generalist time and geospatial ontologies
- ...

Potential Data Sources

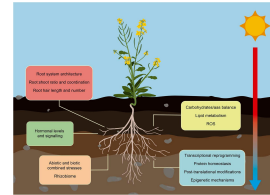
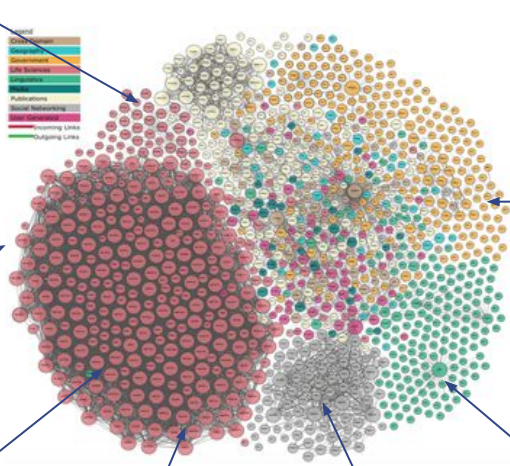
- Macroeconomy - USDA, FAO,...
- Local
- Satellite imagery
- Weather and Climate
- Crops scientific data (genes, variants, cultivars, ...)
- Geological surveys
- Farm data (harvest, soil properties, methods of culture, itineraries, fertilizers, ...)

System Architecture

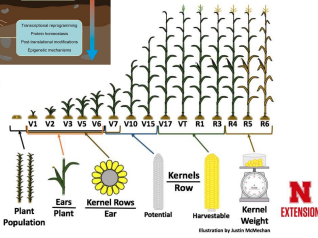
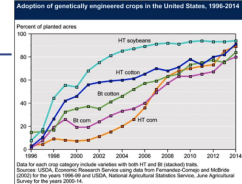




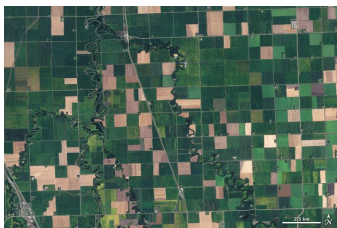
Climate data



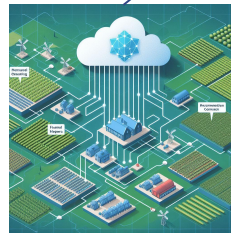
Development Stage



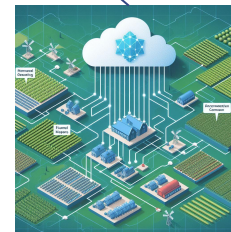
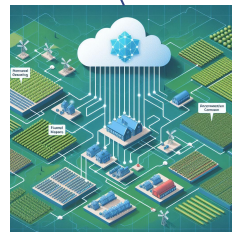
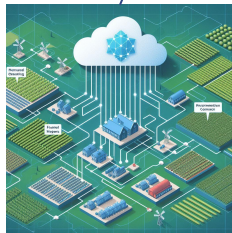
Scientific data



Satellite data



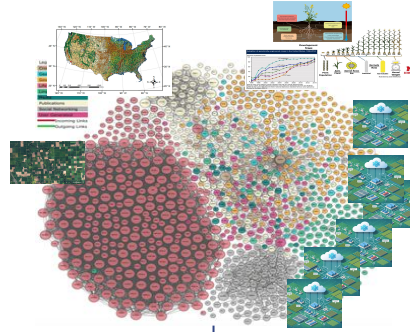
Farm data



A Knowledge Graph-Powered Reasoning Engine

Recommendations

Analytics



AI guided decisions

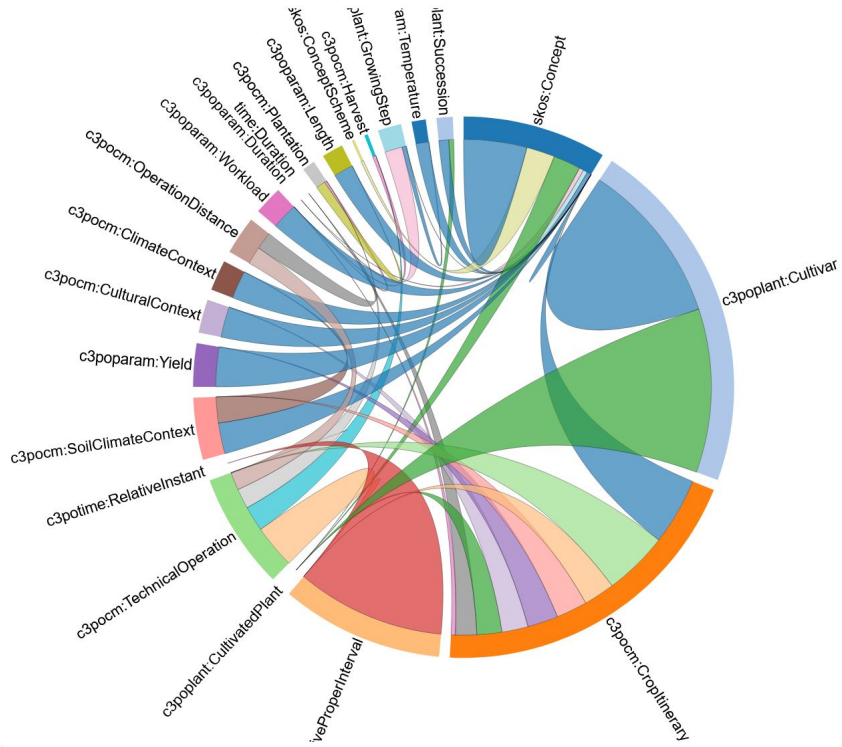
But what about the social problem?

We need to put a tool in the hands of the farmer

- The tool needs to be useful to the farmer
- Helps them with planning, harvest, crops management, budgeting and finance
- So data collection becomes a byproduct of the farmer's activity on the tool



Demo



One System, Multiple Possibilities

- Crops and surfaces usage season over season (Farmer)
- Irrigation systems and material investments (Farmer)
- Land usage and crops recommendation for climate adaptation (Farmer, Policy maker)
- Land and farms investment performance reports (Investor)

All of these can be combined so that recommendations benefit all players and create a virtuous cycle

What's next

- We have a proof of concept
- We're now looking to deploy a pilot at scale over a region with multiple farms
- We're looking for a partner with access to farms and funding
 - If you are a private equity investor, a VC or a government agency and want to support us please reach out!
- Please talk to us ai4agro@thedatachefs.com or reach out on social media.

